

Final Determination

Cedar Bay Cogeneration, Inc.  
Duval County, Florida

Construction Permit No.  
PSD-FL-137A

Department of Environmental Protection  
Division of Air Resources Management  
Bureau of Air Regulation

November 16, 1993

## Final Determination

Cedar Bay Cogeneration, Inc.

PSD-FL-137A

Air permit PSD-FL-137 was issued to the Cedar Bay Cogeneration Project (the Project) of AES/Cedar Bay, Inc. on March 28, 1991, following review by the Division of Air Resources Management of the permit application (part of the Power Plant Siting application) and following certification by the Governor and Cabinet siting as the Siting Board under the Power Plant Siting Act. That permit was issued based on a demonstration by the applicant that the Project would satisfy the requirements of all applicable air regulations.

After questions were raised about the applicant's intention to construct and operate the Project in conformance with the conditions of certification (and air permit PSD-FL-137) and appropriate findings were made, the Siting Board instituted proceedings under the Power Plant Siting Act to modify the conditions of certification for the Project. AES Cedar Bay, Inc., and Seminole Kraft Corporation v. State of Florida Department of Environmental Regulation, DOAH Case No. 88-5740. Those proceedings culminated in the execution of a Settlement Stipulation on April 13, 1993, by the Parties in the modification proceedings which included the Florida Department of Environmental Protection (Department). In that Settlement Stipulation, the Parties agreed to recommend to the Siting Board that it modify the Conditions of Certification for the Project to include, among other things, more stringent emission limitations. On May 11, 1993, the Siting Board followed that recommendation and adopted an order modifying the conditions of certification.

Paragraph 23 of that Settlement Stipulation calls for an amendment of the original air permit (PSD-FL-137) for the Project to reflect the modifications that are applicable to the Project's air permit. Consistent with the terms of the Settlement Stipulation and in response to a request by the permittee, the CBC, Inc. (the new corporate name for the permittee), the Department has determined that the original air permit should be revised to reflect the changes noted in the Settlement Stipulation. On September 24, 1993, the Department sent a proposed revised air permit (PSD-FL-137A) to EPA, recommending that it officially revise the original air permit to incorporate these changes. Since EPA granted the Department full delegation of PSD permitting authority for Power Plants by letter dated October 26, 1993, EPA's response to the Department dated November 3, 1993, recommended that the Department issue the revised air permit.

The key technical changes to the original air permit, which will result in substantial emission reductions from the Project, are as follows:

- A. Lower the limitations applicable to the emissions from the circulating fluidized bed boilers (CFBs) of SO<sub>2</sub>, NO<sub>x</sub>, CO, PM, PM-10, H<sub>2</sub>SO<sub>4</sub>, fluorides, lead, mercury, and beryllium consistent with the Conditions of Certification.
1. The restrictions on the sulfur content of the coal fired in the CFBs have been tightened, and the CBC will make operational changes in the limestone injection system to comply with the lower emission limitations for SO<sub>2</sub> and other acid gases.
  2. SNCR will be added to the CBCP to augment the low NO<sub>x</sub> performance of the CFBs, and an emission limitation for ammonia has been added.
  3. Enhanced combustion management will achieve lower CO emissions.
  4. Operational changes have been incorporated for the flue gas fabric filters to achieve lower PM emission limitations.
  5. Lower emission limitations are now possible for trace elements with this improved baghouse performance and revised emission factors.
  6. New technologies will be tested for additional mercury removal.
- B. Provide for compliance with the CFBs' opacity requirements and emission limitations for SO<sub>2</sub>, CO, and NO<sub>x</sub> to be determined using Continuous Emission Monitors as well as stack tests.
- C. Include permission for --
1. Two of the CFBs to burn short fiber recycle rejects from Seminole Kraft Corporation (SKC).
  2. The CFBs to operate at a furnace heat load below 70%.
  3. An increase in the use of fuel oil during the CFBs' start-ups from 0.16 million gals/yr to 1.9 million gals/yr.
  4. Reduce the allowable sulfur content of the fuel oil used in the CFBs during start-up to 0.05%, by weight.
- D. For the limestone dryers --
1. Decrease their allowable hours of operation.
  2. Reduce the allowable sulfur content of the fuel oil used in them to 0.05%, by weight.
- E. For other sources in the material handling and treatment area --
1. Reduce the allowable grain loadings by a factor of 10 for the point sources controlled with baghouses and by a factor of 3 for the point sources controlled with wet control systems.
  2. Rely on compliance tests based on visible emissions and grain loadings.

This recommendation is also based on the Department's findings that these emission reductions will in turn reduce the air quality impacts from the Project. In February of this year, ENSR submitted to the Department its "CBCP Air Quality Analysis," and in March of this year, a number of replacement pages for this report were filed with the Department. ENSR's work shows (1) regional improvements in air quality with respect to the CBCP as originally certified and with respect to SKC's existing power and bark boilers and (2) some increment expansions in the CBCP's significant impact area. These comparisons hold even when SKC's new package boilers are added to the impacts of the CBCP.

Accordingly, and as the Department reported in its March 25, 1993 staff report on the Project, the Project complies with all air quality requirements. Specifically, the CBCP will continue to comply with applicable PSD requirements: (1) the control technology planned for the CBCP will satisfy BACT requirements for all pollutants subject to new source review; (2) the emissions from the CBCP will not cause or contribute to a violation of the ambient standards or the PSD increments; (3) the CBCP will not have an adverse impact on the air quality related values of any class I area; (4) the CBCP will not adversely affect visibility, soils, or vegetation having significant commercial or recreational value; and, (5) analyses show that any growth associated with the CBCP will not have significant air quality impacts.

Similarly, ENSR's Report indicates that the Project clearly continues to comply with applicable ozone nonattainment requirements: (1) the Project will satisfy the LAER requirement for VOCs; (2) the Project's VOC emissions will be more than offset by the shutdown of SKC's bark and power boilers; and, (3) these offsets will result in a net air quality benefit. Finally, CBC, Inc. does not have any sources in Florida that are out of compliance with their air quality requirements; and Florida has an effective SIP for ozone.

That the Project satisfies all applicable requirements is also reflected in paragraph 2 of the Settlement Stipulation and in the final action taken by the Siting Board on the Conditions of Certification for the CBCP on May 11, 1993.

Under EPA's guidance on permit modifications, changes that do not involve increases in source emissions or in air quality impacts may be considered permit "amendments," which may be accomplished through simple administrative action without further public review or proceedings. (United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Revised Draft Policy on Permit Modifications and Extensions (July 5, 1985) at p. 11.) No increases in emissions or air quality impacts will occur for the Project. Accordingly, the Department finds that there is no need for public notice or comment prior to revising the original air permit PSD-FL-137 (PSD-FL-137A) consistent with the final determination.

Because EPA Method 29 is not a Department approved test method for mercury and was not an approved test method in the previously issued construction permit PSD-FL-137, the test method has been deleted from Specific Condition No. II.A.8.e.(15). If the method is the desired method for testing for mercury over the approved EPA Method 101A, the method may be requested pursuant to Rule 17-297.620, Florida Administrative Code, Exceptions and Approval of Alternate Procedures and Requirements.



Since all pending controversies and hearings have been resolved and the modification of Certification has been finalized, it is recommended that this proposed final permit revision, No. PSD-FL-137A, be approved and signed.



Lawton Chiles  
Governor

# Florida Department of Environmental Protection

Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

Virginia B. Wetherell  
Secretary

**PERMITTEE:**  
Cedar Bay Cogeneration, Inc.  
7475 Wisconsin Avenue  
Bethesda, Maryland 20814-3422

**Permit Number:** PSD-FL-137A  
**County:** Duval  
**Latitude/Longitude:** 30°25'21"N  
81°36'23"W  
**Project:** Cedar Bay Cogeneration  
Project

This air permit is issued for the Cedar Bay Cogeneration Project (CBCP) under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Chapters 17-210 through 297 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department of Environmental Protection (Department) and specifically described as follows:

This air permit is for the installation of the CBCP, an integrated cogeneration power plant complex at the existing Seminole Kraft Corporation (SKC) facility located in Jacksonville, Florida. The power complex will be owned by Cedar Bay Cogeneration, Inc., and consist of: three circulating fluidized bed (CFB) boilers, whose principal fuel will be coal; the associated coal, ash, and other material handling equipment; a cooling tower; and, two limestone dryers.

The three CFB boilers, each rated at a maximum of ~~3,189~~<sup>1063</sup> MMBtu/hr heat input, will fire fuel made up largely or exclusively of coal, with the possibly that two CFBs will fire some short fiber recycle rejects from the SKC facility. The boilers will generate steam to produce power from a turbine generator set. The cogeneration facility will generate electricity for sale to Florida Power & Light as well as process steam for the SKC facility.

Nitrogen oxides will be controlled by selective non-catalytic reduction and good combustion characteristics, which are an inherent part of the CFB technology. Sulfur dioxide will be controlled by limiting the average annual sulfur content of coal to 1.2%, by weight, and the inherent scrubbing provided by the CFB technology; also, the No. 2 fuel oil, which will be fired by the CFB auxiliary fuel burners (normally only for startup) and by other process equipment, will be limited to a maximum sulfur content of 0.05%, by weight. Particulate matter will be controlled with fabric filters.

The existing SKC facility is located at 9469 East Port Road, Jacksonville, Duval County, Florida. UTM coordinates of the site are: Zone 17, 441.8 km E and 3,365.6 km N.

*1063 m told Bennett Parker via phone call. BR*

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The source shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

**Attachments are listed below:**

1. Power Plant Site Certification package PA 88-24 and its associated attachments dated January 19, 1990.
2. Letter from EPA dated March 27, 1991.
3. DER's Final Determination dated March 28, 1991.
4. Settlement Stipulation dated April 13, 1993, in re: Power Plant Site Certification of Cedar Bay Cogeneration Project, PA-88-24, DOAH Case No. 88-5740, OGC Case No. 88-1089.
5. Final Order approving Modification of Certification dated May 11, 1993, in re: Power Plant Site Certification of Cedar Bay Cogeneration Project, PA-88-24, DOAH Case No. 88-5740, OGC Case No. 88-1089.
6. Mr. Patrick Tobin's letter dated October 26, 1993.
7. Ms. Jewell A. Harper's letter dated November 3, 1993.
8. DEP's Final Determination dated November 16, 1993.

**I. GENERAL CONDITIONS:**

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

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**GENERAL CONDITIONS cont.:**

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of F.S. and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

- a. Have access to and copy any records that must be kept under the conditions of the permit;
- b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and,
- c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

- a. A description of and cause of non-compliance; and,
- b. The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

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**GENERAL CONDITIONS cont.:**

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the F.S. or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and F.S. after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by F.S. or Department rules.

11. This permit is transferable only upon Department approval in accordance with Rules 17-4.120 and 17-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

- (x) Determination of Best Available Control Technology (BACT)
- (x) Determination of Prevention of Significant Deterioration and Nonattainment Areas NSR
- (x) Compliance with New Source Performance Standards (NSPS; Subpart Da)

14. The permittee shall comply with the following:

- a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
- b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

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**GENERAL CONDITIONS cont.:**

c. Records of monitoring information shall include:

- The date, exact place, and time of sampling or measurements;
- The person responsible for performing the sampling or measurements;
- The dates analyses were performed;
- The person responsible for performing the analyses;
- The analytical techniques or methods used; and,
- The results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

**II. SPECIFIC CONDITIONS:**

General: The construction and operation of Cedar Bay Cogeneration Project (CBCP) shall be in accordance with all applicable provisions of Chapters 17-210 through 17-297, F.A.C. In addition to the foregoing, CBCP shall comply with the following conditions as indicated, which reflect the conditions of the Modification of Certification dated May 11, 1993:

A. Emission Limitations for CBCP Boilers

1. Fluidized Bed Coal Fired Boilers (CFB)

a. The maximum coal charging rate of each CFB shall neither exceed 104,000 lbs/hr., 39,000 tons per month (30 consecutive days), nor 390,000 tons per year (TPY). This reflects a combined total of 312,000 lbs/hr., 117,000 tons per month, and 1,170,000 TPY for all three CFBs.

b. The maximum charging rate to each of two CFBs of short fiber recycle rejects from the Seminole Kraft Corporation (SKC) recycling process shall not exceed 210 yd<sup>3</sup>/day wet and 69,588 yd<sup>3</sup>/yr wet. This reflects a combined total of 420 yd<sup>3</sup>/day wet and 139,176 yd<sup>3</sup>/yr wet for the two CFBs that fire recycle rejects. The third CFB will not utilize recycle rejects, nor will it be equipped with handling and firing equipment for recycle rejects.

c. The maximum heat input to each CFB shall not exceed 1063 MMBtu/hr. This reflects a combined total of 3189 MMBtu/hr. for all three units.

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**SPECIFIC CONDITIONS cont.:**

d. The sulfur content of the coal shall not exceed 1.2%, by weight, on an annual basis. The sulfur content shall not exceed 1.7%, by weight, on a shipment (train load) basis.

e. Auxiliary fuel burners shall be fueled only with No. 2 fuel oil with a maximum sulfur content of 0.05%, by weight. The fuel oil shall normally only be used for startups. During the commercial operation, the maximum annual oil usage shall not exceed 1,900,000 gals./year. The maximum heat input from the fuel oil shall not exceed 380 MMBtu/hr. for each of the CFBs.

f. The CFBs shall be fueled only with the fuels permitted in Conditions Nos. II.A.1.a., 1.b. and 1.e. Other fuels or wastes shall not be burned without prior specific written approval of the Secretary of the Department of Environmental Protection pursuant to Specific Condition No. II.E., Modification of Conditions.

g. The CFBs may operate continuously, i.e., 8760 hrs/yr, but shall not exceed  $25.98 \times 10^6$  MMBtu/yr total annual heat input.

h. To the extent that it is consistent with Specific Condition No. II.A.1.b. and the following, CBCP shall burn all of the short fiber rejects generated by SKC in processing recycled paper. No less than ninety (90) days prior to completion of construction, CBCP shall submit a plan to the Department for conducting a 30-day test burn within one year after initial compliance testing. That test burn shall be designed to ascertain whether the CFBs can burn the rejects as supplemental fuel without exceeding any of the limitations on emissions and fuel usage contained in Specific Condition No. II.A. and without causing any operational problems which would affect the reliable operation (with customary maintenance) of the CFBs and without violating any other environmental requirements. CBCP shall notify the Department and the Regulatory and Environmental Services Department (RESD) at least thirty (30) days prior to initiation of the test burn. The results of the test burn and CBCP's analysis shall be reported to the Department and to the RESD within forty-five (45) days of completion of the test burn. The Department shall notify CBCP within thirty (30) days thereafter of its approval or disapproval of any conclusion by CBCP that the test burn demonstrated that the rejects can be burned in compliance with this condition.

**2. Coal Fired Boiler Controls**

The emissions from each CFB shall be controlled using the following systems:

a. Limestone injection and fuel sulfur limitations, for control of sulfur dioxide and acid gases.

b. Baghouse, for control of particulate matter.

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c. CBCP shall conduct a test to determine whether substantial additional removal of mercury can be obtained through a carbon injection system for mercury removal, as described in Exhibit 74 of the administrative record for the Lee County Resource Recovery Facility, which feeds carbon reagent into the CFB exhaust stream prior to the baghouse. Within one hundred eighty (180) days after initial compliance testing, CBCP shall conduct a test on one CFB to compare mercury emissions to the atmosphere with and without carbon injection. The test program will include the testing of carbon injection between the boiler and the fabric filter. Carbon forms to be tested may include activated carbon with or without additives and pulverized coal with or without additives. After consultation with the Department, RESD and EPRI, CBC shall submit a mercury control test protocol to the Department for approval by December 1, 1993. Results of the test shall be submitted to the Department within 90 days of completion.

d. Selective Non-catalytic Reduction (SNCR), for control of NOx.

e. Good combustion characteristics, which are an inherent part of the CFB technology, for control of carbon monoxide and volatile organic compounds.

3. Flue gas emissions from each CFB shall not exceed the following:

Pollutant	lbs/MMBtu	Emission Limitations		
		lbs/hr.	TPY	TPY for 3 CFBs
CO	0.175 <sup>1</sup>	186 <sup>1</sup>	758	2273
NOx	0.17 <sup>2</sup>	180.7 <sup>2</sup>	736.1	2208
SO <sub>2</sub>	0.24 <sup>3</sup>	255.1 <sup>3</sup>	--	--
	0.20 <sup>4</sup>	--	866	2598
VOC	0.015	16.0	65	195
PM	0.018	19.1	78	234
PM <sub>10</sub>	0.018	19.1	78	234
H <sub>2</sub> SO <sub>4</sub> mist	4.66 x 10 <sup>-4</sup>	0.50	2.0	6.1
Fluorides	7.44 x 10 <sup>-4</sup>	0.79	3.2	9.7
Lead	6.03 x 10 <sup>-5</sup>	0.06	0.26	0.78
Mercury	2.89 x 10 <sup>-5</sup>	0.03	0.13	0.38
Beryllium	8.70 x 10 <sup>-6</sup>	0.01	0.04	0.11

[Note: TPY represents a 93% capacity factor.]

- 1 Eight-hour rolling average, except for initial and annual compliance tests and the CEM certification, when the 1-hour applies.
- 2 Thirty-day rolling average.
- 3 Three-hour rolling average.
- 4 Twelve-Month rolling average.



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**SPECIFIC CONDITIONS cont.:**

4. Ammonia (NH<sub>3</sub>) slip from exhaust gases shall not exceed 10 ppmvd when burning coal at 100% capacity and 30 ppmvd when burning oil.

5. Visible emissions (VE) shall not exceed 20% opacity (6 minute average), except for one 6 minute period per hour when VE shall not exceed 27% opacity pursuant to 40 CFR 60.42a.

6. Compliance with the emission limits shall be determined by EPA reference method tests included in the July 1, 1992 version of 40 CFR 60 and 61, Chapter 17-297, F.A.C., and listed in Specific Condition No. II.A.8. of this permit or by equivalent methods after obtaining prior written Department approval. In addition, compliance with the emission limitations in Specific Condition No. II.A.3. for CO, NOX and SO<sub>2</sub>, and with the opacity requirements in Specific Condition No. II.A.5., shall be determined with the continuous emission monitoring systems (CEMS) identified in Specific Condition No. II.A.9.

7. The CFBS are subject to 40 CFR 60, Subparts A and Da; except that where requirements within this permit are more restrictive, the requirements of this permit shall apply.

8. Compliance Tests for each CFB

a. Initial and subsequent compliance tests for PM/PM<sub>10</sub>, SO<sub>2</sub>, NOx, CO, VOC, lead, fluorides, ammonia, mercury, beryllium and H<sub>2</sub>SO<sub>4</sub> mist, shall be conducted in accordance with 40 CFR 60.8 (a), (b), (c), (d), (e) and (f).

b. Annual compliance tests shall be performed for PM, CO, SO<sub>2</sub> and NOx, commencing no later than 12 months from the initial test.

c. Initial and annual visible emissions compliance tests shall be determined in accordance with 40 CFR 60.11(b) and (e).

d. The compliance tests shall be conducted between 90-100% of the maximum licensed capacity and firing rate for each permitted fuel.

e. The following test methods and procedures pursuant to Chapter 17-297, F.A.C., and 40 CFR 60 and 61, or by equivalent methods after obtaining prior written Department approval, shall be used for compliance testing:

- (1) Method 1 for selection of sample site and sample traverses.
- (2) Method 2 for determining stack gas flow rate.
- (3) Method 3 or 3A for gas analysis for calculation of percent O<sub>2</sub> and CO<sub>2</sub>.

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- (4) Method 4 for determining stack gas moisture content to convert the flow rate from actual standard cubic feet to dry standard cubic feet.
- (5) Method 5 or Method 17 for particulate matter.
- (6) Method 6, 6C, or 8 for SO<sub>2</sub>.
- (7) Method 7, 7A, 7B, 7C, 7D, or 7E for nitrogen oxides.
- (8) Method 8 for sulfuric acid mist.
- (9) Method 9 for visible emissions, in accordance with 40 CFR 60.11 and Appendix A.
- (10) Method 10 for CO.
- (11) Method 12 for lead.
- (12) Method 13A or 13B for fluorides.
- (13) Method 19 for sulphur dioxide removal efficiency pursuant to 40 CFR 60.48a.
- (14) Method 18 or 25 for VOCs.
- (15) Method 101A for mercury.
- (16) Method 104 for beryllium.
- (17) Method 201 or 201A for PM<sub>10</sub> emissions.
- (18) Ammonia (NH<sub>3</sub>) method to be determined by the Department.

9. Continuous Emission Monitoring for each CFB

CBCP shall install, certify, calibrate, operate, and maintain CEMS for opacity, SO<sub>2</sub>, NO<sub>x</sub>, CO, and O<sub>2</sub> or CO<sub>2</sub>, pursuant to all applicable requirements of Rule 17-296.800, F.A.C.; Chapter 17-297, F.A.C.; 40 CFR 60, Subpart A; 40 CFR 60, Subpart Da; 40 CFR 60, Appendix B; and, 40 CFR 60, Appendix F. These CEMS shall be used to determine compliance with the emission limitations in Specific Condition No. II.A.3. for CO, NO<sub>x</sub>, and SO<sub>2</sub>, and with the opacity requirements in Specific Condition No. II.A.5. The permittee may elect to install, certify, calibrate, operate, and maintain multiple span CEMS for sulfur dioxide and nitrogen oxides providing certification tests and calibrations are performed for each span. Each of the CEMS for sulfur dioxide and nitrogen oxides shall continuously record data on a span that satisfies the requirements of 40 CFR 60.47a. Any exception to the above must be specifically authorized by the

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exception to the above must be specifically authorized by the Department, in writing, and in accordance with state and federal regulations.

a. CEMS data shall be recorded and reported in accordance with Chapter 17-297, F.A.C., and 40 CFR 60.49a and 60.7. A record shall be kept for periods of startup, shutdown and malfunction.

b. A malfunction means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation, or any other preventable upset condition or preventable equipment breakdown, shall not be considered malfunctions.

c. The procedures under 40 CFR 60.13 shall be followed for installation, evaluation, and operation of all CEMS.

d. Opacity monitoring system data shall be reduced to 6-minute averages, based on 36 or more data points, and gaseous CEMS data shall be reduced to 1-hour averages, based on 4 or more data points, in accordance with 40 CFR 60.13(h).

e. For purposes of reports required under this permit, excess emissions are defined as any calculated average emission concentration, as determined pursuant to Specific Condition No. II.A.11., herein, which exceeds the applicable emission limit in Specific Condition No. II.A.3.

f. The permittee is subject to all applicable provisions of Rule 17-4.130, F.A.C., Plant Operation-Problems.

**10. Operations Monitoring for each CFB**

a. Devices shall be installed to continuously monitor and record steam production and flue gas temperature at the exit of the control equipment.

b. All coal and No. 2 fuel oil usage shall be recorded on a 24-hr (daily) basis for each CFB. Recycle rejects usage on a volumetric basis shall be estimated and recorded for each 24-hour period in which rejects are burned.

**11. Reporting for each CFB**

a. A minimum of thirty (30) days prior written notification of compliance testing shall be given to the Department's N.E. District office and to the RESD office, in accordance with 40 CFR 60.8.

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**SPECIFIC CONDITIONS cont.:**

b. In accordance with Rule 17-297.570, F.A.C., the results of the compliance test shall be submitted to the RESD office within 45 days after completion of the last test run.

c. The owner or operator shall submit excess emission reports to the RESD office, in accordance with Rule 17-210.700, F.A.C., and 40 CFR 60.7(c) and (d). The reports shall include the following:

(1) The magnitude of excess emissions computed in accordance with 40 CFR 60.13(h), any conversion factors used, and the date and time of commencement and completion of each period of excess emissions (40 CFR 60.7(c)(1)).

(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the furnace boiler system. The nature and cause of any malfunction (if known) and the corrective action taken or preventive measures adopted (40 CFR 60.7(c)(2)).

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks, and the nature of the system repairs or adjustments (40 CFR 60.7(c)(3)).

(4) When no excess emissions have occurred or the continuous monitoring system has not been inoperative, repaired, or adjusted, such information shall be stated in the report (40 CFR 60.7(c)(4)).

(5) The owner or operator shall maintain a file of all measurements, including continuous monitoring systems, monitoring devices, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous systems or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and, all other information required by this permit recorded in a permanent form suitable for inspection (40 CFR 60.7(e)).

d. Annual and quarterly reports shall be submitted to the RESD office as per Rule 297.500, F.A.C.

12. Any change in the method of operation, fuels utilized, equipment, or operating hours or any other changes pursuant to Rule 17-212.200, F.A.C., defining modification, shall be submitted for approval to the Department's Bureau of Air Regulation (BAR).

13. All records of documentation shall be kept on file for a minimum of 3 years pursuant to Rule 17-4.160(4), F.A.C.

14. The permittee is subject to all applicable provisions of Rule 17-210.700, F.A.C., Excess Emissions.

PERMITTEE:  
Cedar Bay Cogeneration, Inc.

Permit Number: PSD-FL-137A  
County: Duval

**SPECIFIC CONDITIONS cont.:**

15. The permittee is subject to all applicable provisions of Rule 17-210.650, F.A.C., Circumvention.

16. The permittee is subject to all applicable provisions of Rule 17-4.160, F.A.C., Permit Conditions.

**B. CBCP - Material Handling and Treatment**

1. The material handling and treatment operations, including coal and limestone unloading buildings, coal and limestone reclaim hoppers, coal crusher house, limestone dryers, fly and bed ash silos, ash pelletizer, pellet curing silo, coal and limestone day silos, conveyors, storage areas and related equipment, may be operated continuously, i.e. 8760 hrs/yr, except that the limestone crushers/dryers may be operated for a maximum of 11 hours per day (maximum of 2920 hrs/yr) at maximum capacity.

2. The material handling/usage rates for coal, limestone, fly ash, and bed ash shall not exceed the following:

Material	Handling/Usage Rate	
	TPM	TPY
Coal	117,000	1,170,000
Limestone	27,000	320,000
Fly Ash	28,000	336,000
Bed Ash	8,000	88,000

Note: TPM is tons per month based on 30 consecutive days; and, TPY is tons per year.

3. The VOC emissions, from the maximum No. 2 fuel oil utilization rate of 240 gals/hr. and 700,800 gals/year for the limestone dryers and 8000 gals/hr. and 1,900,000 gals/year for the three boilers, are not expected to be significant.

4. Material handling sources shall be regulated as follows:

a. The material handling and treatment area sources with either fabric filter or baghouse controls are as follows:

Coal Crusher Building - 6	Bed Ash Bin - 13
Coal Silo Conveyor - 7	Fly Ash Bin - 14
Limestone Pulverizer/Conveyor - 8	Pellet Vibratory Screen - 15
Limestone Storage Bin - 9	Pelletizing Ash Recycle Tank - 16
Bed Ash Hopper - 10	Pelletizing Recycle Hopper - 17
Bed Ash Silo - 11	Cured Pellet Recycle Conveyor - 18
Fly Ash Silo - 12	Pellet Recycle Conveyor - 19

The emissions from the above listed sources are subject to the PM emission limitation requirement of 0.003 gr/dscf (applicant

PERMITTEE:  
Cedar Bay Cogeneration, Inc.

Permit Number: PSD-FL-137A  
County: Duval

**SPECIFIC CONDITIONS cont.:**

requested limitation which is more stringent than what is allowed by Rule 17.296.711, F.A.C.). Since these sources are RACT standard type, then a one-time verification test on each source shall be required for PM mass emissions to demonstrate that the baghouse control systems can achieve the 0.003 gr/dscf. The performance tests shall be conducted using EPA Method 5 pursuant to Rule 17-297, F.A.C., and 40 CFR 60, Appendix A (July, 1992 version).

b. The PM emissions from the following process and/or equipment, in the material handling and treatment area sources, shall be controlled using wet suppression/removal techniques:

- Coal Car Unloading -20
- Ash Pellet Hydrator -21
- Ash Pellet Curing Silo -22
- Ash Pelletizing Pan -23

The above listed sources are subject to a VE and a PM emissions limitation requirement of 5% opacity and 0.01 gr/dscf (applicant requested limitation, which is more stringent than what is allowed by rule), respectively, in accordance with Rule 17-296.711, F.A.C. Initial and subsequent compliance tests shall be conducted for VE and PM emissions using EPA Methods 9 and 5, respectively, in accordance with Chapter 17-297, F.A.C., and 40 CFR 60, Appendix A (July, 1992 version).

5. VE shall not exceed 5% opacity from any source in the material handling and treatment area listed in Specific Condition No. II.B.4., in accordance with Rule 17-296.711(2)(a), F.A.C. After the one-time PM mass emissions verification compliance tests have been performed, neither the Department nor the RESD will require a PM mass emissions test in accordance with EPA Method 5 unless the VE limit of 5% opacity is exceeded for a given source, or unless the Department or the RESD, based on other information, has reason to believe that the PM emission limits are being violated in accordance with Rule 17-297.620(4), F.A.C.

6. All sources subject to VE and PM mass emissions performance tests shall conduct them concurrently, except where inclement weather interferes.

PERMITTEE:  
Cedar Bay Cogeneration, Inc.

Permit Number: PSD-FL-137A  
County: Duval

**SPECIFIC CONDITIONS cont.:**

7. The maximum emissions from each of the limestone dryers, while using oil, shall not exceed the following (based on AP-42 factors, Table 1, 3-1, Industrial Distillate, 10/86):

Pollutant	lbs/hr.	TPY	TPY for 2 dryers
PM/PM <sub>10</sub>	0.24	0.32	0.64
SO <sub>2</sub>	0.85	1.15	2.3
CO	0.60	0.81	1.62
NOx	2.40	3.25	6.5
VOC	0.05	0.06	0.12

VE from the dryers shall not exceed 5% opacity.

8. The maximum sulfur content of No. 2 fuel oil shall not exceed 0.05%, by weight. The maximum firing rate of No. 2 fuel oil for each limestone dryer shall not exceed 120 gals/hr., or 350,400 gals/year. This reflects a combined total fuel oil firing rate of 240 gals/hr., and 700,800 gals/year, for the two dryers.

9. Initial and annual PM emissions and VE compliance tests for all the emission points in the material handling and treatment area, including but not limited to the sources specified in this permit, shall be conducted in accordance with the July 1, 1992 version of 40 CFR 60, Appendix A, using EPA Methods 5 and 9, respectively.

10. Compliance test reports shall be submitted to the RESD within 45 days of test completion in accordance with Rule 17-297.570, F.A.C.

11. Any changes in the method of operation, raw materials processed, equipment, or operating hours or any other changes pursuant to Rule 17-212.200, F.A.C., defining modification, shall be submitted for approval to the Department's BAR.

**C. Requirements For the Permittees**

1. Beginning one month after certification, CBCP shall submit to the RESD and the Department's BAR, a quarterly status report briefly outlining progress made on engineering design and purchase of major equipment, including copies of technical data pertaining to the selected emission control devices. These data should include, but not be limited to, guaranteed efficiency and emission rates, and major design parameters such as air/cloth ratio and flow rate. The Department may, upon review of these data, disapprove the use of any such device. Such disapproval shall be issued within 30 days of receipt of the technical data.

2. CBCP shall report any delays in construction and completion of the project which would delay commercial operation by more than 90 days to the RESD office.

PERMITTEE:  
Cedar Bay Cogeneration, Inc.

Permit Number: PSD-FL-137A  
County: Duval

**SPECIFIC CONDITIONS cont.:**

3. Reasonable precautions to prevent fugitive PM emissions during construction, such as coating of roads and construction sites used by contractors, regrassing or watering areas of disturbed soils, will be taken by CBCP. CBCP is subject to all applicable provisions of Rule 17-296.310(3), F.A.C., Unconfined Emissions of Particulate Matter.

4. Fuel shall not be burned in any CBCP unit unless the control devices are operating properly, pursuant to 40 CFR 60, Subpart Da.

5. The maximum sulfur content of the No. 2 fuel oil utilized in the CFBs and the two unit limestone dryers shall not exceed 0.05%, by weight. Samples shall be taken of each fuel oil shipment received and shall be analyzed for sulfur content and heating value. Records of the analyses shall be kept a minimum of three years to be available for the Department and RESD inspection.

6. Coal fired in the CFBs shall have a sulfur content not to exceed 1.7%, by weight, on a shipment (train load) basis. Coal sulfur content shall be determined and recorded in accordance with 40 CFR 60.47a.

7. CBC shall maintain a daily log of the amounts and types of fuel used and copies of fuel analyses containing information on sulfur content and heating values.

8. CBCP shall provide stack sampling facilities as required by Rule 17-297.345, F.A.C.

9. Prior to commercial operation of each source, the permittee shall submit to the Department's BAR a standardized plan or procedure that will allow the permittee to monitor emission control equipment efficiency and enable the permittee to return malfunctioning equipment to proper operation as expeditiously as possible.

10. All CBCP records of documentation shall be kept on file for a minimum of three years pursuant to Rule 17-4.160(14), F.A.C.

**D. Contemporaneous Emission Reductions**

The following SKC sources shall be permanently shut down and made incapable of operation, and shall turn in their operation permits to the Department's BAR, within 30 days of written confirmation by the Department of the successful completion of the initial compliance tests on the CBCP boilers: the No. 1 PB (power boiler), the No. 2 PB, the No. 3 PB, the No. 1 BB (bark boiler), and the No. 2 BB. The RESD office shall be specifically informed in writing within thirty days after each individual shut down of the above referenced equipment. This requirement shall operate as a joint and individual



PERMITTEE:  
Cedar Bay Cogeneration, Inc.

Permit Number: PSD-FL-137A  
County: Duval

**SPECIFIC CONDITIONS cont.:**

requirement to assure common control for purpose of ensuring that all commitments relied on are in fact fulfilled.

**E. Modification of Specific Conditions**

The Specific Conditions of this permit may be modified in the following manner:

1. Through the May 11, 1993 Modification of Certification, the Board, which means the Governor and Cabinet, delegated to the Secretary of Department of Environmental Protection the authority to modify, after notice and opportunity for hearing, any conditions pertaining to consumptive use of water, reclaimed water, monitoring, sampling, ground water, surface water, mixing zones, or variances to water quality standards, zones of discharge, leachate control programs, effluent limitations, air emission limitations, fuel, or solid waste disposal, right of entry, railroad spur transmission line, access road, pipelines, or designation of agents for the purpose of enforcing the conditions of this permit.
2. All other modifications shall be made in accordance with Section 403.516, F.S.

Issued this 19th day  
of November, 1993

STATE OF FLORIDA DEPARTMENT  
OF ENVIRONMENTAL REGULATION

Virginia B. Wetherell  
Virginia B. Wetherell, Secretary

Memorandum

Florida Department of  
Environmental Protection

TO: Virginia B. Wetherell  
FROM: Howard L. Rhodes *HLR*  
DATE: November 16, 1993  
SUBJECT: Approval of Revised/Amended Air Construction Permit  
PSD-FL-137A  
Cedar Bay Cogeneration, Inc.

Attached for your approval and signature is a revised/amended air construction permit (PSD-FL-137A), which is the result of a modification of a previously issued Power Plant Site Certification and air permit (PSD-FL-137). The proposed revision was prepared by the Bureau of Air Regulation, since EPA granted full delegation of PSD permitting authority of Power Plants on October 26, 1993.

The facility, consisting of three new coal-fired boilers, was originally certified pursuant to the Florida Power Plant Siting Act in March of 1991. In the summer of 1992, a proceeding was initiated to revise the State's requirements for the project. That proceeding culminated in a Stipulation of Settlement, entered into by all parties and approved by the Siting Board on May 11, 1993. The Siting Board's Order calls for significant reductions to both the Cedar Bay Cogeneration Project's (Project) air emissions and its air quality impacts. To establish federally enforceable conditions, Paragraph 23 of that Settlement Stipulation calls for an amendment of the original air permit (PSD-FL-137) for the Project to reflect the modifications that are applicable to the Project's air permit.

The facility will be located in Jacksonville, Duval County, Florida. All pending controversies and hearings have been resolved and the modification of Certification has been finalized.

I recommend your approval and signature.

HLR/BM/rbm

PSD-FL-137A

11/09/1993

**PYROPOWER CORPORATION  
OPERATION & MAINTENANCE MANUAL  
FOR PYROFLOW CFB BOILERS  
FOR THE**

**CEDAR BAY, INC.  
COGENERATION PROJECT**

<input checked="" type="checkbox"/>	NO EXCEPTIONS NOTED
<input type="checkbox"/>	EXCEPTIONS NOTED REVISE & RESUBMIT FOR DISTRIBUTION
<input type="checkbox"/>	RETURNED FOR CORRECTION
NOV 09 1993	
REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR ERRORS OR DEVIATIONS FROM CONTRACT REQUIREMENTS. BLACK & VEATCH	

**PYROPOWER CORPORATION  
8925 REHCO ROAD  
SAN DIEGO, CA 92121  
(619) 458-3000**

**APPENDICES**

**VENDOR INFORMATION**

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## PYROPOWER

JOB #6J-7877

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ISOCHEM

SPUR GEAR MAGNETIC  
DRIVE PUMP  
MODEL GM6-ACT-KXF-ARXP  
TAG: P-1A  
P-1B

RUBICON

FEED AND BOTTOMS  
EXCHANGER  
MODEL WC4BU4-72H  
TAG: HX-1

DUSENBERY

AMMONIA STRIPPER COLUMN  
MFG. SERIAL NO. 871A  
TAG: VSL-1

VAPOR RESERVOIR  
MFG. SERIAL NO. 872A  
TAG: RVR-1

FISHER

CONTROL VALVE  
MODEL 667-CE  
W/ MODEL 3582I  
POSITIONER  
TAG: ACV/AY-1007  
ACV/AY-102  
ACV/AY-104  
ACV/AY-105  
TCV/TY-109  
ACV/AY-2007  
ACV/AY-3007

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FISHER (CONT'D.)

REGULATOR  
MODEL 92C  
TAG: PRV-060

FOXBORO

TRANSMITTER  
MODEL 823DP-I3S1SM2-M  
TAG: FT-1006  
LT-102  
PDT-103  
FT-2006  
FT-3006

TRANSMITTER  
MODEL 896-TA-A  
TAG: FT-101

TRANSMITTER  
MODEL 823DP-I3K1SH2-BM  
TAG: FT-104

PRESSURE TRANSMITTER  
MODEL 821GM-IS1SM2-M  
TAG: PT-105  
PT-107

MAGNETIC FLOW METER  
W/ TRANSMITTER  
MODEL 2801-SABB-TSF  
TAG: FE-101

GEMS

TRANSMITTER  
MODEL H  
TAG: LT-110

LEVEL GAUGE  
MODEL SURE SITE 86158  
TAG: LI-110

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FARRIS

RELIEF VALVE  
MODEL 26JC10-120/S1  
TAG: RV-006

RELIEF VALVE  
MODEL 26DC10-120/S1  
TAG: RV-039

RELIEF VALVE  
MODEL 26EA21-140/S1  
TAG: RV-059  
RV-052

RELIEF VALVE  
MODEL F2740UL/S4  
TAG: RV-075  
RV-076  
RV-088

HOKE

RELIEF VALVE  
MODEL 6532L4Y  
TAG: RV-1020  
RV-2020  
RV-3020

WATTS

RELIEF VALVE  
MODEL 159-04-75  
TAG: RV-1020      RV-3020  
RV-128      PCV-1020  
RV-2020      PCV-3020

PRESSURE REGULATOR  
MODEL B11-04  
TAG: PRV-1019  
PRV-2019  
PRV-3019  
PRV-127  
PRV-058

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WORCESTER

BALL VALVE  
MODEL 466 RT BWI  
W/ ASCO SOLENOID VALVE  
MODEL 8320G202  
AND NAMCO PROXIMITY SWITCH  
MODEL EA700  
TAG: ABV/SV-1001  
ABV/SV-1009  
ABV/SV-2001  
ABV/SV-2009  
ABV/SV-3001  
ABV/SV-3009

THERMO ELECTRIC

THERMOCOUPLE  
MODEL ADSL 14  
W/THERMOWELL  
TAG: TE/TW-106  
TE/TW-108  
TE/TW-109

ASHCROFT

PRESSURE GAUGE  
MODEL 45-1279SS-04L  
TAG: PI-1004      PI-125  
PI-1008      PI-2004  
PI-104      PI-110  
PI-115      PI-116  
PI-2008      PI-3004  
PI-3008      PI-112

PRESSURE GAUGE  
MODEL 25-1009SW-02B  
TAG: PI-1019  
PI-127  
PI-2019  
PI-3019



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SOR

PRESSURE SWITCH  
MODEL 6V3-AG3-M9-C2A-PCTT  
TAG: PSL-1005  
PSL-2005  
PSL-3005

PRESSURE SWITCH  
MODEL 52SC-KK117-M9-C2A-  
PBPCCT  
TAG: PSL-111

PRESSURE SWITCH  
MODEL 5V3-AG3-M9-C2A-PC-TT  
TAG: PS-112

ABB KENT-TAYLOR

INTEGRAL WEDGE FLOW  
ELEMENT  
MODEL 1337LZ32100  
TAG: FE-2006  
FE-3006  
FE-1006

INTEGRAL WEDGE FLOW  
ELEMENT  
MODEL 161OLF15052  
TAG: FE-104

ERDCO

ROTAMETER  
MODEL 3263-04T0  
TAG: FI-1010      FI-1014  
FI-1011      FI-1015  
FI-1012      FI-1016  
FI-1013      FI-1017  
FI-2010      FI-2012  
FI-2013      FI-2014  
FI-2015      FI-2016  
FI-2017      FI-2111  
FI-3010      FI-3011  
FI-3012      FI-3013

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ERDCO (CONT'D.)

ROTAMETER  
MODEL 3263-04T0  
TAG: FI-3016      FI-3017

ARMSTRONG

STRAINER  
MODEL 1 1/2"-BXFL  
TAG: FX-119  
      FX-126

STEAM TRAP  
MODEL 1/2" CD-61A  
TAG: LCV-119  
      LCV-119A  
      LCV-126

MASONEILAN

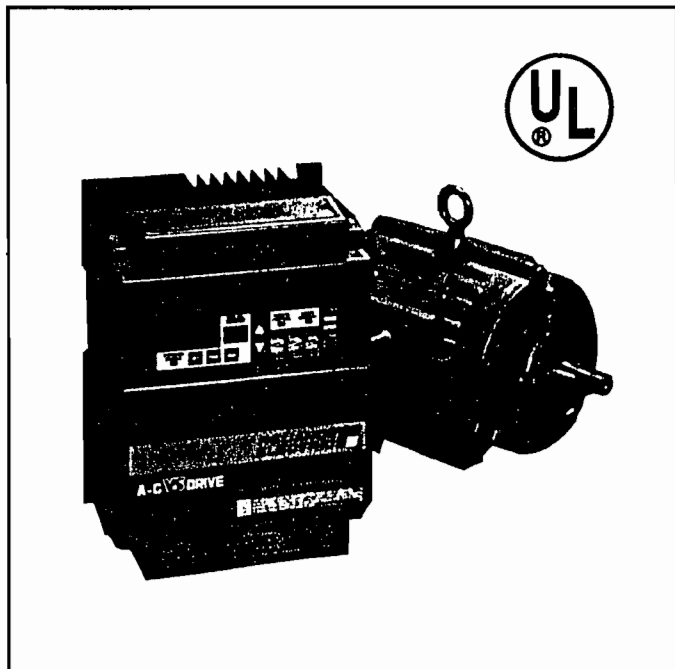
PRESSURE REGULATOR  
MODEL 17-17  
TAG: PRV-089

PEK

ORIFICE PLATE  
PADDLE TYPE  
TAG: RO-114



**GP2000**  
**A-C V★S DRIVES**  
**1/4 – 125 HP**



The GP2000 Series is a fully digital, microprocessor-based PWM A-C V★S Drive. This state-of-the-art micro controller offers "full spectrum switching" to eliminate annoying PWM acoustic motor noise. The 16-bit micro allows repeatability of settings, zero drift, high noise immunity and enhanced diagnostics. In addition, the regulator utilizes Large Scale Integration (LSI) and surface mount technology for increased reliability and compactness.

GP2000 Series drives feature two menus to choose from. Menu 1 lets the user adjust commonly used functions. Menu 2 is password-protected and allows the user to configure GP2000 controllers to more sophisticated application requirements. A second password is used for safety-related variables.

When matched to Reliance Electric Duty Master® XE motors, this controller/motor package offers improved performance, higher efficiencies and longer life compared to standard induction motors. For the most rugged of applications requiring low speed high torque and high speed, the GP2000 Series controller can be matched to the RPM® A-C motor. This drive is UL listed and when matched to Reliance Electric explosion-proof motors, will maintain the motors division I, explosion-proof certification (contact Reliance for specifics).

Reliance Electric has built its reputation on supplying performance-matched industrially rugged drive packages. The GP2000 drive is no exception. Like all V★S Drive products, Reliance takes complete responsibility for the total drive performance – that means we are your single source for total "system" requirements. By choosing the GP2000 A-C V★S Drive, you select a product design that draws upon research and development efforts from Europe, Japan and the U.S. The product you buy is Reliance Electric designed, built and backed using the best of the world's technology.

Reliance Electric's involvement in A-C drive applications from the very beginning of this industry gives us the experience and know-how to properly select and apply the right technology solution for any industrial and commercial requirement. With GP2000 you get the best application and technology solution available in a high-quality, high-value product.

## STANDARD FEATURES

- Full spectrum switching technology to minimize annoying PWM acoustic motor noise.
- Automatic flux control for improved response to changing load conditions.
- Drive can be controlled via:
  - Standard keypad
  - Remote operator station (optional)
  - AutoMate/AutoMax Industrial Controller Interface (optional)
- Standard keypad functions:
  - Speed selection, Start/Stop, Forward/Reverse, Auto/Manual, Run/Jog
  - Keypad controller parameter inputs
  - LED display of volts, amperage, frequency, RPM, external reference signal and count down of autoreset time interval.
- 24 volt D-C control circuits (start, jog, forward, reverse)
- Speed range of 3 to 60 Hz (20:1), programmable to 400 Hz.
- Three programmable preset speeds.
- Programmable slip compensation circuit for accurate speed regulation – 1% – without the need of a tachometer.
- Multiple programmable V/Hz curves for constant torque and variable torque applications.
- "S" Curve acceleration and deceleration
- 0–20 ma, 4–20 ma, 0–10 VDC and pulse train isolated or non-isolated input signal capability.
- Inverse reference capability
- Programmable auto restart (number of restart attempts and time interval between resets are selectable).
- Frequency avoidance with programmable frequency avoidance band width.
- Adjustable D-C braking programmable in amplitude and duration.
- Coast-to-rest on "stop" as standard, or ramp-to-rest.
- Adjustable torque boost.
- D-C offset at 0 Hz for synchronous motor operation.
- Programmable electronic motor overload protection.
- Line dip ride through programmable through 15–500 msec.
- Line-to-line and line-to-ground output short circuit protection – running and starting.
- Motoring current limit & regenerative voltage limit.
- Digital display for controller fault conditions:
  - High Bus Voltage, Low Bus Voltage, Overcurrent, Overload, Overheat, CPU Error, Function Loss, Coast Stop
- Other programmable functions include:
  - Acceleration
  - Deceleration
  - Minimum Hz
  - Overfrequency limit
  - Jog frequency
  - Maximum Hz
  - Frequency and current level detection
  - Current limit
  - Static MOP
  - Output Voltage regulation
  - Independent Jog Acceleration and Deceleration time selection
  - Current limit Deceleration rate
  - Start into a Rotating Load
- A Line Reactor is standard on the following:
  - 15 & 20 HP (230 V) and 25–40 HP (460 V and 575 V)
  - 1–10 HP (230 V) and 1–20 HP (460 V and 575 V) in expanded cabinet
  - 25–50 Hp (230 V), 50–125 HP (460 V) and 50–100 HP (575 V) with bypass

A-C V★S® Drives  
GP2000 Customer  
Application Handbook



D-9576

**RELIANCE**  
**ELECTRIC** 

This handbook demonstrates some of the GP2000's capabilities to solve customer applications. Each success story highlights a specific feature and customer benefit provided by the GP2000. It is intended as a sales reference to reinforce the problem solving ability of the product line. The Reliance sales engineer involved in each application is recognized following each entry so more specific information may be obtained by the reader. These shared success stories are listed in the index by customer industry or business type, but may present similar problem solving advantages to many other applications. The reader is encouraged to view each as a unique competitive benefit for the GP2000.

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# GP2000 Customer Application Handbook

## 1. AUTOMOTIVE HIGH-SPEED TEST STAND

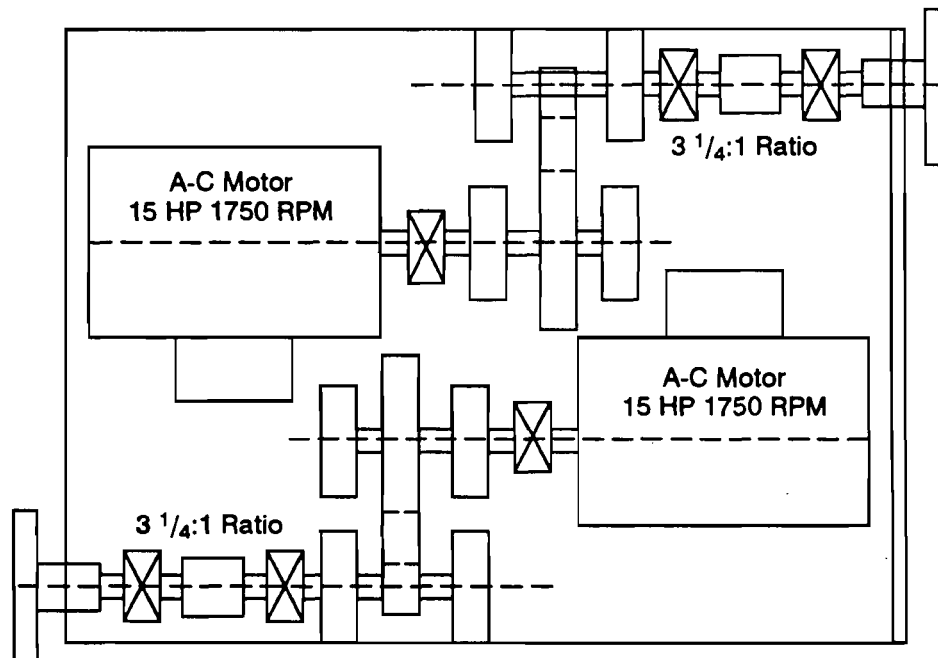
### 32:1 Speed Range with RPM A-C

A user had to redesign its high-speed bearing test stand due to new automotive requirements for more accurate and higher-speed requirements. They came to Reliance due to prior successful controller applications.

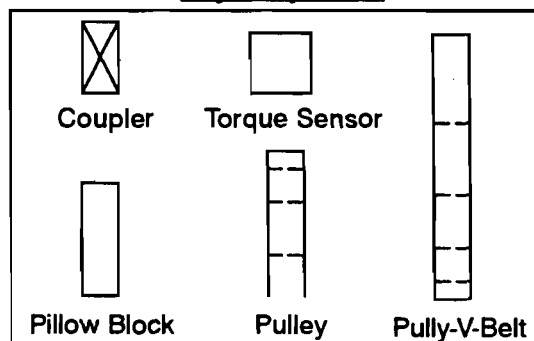
Needed on this test stand were a motor and controller that would produce 160 inch-pounds of breakaway torque and a speed profile from 500 to 16,000 RPM. This was all to be accomplished in an environmental chamber with varying temperatures. Each cycle took 10 hours and could be repeated indefinitely.

The solution was GP2000 and RPM A-C Motors. The 32:1 speed range is achieved by operating between 3.9 and 126 Hz. Belted to the bearing shaft is a 1:4 speed increaser, giving the customer the desired test-stand speeds. This application used two systems so the test stands can run different computer-controlled, simultaneous tests on each end of the station.

### Bearing Test Chamber



### Key to Symbols



Submitted by: Ron Mammoser - RDT

**2. MATERIAL HANDLING ROTARY FEEDERS**

**Jam Detection with RMI Card**

A material handling OEM needed a semi-automated coal prep feeder process. They wanted to be able to sense a jam condition in the feeder, try to clear by reversing, and stop only if the reversing process failed to clear the obstruction. This detection also enabled them to eliminate a mechanical zero speed switch typically used. Reliance® handled the entire control scheme by using GP2000's with remote meter interface cards and Shark™ programmable controllers. The application had a right and left feeder so two GP2000's were tied to a single Shark. To sense the jam, the 0–10 volt output proportional to current was fed from the remote meter interface card to the Shark. At a customer selectable preset value, the Shark initiated a reverse command and timed the reverse. If after three reversals (number is selectable by user) the Shark still monitored a high current signal, the system stopped and gave a jam failed to clear signal. Reliance also supplied the OEM with a run and zero speed contact for customer use. Additionally, 0-10 volt signals proportional to speed and voltage were used for remote indication. All features that were required in this application were conveniently packaged on the remote meter interface card and easily connected to the Shark programmable logic controller. The user in this case was assured that a simple programmable system using GP2000's was the best solution to detect jams in the rotary feeders.

*Submitted by: Bobbi Riley - RPH*

**3. WASTE WATER SCREW FEEDER**

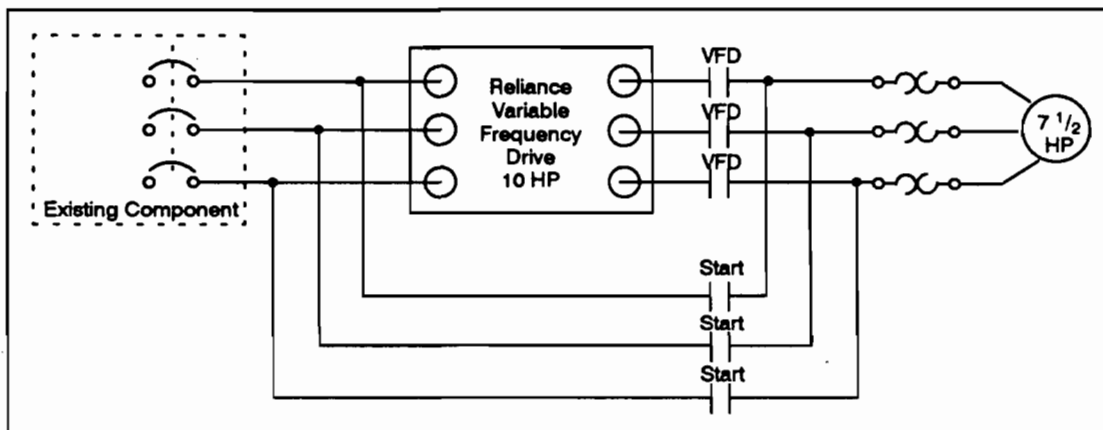
**Starts Into Rotation Load**

The customer had existing competitive A-C drives installed that could not provide the required torque to break the screw feeders away.

A consulting engineer inquired as to whether Reliance would provide a means of both starting the motors across-the-line and then control the motors. Because the GP2000 can accomplish this transition without hesitation, speed reduction, or time delay, it was the centerpiece of the solution for this application.

A system was then designed around the GP2000 controller using a series of contactors that would start the motor across-the-line and after a time delay (adjustable via time delay relay), transfer operation to the GP2000. After operating the system for several months, only a few IET trips have been observed. To stop these occasional trips, auto reset has been programmed into the controller. The GP2000 has always started successfully on the second attempt.

The user is extremely pleased with the results the replacement GP2000 has achieved, and the equipment manufacturer is anxious to begin placing Reliance controllers on all his machines. Support drawings and fabrication of the units also played a part in this application.



*Submitted by: Tom Weinandy - REO*



**4. YARN WINDERS**

**Programming Simplicity**

These GP2000's replaced a D-C drive system on "Sulzer" yarn winding machines. The key to this application was the ease of programming and lack of analog potentiometers. Each GP2000 is controlled by a master speed pot reference. The winding speed is then automatically "trimmed" by a dancer input of +/- 20%. A dancer input card manufactured by Caretron was supplied to tie the controllers and dancers together.

Start-up of 12 units was completed in under four hours! Due to the duplication of the variables from setup of the first controller, each additional controller was programmed in a very short amount of time. The customer is very pleased with the installed system and maintenance of the new GP2000 controlled A-C system vs. the older D-C system has significantly reduced operating cost.

*Submitted by: Scott Stocklager - RGB*

**5. PUMP AND SLURRY SCREW**

**Single Source Responsibility**

As part of a large paper mill modernization, Reliance was successful in negotiating an order for four GP2000 units and a number of XE Premium Efficient motors. The key factor that persuaded the user to deviate from his standard competitive product was Reliance's ability to assume complete application responsibility with a single product line.

Start up and training were part of the value-added service Reliance provided to get the customer familiar with the GP2000 product. After six months of operation the products have operated nearly trip-free. The customer describes the GP2000 as being a user-friendly yet feature-rich product that made his day-to-day activity much simpler.

*Submitted by: Bob Meilinger - RKZ*

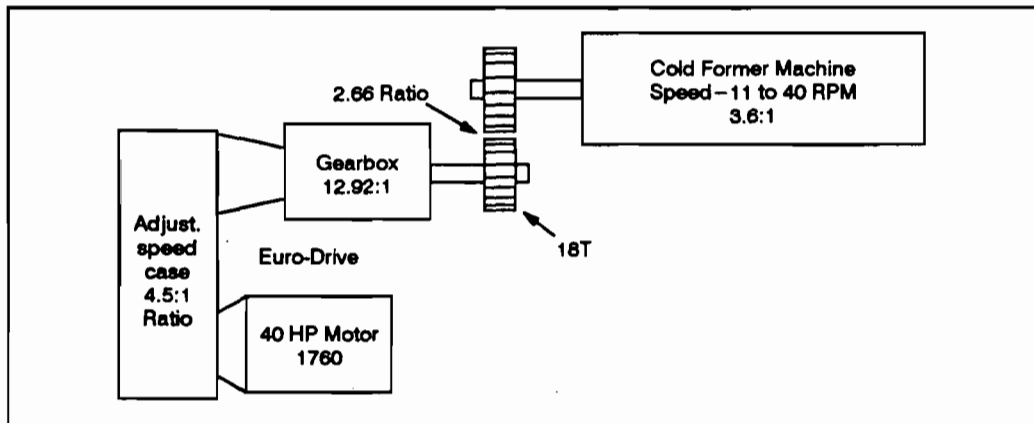
**6. CEREAL PLANT**

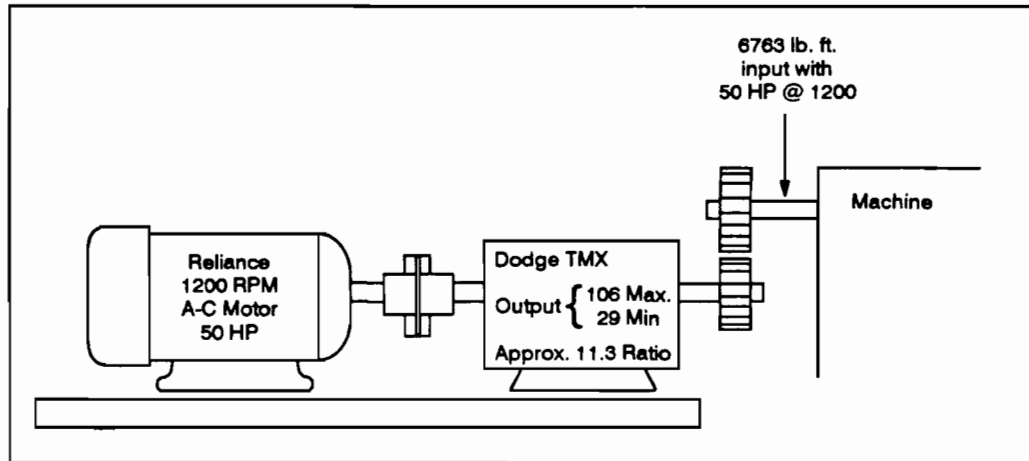
**Constant Speed Requirements**

A customer has had many maintenance problems with variable speed Eurodrives on cereal cold formers. The customer did not change speeds very often, which is the worst case for mechanical Eurodrives. After reviewing the torque and gear ratings, we sized the gearbox, motor (40HP), 1200 RPM, and 40HP GP2000.

The customer purchased two packages. They worked so well he purchased two more packages. A distributor built the custom base for the gearbox and motor, and also put drives in a NEMA-12 cabinet which the customer then ducted air into.

**Existing System Plan View**



**New System Profile**

*Submitted by: Steve Pappas - RSL*

**7. PRINTER/SLOTTER MACHINE****GP2000/Shark XL Package**

A distributor received a request from a customer regarding the possibility of replacing a 40HP D-C MG set with a GP2000 on a Hoper 72 inch printer/slotter machine.

The application required the use of a 30HP GP2000 interfaced with a Shark XL and a 30HP 1800 TEFC motor with a manual brake. By using an A-C controller and motor in this replacement solution, the customer enjoys the following benefits:

1. No brush wear
2. Programming flexibility with the Shark XL and GP2000
3. New E-stop circuit
4. Shorter deceleration time
5. Increased productivity

*Submitted by: Tom Keyes - RDN*

**8. TABLE GRINDER****Custom Operator Station**

A customer needed a drive package for a table grinder application. A unique requirement for this application was a custom 9C300 operator control station. The 9C300 station was field-modified with one set of contacts to reverse table direction. A second set of permanent contacts detected if the table overtravelled a pre-set point. These contacts initiated a controlled stop, utilizing D-C injection braking function for E-stop command.

The 9C300 was also modified to accept a bypass switch for jog in the opposite direction following the E-stop signal.

The key to success here was Reliance's willingness to take a standard, "off the shelf" product and custom engineer it to meet the customer's specific application requirements. Since installation this customer has allowed prospective Reliance customers in to view the operation of this machine, providing a great reference for the GP2000.

A second application from the same field source involved connecting a GP2000 to a joystick for position control. This application required connection of start/stop and forward/reverse signals from the joystick contact blocks into the GP2000.

*Submitted by: Al Henderson - RPT*

**9. GRINDING WHEELS**

**Current Level Detection Trip**

**WARNING**

**THE DESIRED CURRENT LEVEL TRIP POINT PROGRAMMED IN FUNCTION 35 SHOULD NOT BE USED AS A SAFETY INTERLOCK. IN THIS APPLICATION, THE INTENTION IS TO SHUT THE GRINDING WHEEL OFF AT A SPECIFIC MOTOR CURRENT LEVEL. ALL PRECAUTIONS STATED BY THE MACHINE MANUFACTURER SHOULD BE OBSERVED IN ADDITION TO PRECAUTIONS SUPPLIED WITH THE CONTROLLER. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY. FAILURE TO OBSERVE THE ABOVE WARNING COULD ALSO RESULT IN DAMAGE TO, OR DESTRUCTION OF, THE EQUIPMENT.**

A customer's application required the GP2000 to control the speed of a grinding wheel used for cut-off machines. The standard packaged GP2000 and optional remote meter interface card (1MI4000) were used to shut down the grinder when a pre-set current level was reached. The object of this intentional trip level was to sense when an operator applied too much pressure on the wheel. Previously, this excessive pressure resulted in replacement of the costly grinding wheels. With the GP2000 installed, if an operator attempted to cut faster than the wheel could withstand, a function loss trip caused the entire machine to shut down and a FL trip code appeared on the controller.

To wire this operation, take the N.C. contact from output relay 1 (terminals 38 and 39) into function loss circuit (terminals 11 and 12). Program function 28 to parameter 6— current level detection. To set the desired current level trip point use function 35 (programmed as a percent of controller nameplate amps).

*Submitted by: Al Henderson - RPT*

**10. MIXERS**

**Price/Delivery/Success**

Equipment: 50HP, GP2000; 50HP XP XE motors; spare motor, isolation transformer, XP remote station

We used the GP2000 equipment to replace a mechanical variable speed drive, that was operating a mixer to mix chemicals. The customer wanted to switch from mechanical to electrical controls. The customer had a "bad taste" about Parametrics. They also considered a competitor but our price, delivery, and support beat the competition through a distributor. The customer may buy two more GP2000/motor sets if this one works well.

*Submitted by: Bob Gluszik - RCG*

**11. CARROUSEL CONVEYORS**

**Drive Flexibility**

A user was developing new and different product lines. These product lines demand more of the drive itself. The major features of the GP2000 that allowed us to demonstrate that it can meet these demands are:

1. Pointable contacts to start/stop coordinated operation using meter interface 1MI4000.
2. Two and three pre-set speeds as opposed to two on the old T.B. Woods drive.

*Submitted by: Ray Noddin - RBG*

## 12. LEVEL CONTROLS FOR WORK PLATFORM

### Inherent Features/Flexibility

The competitive advantages in selling to this customer were:

1. Good sales coverage through a distributor.
2. Application experience.
3. Inherent features and flexibility of the GP2000; parameters that were used in this application: 0-1-2-3-4-5-6-7-9-10-11-12-13-24-25-26-27-28-29-30-35-36-39-44-45.

A quantity of five other XE TEFC motors were used on this project. This application may also lead to the use of a Shark PLC to replace current relay logic.

*Submitted by: Jack Lyons - RCR*

## 13. LUMBER INSPECTION/SORTER BELT

### Flexibility of Drive

Depending on the length of the board being inspected, the feeder belt speed can vary. The speed must be faster for long boards and slower for short boards. The application is very simplistic, with a manual start/stop speed control. The important part of the application is that the sorter belt determines the feed and therefore also the productivity of the planer.

*Submitted by: Jack Lyons - RCR*

## 14. BUFFING WHEEL

### Load and Speed Flexibility of the Drive

We reviewed an existing application of a 1.45" buffing wheel used to remove the weld marks from decorative stainless steel tubing. The existing 5HP D-C drives and motors could no longer be economically refurbished. A 230 volt 7.5HP GP2000 was specified for the application with several unknown existing in the system regarding loads and speeds of the buffing wheel.

Currently, the system on the remaining application are 460 volt 5HP GP2000's utilizing a 230 volt motor at 120 hertz to maximize wheel usage. The buffing wheel cost annualized was estimated at \$100,000 by the customer. The readout on the GP2000 gave the customer the confidence to reduce the horsepower size and increase the wheel utilization by increasing the speed.

*Submitted by: Bob Bliss - RCR*

## 15. DAIRY PRODUCTS PUMP

### Speed And Reference Flexibility

A distributor sold a 5HP 460V GP2000 in a NEMA 4 enclosure to a dairy which uses the equipment to operate a pump used to make ice cream. The critical selling features were:

1. Pre-set speed capability
2. Inverse reference capability

*Submitted by: Betty Ducker - RGI*

## 16. POSITIVE DISPLACEMENT GEAR PUMP

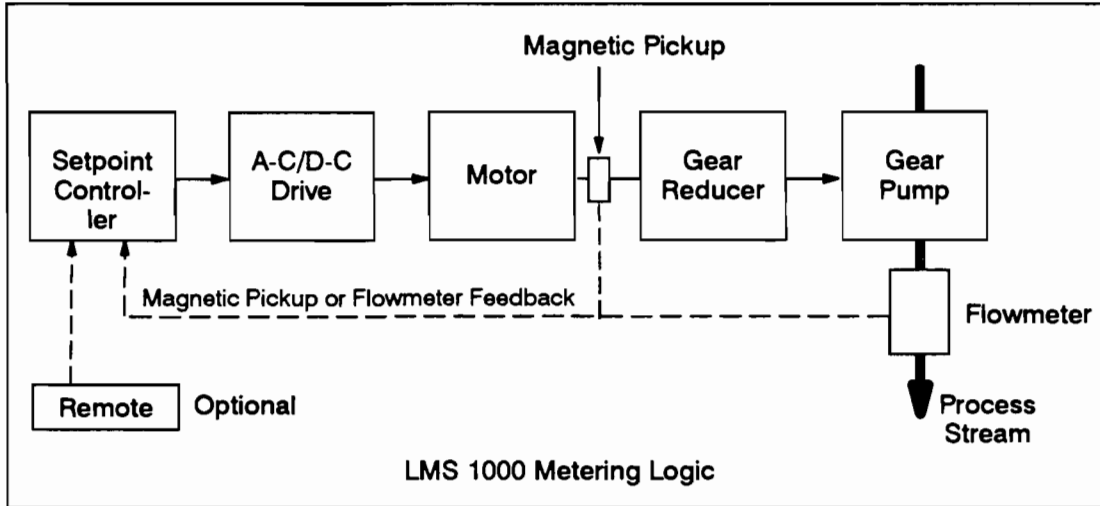
### Standard Features

Equipment included: 5HP GP2000 controller and motor, 460V FCXPXEX Class I, Group D, Division I, and transformer. Positive displacement gear pump.

Constant torque pumps and meter petroleum for lab line at a chemical plant.

Reliance has the competitive edge because:

1. Most features are standard
2. The GP2000 features simple operation
3. Price
4. Availability
5. Easy start-up and operation



Submitted by: Jerry Robinson - RCR

## 17. FOAM POURING LINE

### Serial Communications Need

A customer has a foam pouring line which involves a microcomputer which talks to a Fenner M Trim which instructs the GP2000. This particular application utilizes thirty-two (32) drives. Fourteen (14) drives operate at the same time. The software that controls the application was written by our customer and overcomes the need for a serial communication port.

Submitted by: Barbara Walker - RCR

## 18. FIBER CHOPPER

### Flexibility of Drive

The user was seeking proposals to replace an old eddy-current drive. This gave us a chance to quote against a traditional D-C drive replacement for this old, high starting torque drive.

We quoted as a replacement 5HP GP2000 drive with RPM™ A-C motor after educating the customer on the unique characteristics of this motor versus D-C. We also educated the customer on the unique capability of this motor when coupled with the flexibility of the GP2000 that could be pre-set to allow for quick changeover. These features of this drive package were very important since every product in this plant goes through this machine.

With our help, this customer was able to install, program, and start up the new drive. Today he is very satisfied with his new technology.

Submitted by: Robert Stenhouse - RGR

## 19. PAPER MILL BLEACHING MACHINE

### Voltage Line Dip Ride-through

A large paper company was given a GP2000 demonstration on the features of the product. The engineers from the paper mill were impressed but wanted to test two of the competitors products and a GP2000 side-by-side in the mill. A demonstration was scheduled in the electric shop. When the GP2000 was plugged and unplugged and the drive did not shutdown, they were amazed!

On the weekend during the first week of operation a grinder motor was started on the same power house bus which feeds the bleach plant. This event found all of one of the competitor's drives shut down but the GP2000 still running. The planner was so impressed by the GP2000 that he purchased five more drives!

The mill to date has purchased 16 drives. The plant electricians have commented on the simplicity of programming as one of the best features.

*Submitted by: Kirk Armintor - RET*

## 20. XP AREA IN CHEMICAL PLANT

### Hazardous Area

The customer wanted to put a 5HP GP2000 in a hazardous area and purge the drive for use with a Class 1, Division 1, Group D motor.

The customer was advised that the drive needed to be in a non-hazardous area but we could supply a remote operator station and that the combination would be U.L. listed.

*Submitted by: Roberta Richardson - RGR*

## 21. ASPHALT PUMP

### Torque Requirements/Speed Range

The application was for the coating section of a fiberglass shingle line. Asphalt was to be pumped from a holding tank through a heat exchanger to improve liquification of the material. The manufacturer was experiencing clogging problems because the asphalt was going through the heat exchanger too fast and as a result it was not getting liquified sufficiently. The existing 15HP, constant speed motor was severely undersized, even through a 3:1 reduction. Our solution was a 30HP drive and RPM A-C combination to handle torque requirements throughout the fairly wide speed range necessary for operation.

*Submitted by: Mike McCormack - RCB*

## 22. DOUGH PUMP/DOUGH CUTTER

### Speed Regulation/Start-up

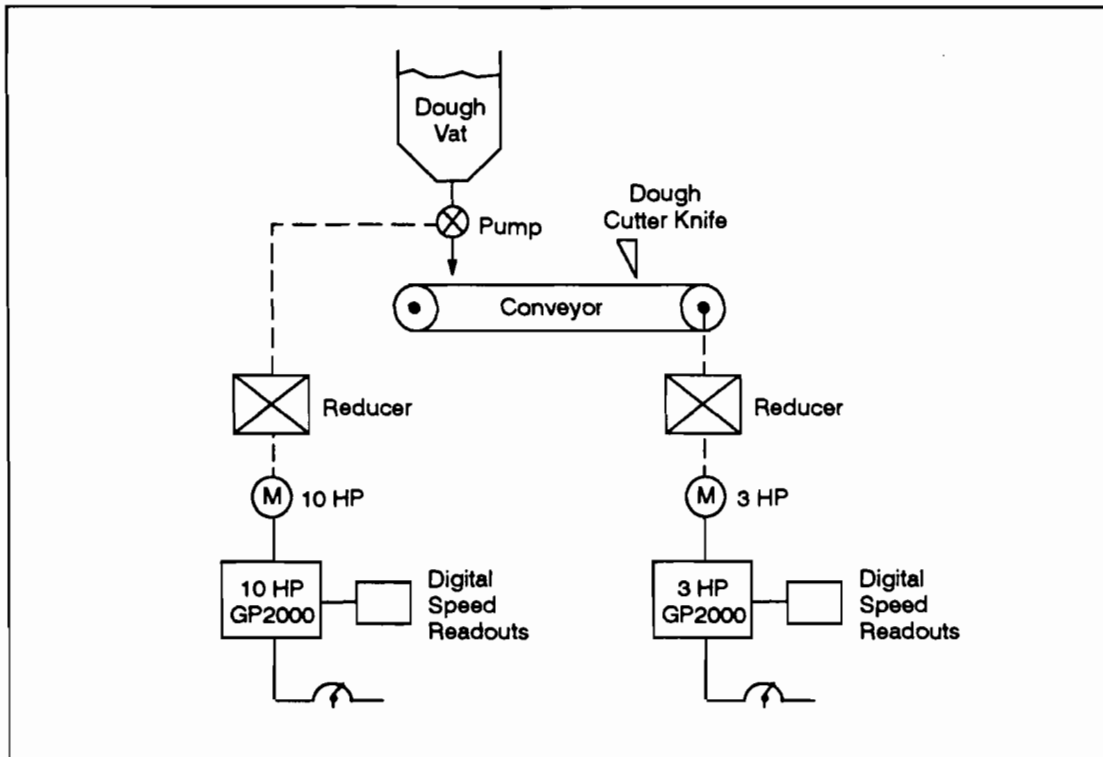
A bakery makes loaves of bread by batch mixing raw dough in a vat. Depending on consistency of batch and the size of the desired loaf (weight), bakery workers must vary the dough pump speed as well as the take-away conveyor speed. By regulating these two speeds, the customer can vary the loaf size. The process must be precise in order for the loaf size to be repeatable.

**Problem:** Previously, the customer had to physically change the pulley ratios in order to vary the loaf size.

**Solution:** We suggested using a GP2000 Reliance inverter on each section to vary the speeds. A digital speed readout is utilized to indicate RPM on each section. Today the customer sets speed manually- based on experience- on both drives.

**Future:** Once the customer has a record of all operating speed combinations, he intends to set the speeds automatically via recipes from a PLC.

**Competitive Edge:** Regulator board interchangeability between HP, ratings, and ease of start-up.



Submitted by: Randy Kirkland - RCB

### 23. REPLACE BELT-DRIVED GENERATOR

#### Programmable & Ramp Start

We replaced a variable frequency belt driven generator that was obsolete, since no parts were available. Customer's rip saw in-feed application used three motors which all must vary speed together. Other requirements included a broad speed range (10:1) and constant torque above base speed motors wired for 230V. We used a 460V controller with volts/hertz parameter set to reach full volts at 120hZ.

Results: Overcame breakdown situation on a weekend; the adjustable volts/hertz approach reduced amps to the motor, allowing it to run cooler.

Features of GP2000 used: Programmable volts/hertz.

Additional benefit: Ramp start for reduced shock load to equipment.

Submitted by: Jim Hunt - RSU

### 24. HONEY EXTRACTOR

#### Long Acceleration/Deceleration

Honey extractor (centrifuge) 230V single-phase input 2HP.

Transfer switch to utilize the controller for two extractors (load/unload one while the other is operating).

A long accel/decel time of six minutes (6 min) needed

A delay-off-timer was used for start/stop control a forty-five (45) minute cycle- providing one button operation for complete cycle. The result was an easy to monitor load in accel/decel and adjustable accel/decel times.

Submitted by: Jim Hunt - RSU

## 25. HVAC Retrofit

### Reduced Energy Consumption

We worked with a customer on an HVAC retrofit for a bank office building. Requirements included reduction of motor sizes to 20HP supply, 10HP return, and 4 minute accel/decel time.

Features of GP2000 utilized included:

1. Auto restart.
2. Pulse out of lead (supply) and pulse in for follower (return) to ration speed of return to supply.
3. Use two wire start/stop with NC contacts for restart in case of power failure.

Process controller used to monitor plenum pressure (0–2" W>C.) and provide controller input. The system maintains constant air flow throughout the building based on opening and closing of various outlets.

Approximate kW savings: one-third

*Submitted by: Jim Hunt - RSU*

## 26. BEARING TEST MACHINE

### Varying Speeds

A research and development facility for journal bearings used in the automotive industry had a unique application. As part of its continuous development program to test and improve its bearings, the company needed a test machine that could test bearings at speeds of up to 7200 RPM. It was required that the speed of the drive bearing be adjustable and reasonably accurate for it was one of four controlled variables in its test procedures.

After working with marketing, we were able to offer a GP2000/RPM A-C drive package to give the customer capability to run at varying speeds of up to 7200 RPM. By utilizing an analog speed reference, the three (or four with min speed) pre-set speeds, or the key pad, the customer has been able to set up several different bearing tests depending on the type of bearing and specific variables being tested. The combination of the RPM A-C motor built for variable speed and now for high speed to run 7,200 RPM— proved to be more than any competitors' products could offer. The drive/motor package is up and running and performing well. In fact, the motor is virtually noise-free, particularly at higher speeds.

*Submitted by: Robb Gardener - RDT*

## 27. PAPER MACHINE

### Adjustable Current Limit

In the paper industry the product of a paper machine is wound into a rough roll on a drive section called the reel. When the roll is the required size, the machine operator needs to "turn up" or begin winding the paper on a new roll. Another section of the machine associated with the reel is the reel spool starter. Its function is to accelerate the empty spool up to the speed of the paper, so a smoother transfer can be accomplished. Once the operator decides it is time to splice, it is important that the spool be accelerated to the proper speed as quickly as possible. A variable speed drive is required since the speed of the machine and the required speed of the spool with vary according to the product being produced.

An OEM supplied the customer a competitor's A-C drive for this application. One limitation of that drive is the lack of a current limit function. The inertia of the spool is high enough that the drive could not accelerate it at 150% torque in less than a minute, causing the competitors drive to trip, and then the paper machine shut down. The customer was forced to try to experiment with the acceleration rate to ensure a successful start while still trying to minimize the acceleration time. Any variation on the load jeopardized the reliable operation of the drive.

GP2000 was a suitable drive for the application. With adjustable current limit, the acceleration rate could be set low, and the drive now accelerates at 100% current repeatedly. As an added feature,



we were able to supply the use of the programmable relay. Because the spool requires very little horsepower once running at a set speed, we programmed the relay to respond to output current. The relay activates below 50% current, signaling that the spool is done accelerating and ready for the "turn-up."

*Submitted by: Richard Fritts - RMN*

## **28. EXHAUST FAN DRIVE**

### **Size, Easy to Program and Maintain and Price**

An automotive engineering center came to Reliance looking for an A-C drive to power and control an exhaust system for their engine dynamometer test cell.

They were looking to replace existing competitors power units. This was due to the fact that it was becoming increasingly difficult to maintain the existing units and spare parts were not available.

After seeing a demonstration of the GP2000 drive, the customer chose the Reliance drive for three reasons:

1. The drive was compact enough to fit in the previous power unit's footprint.
2. It was easy to maintain and program.
3. It was priced comparably with the competition.

The initial order was for one drive and there are plans to update the remaining ten engine dyno test sites during 1992.

*Submitted by: Mark Gmitro - RDT*

## **29. DAIRY PACKAGING MACHINES**

### **Features**

A distributor found a rather interesting application for the GP2000 on a line of dairy product packaging machines. Using two 2HP GP2000 drives, one driving two parallel conveyors through a gearbox and jack shaft arrangement and the other driving an auger which moves the particular dairy product (ice cream, yogurt, sour cream) in a filler/hopper.

The GP2000's are controlled via a PLC which monitors the container size and the fluidity of the product. Conveyor speed changes are based on these two parameters. The GP2000 was selected because of several reasons:

1. Cost-effectiveness.
2. Ability to select from a family of torque/hertz profiles to meet needs on the auger.
3. Torque-boost capability.
4. The availability of output relays for remote indication of machine fault conditions.

*Submitted by: Steve Mitton - RRK*

## **30. CHANGE-OVER OF MECHANICAL/EDDY CURRENT DRIVES**

### **Equipment Features**

A competitor's mechanical drive (similar to a Reeves) was originally supplied on this equipment. Parts to repair the unit are no longer available. The OEM's standard drive for this equipment had been changed to an eddy current coupling.

The distributor salesman recognized the ability of our GP2000 with RPM motor to provide the original speed/torque output to the machine. A P21L206, 2GU41010, 11M4000, 9C42, and a remote meter with a special scale to convert the output at 81.5 HZ to read 250 strokes/minute, completed the package of equipment.

Software had to be provided by local sales office. The OEM's drawings were marked up to show the addition of a customer furnished relay and give detailed information on how to install the drive. Because of the OEM's requirement for minimum field wiring changes, the optimum control solution could not be used.

Reports from the user indicate that he is well pleased with his rebuilt machine and plans to convert other similar machines in the next year.

*Submitted by: Don Majer - RCN*

### **31. CANNING PLANT**

#### **Flexibility/Pass Code Requirements**

This is a classic case of an aggressive distributor going into a plant, finding an application for the GP2000, and introducing it.

Applications in the plant vary. Units from 3HP up to 20HP are being used on different applications. The can plant is using it on conveyors, flangers, and washers. For next year, they are going to implement the GP2000 on their decorators and wall irons that punch the cups to form cans. These projects are going to require up to 50HP. The maintenance engineer has implemented about 10 units in his plant and has boosted production. Since they have started to use the drive they have boosted production approximately from 1100 cans per minute to 1400 can per minute.

*Submitted by: John Sajovic - RTL*

### **32. TEXTILE APPLICATION**

#### **Improvements and Quality**

This customer originally had Dierikon A-C variable speed drives. It became extremely difficult to get parts and service. We had to convert the process line to constant speed A-C motor and varied line speed to make the process line work.

We added a complete GP2000 A-C V★S Drive and an RPM A-C motor to the line. The tambor section now follows input conveyors with trim capacity. Since installation, process performance has improved and a better quality product can be manufactured.

*Submitted by: W. Kirby/J. Sajovic - RTL*

### **33. AUTOMOTIVE ASSEMBLY LINE**

#### **Ease Of Maintenance/Speed Change**

A customization shop converts Ford Mustangs into convertibles. They needed a method of slowing down their assembly line easily. The current method employed a 20-year old Reeves transmission with 2:1 sheave butted to a 30:1 gearbox.

The transmission was discarded at the belt/pulley arrangement and a 7.5 HP GP2000 and a 7.5 1800 RPM A-C motor were installed. The average speed is about 1/2 RPM from the gearbox. The GP2000 is located at the foreman's station and it allows the line to start slowly first thing in the morning and then to slowly speed up as the day goes on. The customer has not had to perform any maintenance on the transmission since the new GP2000 has been installed.

*Submitted by: John Conzett - RDT*

### **34. LINE SCREW CONVEYOR/WWTP PLANT**

#### **Ability to Control Conveyor**

A contractor was in need of a 1HP VFD to control a line screw conveyor for a local waste water treatment plant. The plant utilizes a 4-20 milliamp signal to control the conveyor.

*Submitted by: John Blake - RDT*

### 35. LIQUID INDUSTRIES

#### Constant Torque Applications

A pump OEM serves the petroleum, chemical, waste water, and various liquid industries. They use any combination of high volume/low pressure or low volume/high pressure motor and controller packages for these industries. They are typically 4:1 or 6:1 constant torque applications.

This time the customer needed 1 through 40HP GP2000's constant torque on a 3-screw positive displacement pump.

The customer was sold on:

1. Simple operation.
2. Large number of standard features.
3. Availability.
4. Ease of start-up and operation.

*Submitted by: George Mazzoli - RCR*

### 36. CONVERSION OF TOOL ROOM LATHE

#### Adjustability of Drive

A user has a very old lathe that used a 1/2 HP A-C motor and a set of composite material adjustable sheave pulleys to change lead speed over 3:1 range. The adjustable pulley hardware finally broke and no replacements were available.

We sold GP2000 to the customer on the basis of:

- It would have low maintenance (no brushes).
- Existing motor could be easily replaced.
- Entire drive could be moved and utilized if lathe was discarded in the future.
- Ease of changing set-up/operating parameters.

Product selected:

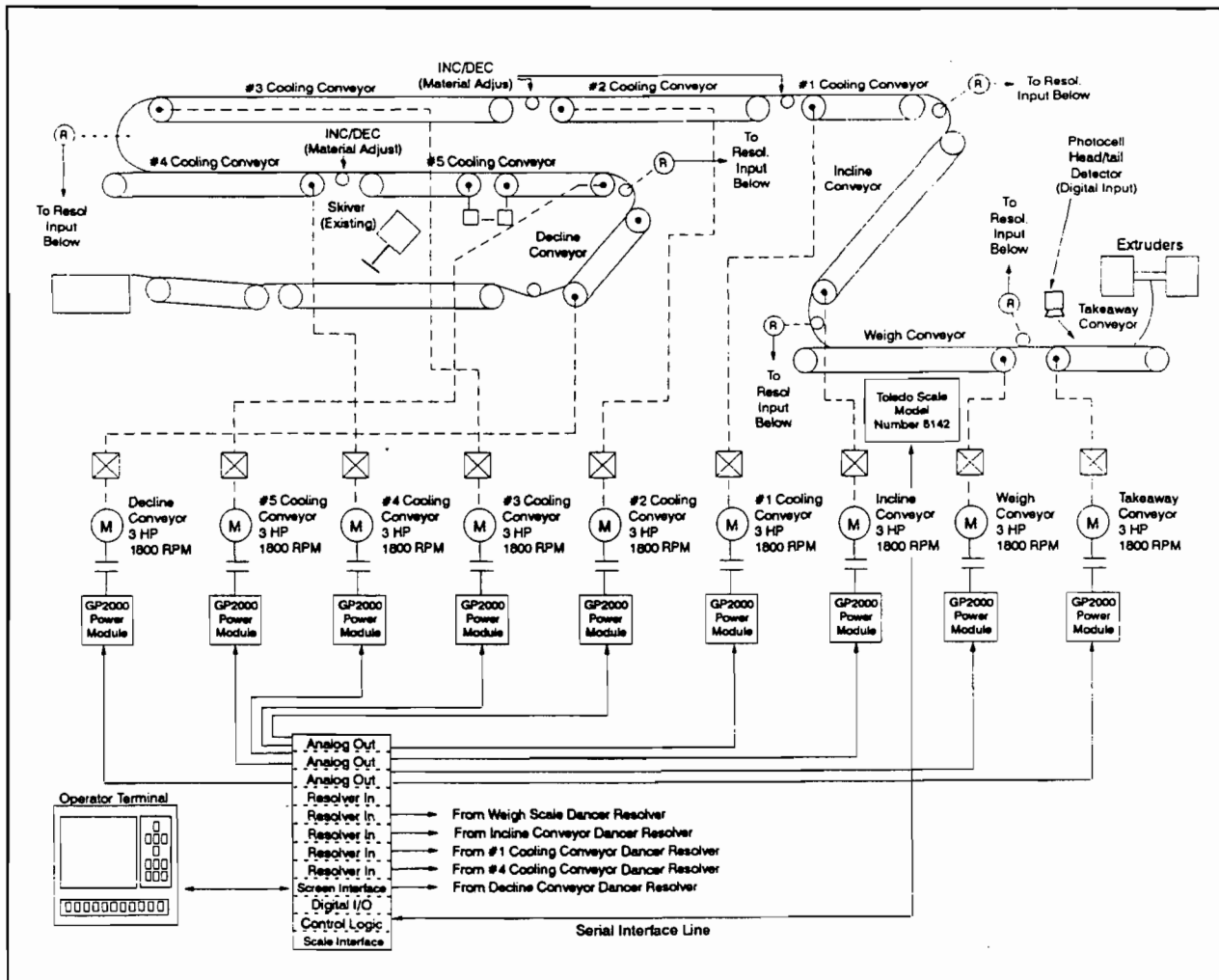
- GP2000 1HP drive, 1HP foot mounted motor.
- Horsepower was doubled to take into account the normal operating range of 1/2 speed and down out of the old pulleys; doubling horsepower offset the loss of mechanical advantage.

*Submitted by: Jerry Walter - RGN*

### 37. TREAD COOLING LINE

#### Functionality and Performance

A quantity of nine 7.5 GP2000's were supplied on a tread cooling line. These drives, which are replacing a competitor's D-C drives, are being used with Reliance PMR Synchronous motors and an AutoMax controller. The GP2000's will get a speed reference from the AutoMax which will also provide draw control and position control on the section with dancers. This system will more than adequately replace the a competitor's system with regard to functionality and performance. Reliance's long term relationship with the customer and service/start-up helped seal the deal. Start-up was completed in January 1992. The entire line is running well and the customer is extremely pleased.



Submitted by: Warren Ginn - RGB

**38. MILLING BRAZE**  
**Flexibility and Cost**

A user was looking for a servo to run a milling braze. After reviewing the application, it was concluded they did not need the accuracy or cost of a single axis servo but needed a GP2000 using micro switches and a Shark.

Submitted by: Caston Dalon - RLA

**39. BLOWER IN A CANDY FACTORY**  
**Flexibility of the Drive**

A candy manufacturer needed an A-C drive on a blower. The blower was used to blow excess chocolate off the candies they coat. The blower in use had an intake valve to regulate the amount of air. A problem occurred when the air was closed off on the intake. The air became heated and caused the chocolate finish on the candies to melt. The use of the GP2000 meant that the blower could work with the intake wide open and the motor speed was reduced using the A-C drive.

The results were excellent and the customer was very pleased by the performance of the GP2000.

Submitted by: Iain Reed - RDY

#### **40. SCREW PRESS**

##### **Programming Features**

A machine builder needed a small A-C drive that would provide a 10:1 constant torque for a small screw press. The use of the GP2000 drive with an RPM A-C motor met its application needs. The customer was sold on the idea of the new operator's front panel and the programmable features. The press will be used as a demo for their customers. With the help of the mechanical group, the reducer, coupling sheaves, and bolts will be Dodge. The whole project will be Reliance.

*Submitted by: Iain Reed - RDY*

#### **41. PAPER MACHINE WINDER/SLITTER**

A paper mill was rebuilding a paper machine winder. The slitter section had an "open loop" D-C motor operating over a narrow speed range. The existing drives were all supplied by a competitor. We quoted an AutoMax D-C system with the GP2000 on the slitter section. The GP2000 is interlocked with the AutoMax lead section.

The GP2000 was perceived to be a better approach than D-C on the slitter section and helped us land this order.

*Submitted by: Greg Ring - RBG*

#### **42. BEVERAGE MEASUREMENT**

##### **Speed, Flexibility**

A special order for the "Blue Dot Regulator" of the GP2000 was sold to a large soft drink bottling company.

The GP2000 programs the speed display in any unit of measure required, in this case, bottles per minute. The customer liked the fact that the GP2000 is a digital drive with no potentiometers requiring adjustment.

*Submitted by: Michele Foley - RGB*

#### **43. PLYWOOD GLUE SPREADER**

##### **Flexibility Of Speed Control**

A local veneer and plywood company had an old 1-1/2 HP Reeves motor drive to control the speed of gluing rolls in a plywood operation. The customer was having trouble with belt wear and getting new parts for the Reeves unit and was interested in using an A-C drive. Using Application Note #22, (Replacing a Motodrive D-9574) a distributor replaced the unit with a new gear box, XE motor, and a 5HP GP2000. The operation now has a broader speed range. The operator used the frequency readout to set the proper speed each time a given veneer thickness changes. This customer is quite pleased with the ease of start-up and is looking to other places in his plant for the GP2000.

*Submitted by: Curt Westadt - RML*

#### **44. PLASTIC GRINDER**

##### **Speed Regulation**

A distributor sold an initial GP2000 3HP controller to an OEM that manufactures a plastic grinder which crushes plastic parts into useable plastic for making new parts. The GP2000 is used on a conveyor supplying the plastic to the grinder motor. The conveyor either speeds up or slows down the amount of parts to the grinder.

Total usage per year is estimated at 10 to 20 units.

*Submitted by: David Weber - RRK*

#### **45. DISC BRAKE GRINDER**

##### **Installation, Start-up, Operation**

The application consists of a 25-HP main A-C motor driving a grinder which tools new brake assemblies. The GP2000's task was as follows:

1. Receive a 0–10 VDC reference from a controller.
2. Provide 1% open loop speed regulation.
3. Work in the auto mode to vary grinder speed.
4. Use the remote digital meter I/F board to provide a grinder RPM digital display for the operator.
5. Using the current level detection variables to detect a low current to close a contact to modify grinder operation and using a second external current level detection device (a third party current relay) to provide an emergency stop for a high (unsafe to application) current level.

Reliance got the order because all options necessary to perform the application were standard option decisions. The customer has expressed very positive comments regarding the installation, start-up, and operation of the GP2000.

*Submitted by: John Bizjak - RML*

#### **46. POSITIVE DISPLACEMENT PUMPS**

##### **Flexibility of Drive**

This application was for a consulting engineering company trying to apply variable frequency drives to a bank of positive displacement pumps. The application was for an XP with low speed operation. Several factors gave Reliance a strong edge over the competition.

The first advantage was Reliance's ability to offer information on the cooling capability of the motor on the GP2000. The customer was very concerned with overheating the motor at low speeds. Reliance was the only company which was able to thoroughly discuss the effects of high switching PWM power and low speeds on motors. This was greatly appreciated by the customer.

The second advantage offered by Reliance was our XP package. Several of our competitors could not provide the XP label at the horsepower and speed needed.

One final difference the GP2000 was able to offer was the ability to perform internally pre-set speeds. The customer wanted to be able to switch the drives into a hand mode directly to a pre-set speed mode without following a control signal. The pre-set speed parameters in the drives provided the ability to handle the application.

Reliance should actively promote our controller/motor matching capabilities. As drives continue to move to higher and higher switching frequencies, informed customers are increasingly more concerned about the motor. We should capitalize on our ability to address these concerns.

*Submitted by: Doug Martin - RSL*

#### **47. DIGESTIVE SLUDGE SYSTEM**

##### **"Latest" A-C Drives Technology**

In early 1990, Reliance had a quote request from a county wastewater department through a pump OEM. The equipment to be quoted was to be used with the positive displacement pumps that the OEM was supplying for the digestive sludge system.

The specification called for the latest technology in A-C drives. We quoted a total of 24 GP2000 A-C drives. In mid-May, we received the order. These drives were some of the first to be shipped to the U.S. and to be installed.

*Submitted by: Tricia Thomas - RCO*

Reliance Electric / 24703 Euclid Avenue / Cleveland, Ohio 44117 / 216-266-7000

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**A-C AND D-C V★S DRIVE  
APPLICATION CONSIDERATIONS**



**V★S<sup>®</sup>**  

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**DRIVES**  

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**RELIANCE  
ELECTRIC** 



# Defining Loads

## Calculating Horsepower

For rotating objects:

$$HP = \frac{TN}{63,000}$$

or:

$$HP = \frac{TN}{5250}$$

where: T = Torque (lb-in)  
N = Speed (RPM)

where: T = Torque (lb-FT)  
N = Speed (RPM)

For objects in linear motion:

$$HP = \frac{FV}{396,000}$$

or:

$$HP = \frac{FV}{33,000}$$

where: F = Force (lb)  
V = Velocity (in/min)

where: F = Force (lb)  
V = Velocity (FPM)

## Centrifugal Applications

Affinity laws for centrifugal applications:

$$\frac{FLOW_1}{FLOW_2} = \frac{RPM_1}{RPM_2}$$

$$\frac{PRES_1}{PRES_2} = \frac{(RPM_1)^2}{(RPM_2)^2}$$

$$\frac{BHP_1}{BHP_2} = \frac{RPM_1^3}{RPM_2^3}$$

For pumps:

$$BHP = \frac{GPM \times FT \times (\text{Specific Gravity})}{3960 \times (\text{Efficiency of Pump})}$$

$$BHP = \frac{GPM \times PSI \times (\text{Specific Gravity})}{1713 \times (\text{Efficiency of Pump})}$$

For fans and blowers:

$$BHP = \frac{CFM \times PSF}{33000 \times (\text{Efficiency of Fan})}$$

$$BHP = \frac{CFM \times PIW}{6344 \times (\text{Efficiency of Fan})}$$

$$BHP = \frac{CFM \times PSI}{229 \times (\text{Efficiency of Fan})}$$

Where:

BHP = Brake horsepower

GPM = Gallons per minute

FT = Feet

PSI = Pounds per square inch

Specific Gravity of water = 1.0

PSF = Pounds per square foot

PIW = Inches of water gauge

Specific Gravity of water = 1.0

## Calculating Accelerating Force For Linear Motion

The following formula may be useful to calculate the approximate accelerating force required for linear motion. However, before sizing the drive, add the torque required to accelerate the motor rotor, gears, pulleys, etc., to the linear-motion accelerating force converting to torque.

$$\text{Acceleration Force (F)} = \frac{WV}{1933t}$$

where: W = Weight (lb)  
V = Change in Velocity (FPM)  
t = Time (seconds) to accelerate

## Calculating Accelerating Torque For Rotary Motion

The formula to calculate accelerating torque of a rotating member:

$$T = \frac{(WK^2) N}{308t}$$

where: T = Accelerating torque (lb-FT)  
WK<sup>2</sup> = Total inertia (lb-FT<sup>2</sup>) that the motor must accelerate. This value includes motor rotor, gearing, shafting and load.  
N = Change in speed required (RPM)  
t = Time to accelerate load (seconds)

The same formula can also be used to determine the minimum accelerating time of a given drive:

$$t = \frac{(WK^2) (N)}{308T}$$

WK<sup>2</sup> is calculated based on the radius of gyration, not diameter. Be cautious in converting from metric units which are often based on diameter.

## Other Useful Formulae

Torque = Force x Radius

Reflected WK<sup>2</sup> through a reducer (gear or belt) =  $\frac{WK^2 \text{ of Load}}{(\text{Reduction Ratio})^2}$

$$RPM = \frac{FPM}{.262 \times \text{Diameter (Inches)}}$$

For A-C induction motors:

$$\text{Synchronous RPM} = \frac{\text{Hertz} \times 120}{\text{Number of Poles}}$$

$$\text{Percent Slip} = \frac{(\text{Synchronous RPM} - \text{Full Load RPM}) \times 100}{\text{Synchronous RPM}}$$

# A-C V★S Drives Application Considerations

## 1. Torque Parameters

### • How Torque Varies With Speed

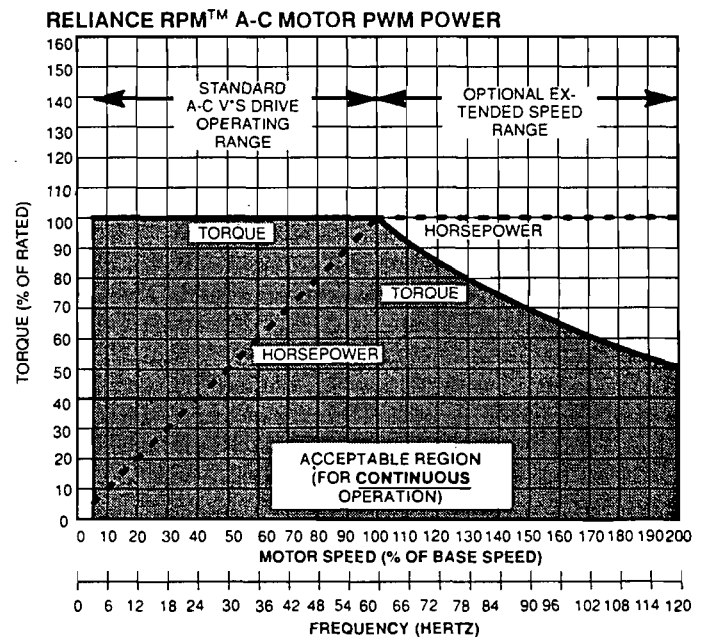
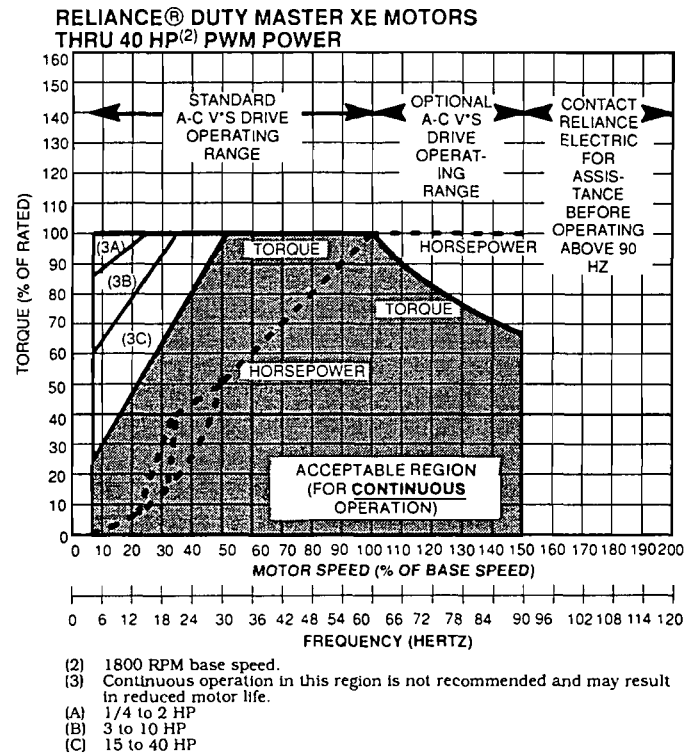
Under constant volts/hertz conditions, from 1/4 to 150% of full load, A-C motors produce torque proportional to stator current, and torque output varies with speed demands of the load. In A-C adjustable speed applications, because of their constant torque capabilities, A-C V★S Drives can continuously produce full load torque without overheating over speed ranges dependent upon the type of motor being used. The first graph to the right shows the speed-torque profile for A-C V★S Drives using an energy efficient Duty Master® XE Motor. The second graph shows this profile can be 20:1 throughout the speed range with special motors designed for adjustable speed operation, such as the Reliance RPM™ A-C Motor.

### • Starting Torque

Starting torque is generally measured as a percent of full load torque. Many A-C V★S Drives are sized to produce 150% of full load current for one minute, developing 125% to 150% of full load motor torque depending upon the type of motor. Some A-C V★S Drives are sized for lower starting torques, such as variable torque A-C drives for pump and fan applications.

### • Deceleration or Braking Torques

For rapid stopping, "emergency" braking or holding at rest a friction brake should be used. Most A-C V★S Drives can provide a form of dynamic braking. When the drive is commanded to slow down, the motor may turn into a generator, depending on load inertia, and generate power back into the drive. This power is dissipated through a resistor. In that way, it is similar to a regenerative D-C drive, but under intermittent operation only. It should not be confused with D-C style dynamic braking. In the D-C drive,

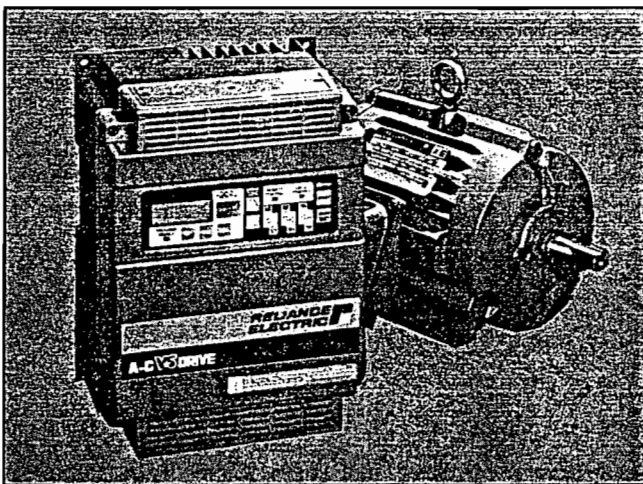


dynamic braking is used to rapidly brake a motor to near rest. In the A-C V★S Drive, dynamic braking is used to control the slowdown of an A-C motor from one speed to another speed. Continuous, regenerative braking can be achieved in A-C V★S Drives using a current source input (CSI) style drive.

# A-C V★S Drives Application Considerations

## 2. Environmental Parameters

A-C and D-C V★S Drives can be supplied as open chassis to be used in the customer's enclosures or as a completely enclosed package. As an enclosed package, the drive controller can be supplied in a NEMA 1, ventilated enclosure, which is normally meant for a clean environment without atmospheric dust or moisture; a NEMA 1, positive pressure, ventilated enclosure, which is an open enclosure with the addition of blowers and filters to increase the supply of air to the cabinet; a NEMA 12, totally enclosed cabinet which is suitable for dusty or oily environments; or a NEMA 4, water tight cabinet. Normally drive controllers are not mounted in hazardous areas. In all applications, local codes should be consulted.



GP2000 A-C V★S Drive For General Purpose Requirements

## 3. Regulation Parameters

### • Speed Regulation

The inherent, unregulated speed regulation of an A-C drive is a function of the slip of the A-C motor. Synchronous motors provide 0% speed regulation since their speed does not change from no load to full load. However, when synchronous motors are used, the controller must frequently be oversized. High efficiency A-C motors, such as the Reliance XE

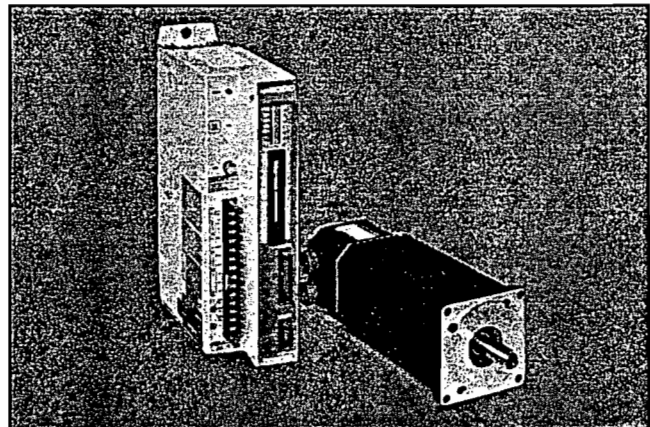
Motor, generally have very small speed changes from no load to full load – in the range of 1% to 2%. Standard efficiency A-C motors have speed variations from 2% to 5%. All percentages are measured as a percent of the nameplate speed – usually at 60 Hz. A-C motors, in general, do not have provisions for adding feedback devices, such as tachometers, for improved speed regulation. However, the Reliance RPM A-C motor can accommodate tachometers, resolvers and encoders for special applications involving tighter speed regulator or position application requirements.

### • Torque Regulation

Torque regulation is seldom used with standard A-C drives because current is not always proportional to torque. Very basic torque regulation can be done by allowing the motor to operate against current limit, however, extreme care must be taken to make sure that the motor does not overheat under these conditions. A new style of A-C drives, known as “vector” drives, does allow torque control.

### • Tension Regulation

Because of high gain requirements, tension regulation is seldom useable in standard applications. In some custom drives, tension regulation is possible, but only with application assistance.



HR2000 V★S Drive For High-Performance Applications

# D-C V★S Drives Application Considerations

## 1. Torque Parameters

- **How Torque Varies With Speed**

D-C motors produce torque proportional to armature current with constant field excitation. They are capable of drawing full load current at any speed, and producing full load torque at any speed. Therefore, the D-C V★S Drive is said to have constant torque capability over its entire speed range, limited only by motor cooling requirements.

- **Starting Torque**

Starting torque is generally measured as a percent of full load torque. D-C V★S Drives are sized to allow the motor to draw 150% of full load current and produce 150% of full load torque for 1 minute. Higher momentary starting torques can be generated for shorter periods of time depending on the capabilities of the controller and motor.

- **Deceleration or Braking Torque**

Using regenerative controllers, D-C V★S Drives can supply continuous full load torque for both acceleration, deceleration, reversing or braking applications. Under deceleration, braking or reversing loads, the current reverses and automatically applies opposite or braking torque to the load. Regenerative D-C V★S Drive characteristics also provide the benefits of solid state reversing action and the ability to handle highly cyclic loads. Dynamic braking is also available. D-C motors convert rotating energy into electrical energy which is dissipated as heat through the resistor as long as field excitation is maintained. Dynamic braking is automatically applied the moment the stop button is depressed and the output contactor de-energizes. For holding a load at rest, a friction

brake should be used. Some special forms of regenerative drives also can apply static load.

## 2. Environmental Parameters

A-C and D-C V★S Drives can be supplied as open chassis to be used in the customer's enclosures or as a completely enclosed package. As an enclosed package, the drive controller can be supplied in a NEMA 1, ventilated enclosure, which is normally meant for a clean environment without atmospheric dust or moisture; a NEMA 1, positive pressure, ventilated enclosure, which is an open enclosure with the addition of blowers and filters to increase the supply of air to the cabinet; a NEMA 12, totally enclosed cabinet which is suitable for dusty or oily environments; or a NEMA 4, water tight cabinet. Normally drive controllers are not mounted in hazardous areas. In all applications, local codes should be consulted.



MaxPak® III D-C V★S Drive in an open-chassis style enclosure.

# D-C V★S Drives Application Considerations

## Regulation Parameters

### • Speed Regulation

The speed on D-C drives is adjusted by regulating armature voltage, with compensation for loss through the armature (IR drop compensation), usually resulting in a 1-2% of base speed regulation. The speed range for voltage regulation is generally limited to 20:1. On most D-C motors, the addition of a motor-mounted tachometer, with proper regulator parameters, can improve speed regulation to 1/100 of set speed. This is achieved with digitally regulated drives. With the use of regenerative drives and proper tachometers, D-C drives can maintain very precise control over a process and allow upstream or downstream processes to pull as the process demands.

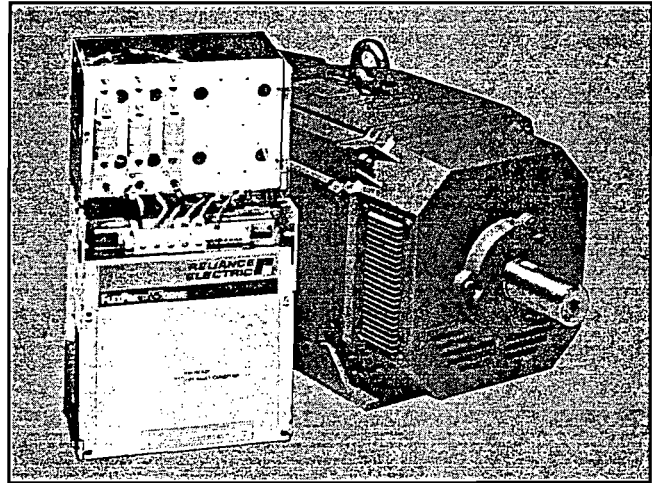
### • Torque Regulation

Torque in a D-C drive is determined through regulation of armature current, making it easy to control processes such as winders, takeups, and similar operations. For optimum performance of the torque regulated regenerative drive to pull against. Regenerative D-C drives can fulfill this requirement in variable speed applications.

### • Tension Regulation

Tension levels are set through torque regulation, or by mechanically placing a force transducer at some point where sheet tension can be measured, such as under a bearing mount or on the winder frame. High gain regulators, and in most cases, regenerative drives, should be used in the system. D-C drives are used in virtually all cases where precise tension regulation is required. A regenerative drive is generally placed upstream or downstream to give the tension

regulated drive something to pull against.



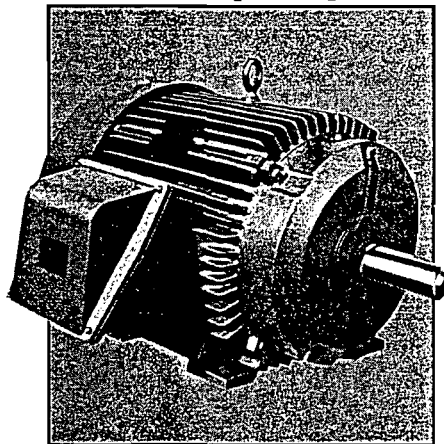
FlexPak® Plus D-C V★S Drives are available from 1/4 to 300 HP in open-chassis designs like this one. MinPak™ Plus D-C V★S Drives are available in NEMA 4/12 enclosures from 1/4 to 5 HP and from 3 to 40 HP in NEMA 12 enclosures.

## A-C and D-C Motor Application Considerations

The proper selection and application of electric motors involves a number of variables, which affect the installation, operation and service. The following items should be specified to properly select an A-C or D-C motor:

### • Speed Range

**A-C Motors** are primarily designed for constant speed operation. When operated



Duty Master XE A-C Motor

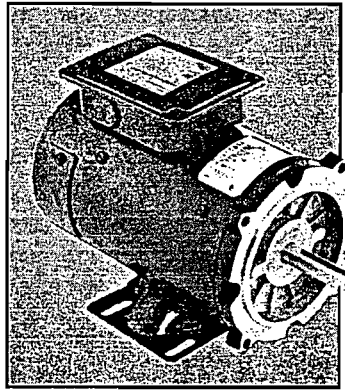
on variable speed drives, their speed range is a function of the torque demand and their ability to dissipate heat.

Speed-torque characteristics for XE motors are shown on the graph on

# A-C & D-C Motor Application Considerations

page 1. Motors specifically designed for variable speed operation, such as the Reliance RPM A-C motor, have speed ranges of at least 20:1 dependent on drive and motor configurations.

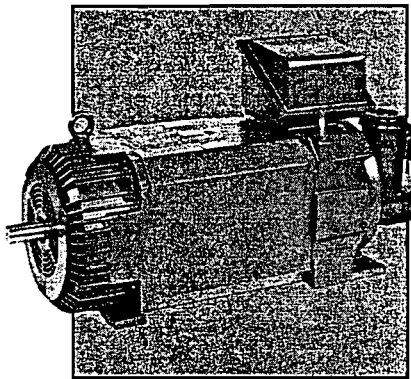
**D-C Motors** are primarily designed for variable speed operation. Most D-C motors, 5 HP and below, can operate over a 20:1 speed range under constant full load torque operation. Above 5 HP, most D-C motors standardly will provide a 2:1 speed range under full load torque operation except when equipped with auxiliary cooling operations - then the speed range can be in excess of 20:1 under full load torque operation.



Permanent Magnet D-C Motor

## • Heating Considerations

The Standard **A-C Motor** has a limited variable speed capability based on its efficiency and the motor mounted fan. At reduced speeds the limited air movement and the heat generated causes the frame to heat up. Higher efficiency motors generate less heat and, therefore, can reach lower speeds. Special A-C motors, like the Reliance RPM A-C have a constant speed fan for a wide constant



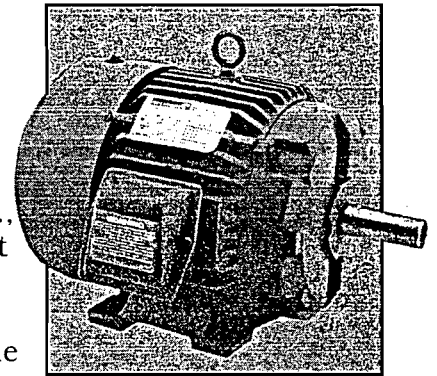
RPM A-C Motor for A-C V\*S PWM Drives

speed range, provisions for feedback devices and a laminated frame to improve operation on PWM A-C V\*S Drives.

**D-C Motors** in the 1/4 to 5 HP range generally do not require auxiliary methods of cooling since they are totally enclosed, non-ventilated motors. Therefore, they can provide a 20:1 speed range under full load constant torque operation. Larger D-C motors can provide the same speed range, but are generally supplied with auxiliary cooling, such as motor-mounted blowers.

## • Environmental Parameters

**A-C Motors**, due to their simpler design (no brushes or commutator), will operate in more severe environments than D-C motors. Many specific A-C motor enclosures (i.e., Chemical Plant Duty) are available from stock to provide necessary protection.



Duty Master XT A-C Motor for Harsh Environments

**D-C Motors** should generally be applied in areas that have a minimum amount of contaminants (i.e., moisture, dust/dirt, chemicals) present. D-C motors may be used in harsh environments, but shorter motor life and higher repair/maintenance costs can be expected.



Extruder Duty RPM III D-C Motor

# Which Drive Is Right For You . . . A-C or D-C?

Your choice depends on many application-specific factors such as ambient conditions, type of loads, duty cycle, maintenance accessibility, horsepower range, sequencing and more. The following brief guidelines have been developed to provide you with a basic understanding of the differences between A-C and D-C drive technologies. If you have specific questions, or require application/selection assistance, please contact your nearest Reliance Electric Sales Office or authorized Reliance Distributor.

## A-C Drive Characteristics

- Available from 1/4 to 500 HP
- These drives utilize a solid-state adjustable frequency controller (PWM, VVI or CSI) which adjusts frequency and voltage for varying the speed of a conventional A-C motor. This adjustment of voltage and frequency, increases or decreases the output speed of an otherwise fixed speed A-C motor.

## A-C Drives Are Often The Best Choice When:

- The environment surrounding the A-C motor is corrosive, potentially explosive or very wet and demands special enclosures such as explosion-proof, washdown, XT-Extra Tough, etc.
- Motors are likely to receive little regular maintenance due to inaccessibility of the motor or poor maintenance practices.
- The motor must be small in size and weigh as little as possible.
- Motor speeds of 2500 RPM or greater are required.
- Multiple motors are operated at the same speed by a single controller.

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©Reliance Electric Company, 1992.

- Existing fixed speed A-C motors can be used.
- U.L. listed approval of A-C controller and motor packages in hazardous classified locations is required.

## D-C Drive Characteristics

- Typically available with ratings from 1/4 to 600 HP. Higher horsepower ratings can be specially ordered.
- These drives utilize a converter to transform A-C current into D-C current which is then fed to the D-C motor which is designed for adjustable speed operation. Speed changes are made by increasing or decreasing the amount of D-C voltage fed to the motor from the controller.
- Usually offer the lowest initial cost for adjustable speed applications.

## D-C Drives Are Often The Best Choice When:

- The application requires wide constant horsepower speed range.
- Environmental conditions surrounding the D-C motor are reasonably clean, dry and allow the use of DPG, DPG-FV, TENV or TEFC motor enclosures.
- Maximum motor speed will be below 2500 RPM.
- Starting torques are greater than 150% or unpredictable.
- Precise closed-loop speed regulation (to 0.01%) is required.
- The presence of overhauling loads require regenerative, four quadrant power flow.
- High peak torques or shock loads are anticipated.

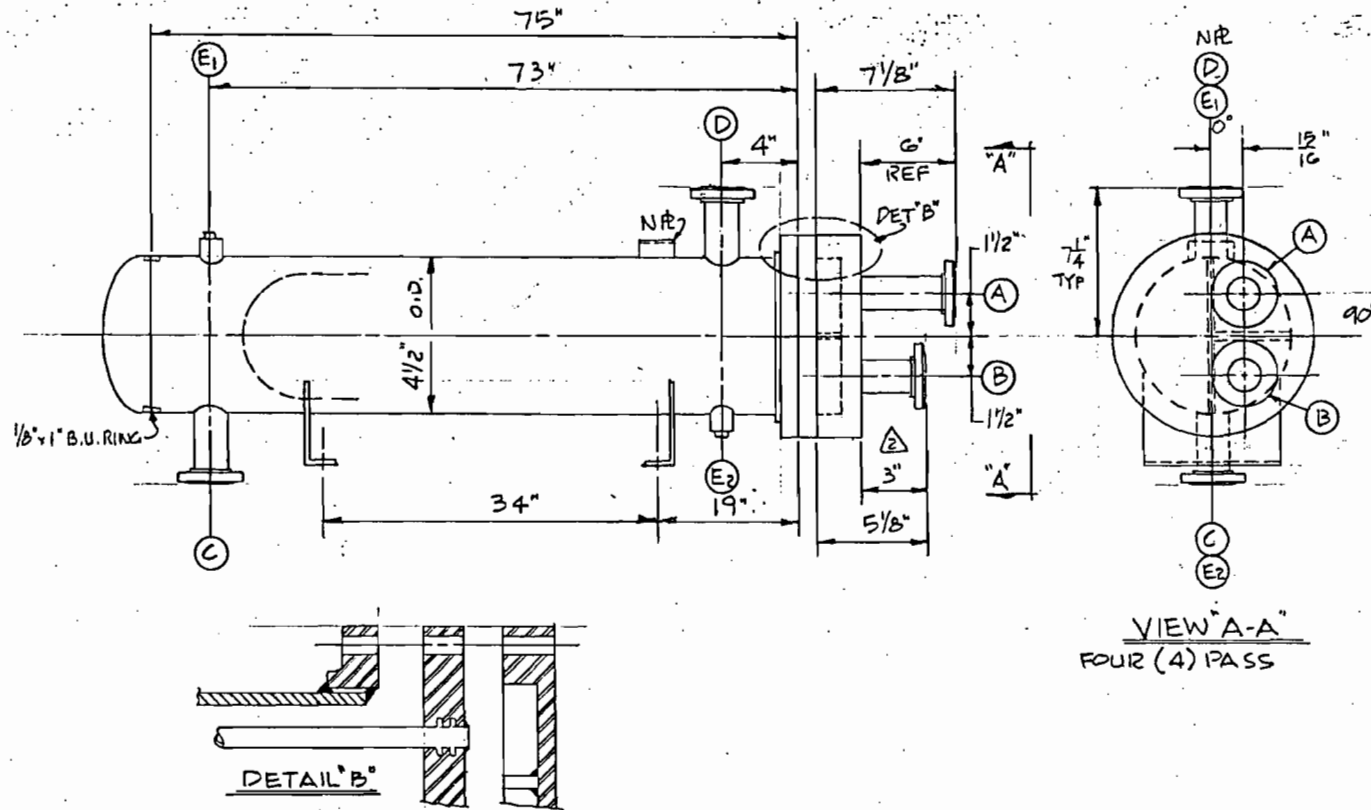
Note: this material is not intended to provide operational instructions. Appropriate Reliance Electric Industrial Company instruction manuals and precautions should be studied prior to installation, operation or maintenance of equipment.

Reliance Electric / 24701 Euclid Avenue / Cleveland, Ohio 44117 / 216-266-7000

**RELIANCE**  
**ELECTRIC** 



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- GENERAL NOTES:**
1. CONSTRUCTION TO COMPLY WITH A.S.M.E. CODE SECTION VIII DIV. 1 LATEST EDITION.
  2. A.S.M.E. STAMP & NAT'L. BD. INSPECTION.  YES  NO
  3. TEMA CLASS. "B" TYPE BEU
  4. 9 SQ. FT. HEAT TRANSFER SURFACE.
  5. ALL BOLT HOLES TO STRADDLE CENTERLINES.
  6. SEE "A-A" VIEW FOR TRUE NOZZLE ORIENTATION.
  8. WEIGHT: 245 LBS. EMPTY  
278 LBS. FLOODED
  9. SEAL WELD TUBES TO TUBESHEET

**CERTIFIED FOR CONSTRUCTION**

**DESIGN CONDITIONS:**

	SHELL SIDE	TUBE SIDE
DESIGN TEMPERATURE	400 °F.	400 °F.
DESIGN PRESSURE	150 P.S.I.	150 P.S.I.
TEST PRESSURE	261 P.S.I.	261 P.S.I.
CORROSION ALLOWANCE	—	EXCEPT TUBES
RADIOGRAPHY	—	—

MATERIALS OF CONSTRUCTION		NOZZLES & FITTINGS					
SHELL	4 1/2" O.D. 304 STAINLESS STEEL PIPE SA312 SCH 10 (1.120 NOM.)	MARK	SIZE	DESCRIPTION	SERVICE	NECK	SCH
SHELL FL'G.	9" O.D. FL'G. 304 ST. STEEL SA-182 1/16" TK (4" 150# RFS)	A	1"	150 # STD. ASA R.F. SOF S.S. SA-182-304	PROCESS IN	SA312 304	40
TUBESHEETS	9" O.D. 304 STAINLESS STEEL SA-240 3/4" TK	B	1"	150 # STD. ASA R.F. SOF S.S. SA-182-304	PROCESS OUT	SA312 304	40
TUBES	(4U) 3/4" O.D. X 18 BWG SA-249 304 S.S. TUBES 6" O.D. LG ON 1 1/16" PITCH	C	1"	150 # STD. ASA R.F. SOF S.S. SA-182-304	BOTTOMS IN	SA312 304	40
		D	1"	150 # STD. ASA R.F. SOF S.S. SA-182-304	BOTTOMS OUT	SA312 304	40
BILLET HD.	9" O.D. 304 STAINLESS STEEL SA240 1/16" TK	E1,2	3/4"	3000 # F.S. HALF CPLG. SA 182-304 / PLUG	VERY CRASH	—	—
BAFFLES	304 SEGMENTAL TYPE 2 1/2" NOM. PITCH 33% HOR CUT (24 REW'D)						
GASKETS	NON-ASBESTOS 1/16" TK (GARLOCK "BLUE GARD" OR EQUAL) $\Delta$	2		NOZZ "B" DIM 3" WAS 4" / CERTIFIED	RB		3-1-93
BOLTING	ALLOY STEEL SA-193 B7 STUDS & SA-194 CL. 2H NUTS (ZINC P)	1		REV. PER CUST. COMMENTS / CERTIFIED	RB		2-16-93
SHELL SUPPTS.	304 S.S. AS PER RUBICON DWG. STD-100	0		ISSUED FOR APPROVAL	RB		1-29-93
		NO.		REVISION	BY		DATE

CUSTOMER GLITSCH PACKAGE PLANTS INC  
105 PARSIPPANY BLVD, PARSIPPANY, N.J. 07054  
P.O. NO. 18971  
JOB 6J-7877 (PYROPOWER)  
RUBICON JOB NO. 2051  
RUBICON MODEL NO. WC4BU4-72H  
TAG EQUIP. NO. 1CCF-HX-1  
NO. UNITS RECD. CNE

**RUBICON INDUSTRIES CORP.** 848 E. 43<sup>RD</sup> ST. BROOKLYN NY 11210

DRAWN RB	SCALE	B-2051	REV. 2
CHECKED F.C.	DATE 1-29-93		
APPROVED	DATE		



**FORM U - MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS**  
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1 2(a)

1. Manufactured and certified by RUBICON INDUSTRIES CORP., 848 EAST 43RD STREET, BROOKLYN, NY 11210  
(Name and address of Manufacturer)

2. Manufactured for Glitsch Package Plants, Inc., 1055 Parsippany Blvd., Parsippany, NJ 07054  
(Name and address of Purchaser)

3. Location of installation \_\_\_\_\_  
(Name and address)

4. Type: Horizontal Heat Exchanger 2051  
(Horiz., vert., or sphere) (Tank, separator, etc. vessel, heat exch., etc.) (Mfg's serial No.)

B-2051 Rev. 2 1371 1993  
(ICRN) (Drawing No.) (Nat'l. Bd. No.) (Year built)

5. ASME Code, Section VIII, Div. 1 1992  
Edition and Addenda (date) Code Case No. Special Service per UG-120(d)

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) No. of course(s): 1 (b) Overall length (ft & in.): 6'-2 3/4"

Course(s)	Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment			
	No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	4.50	6'-2 3/4"	SA312 304	.120			E	None	85	2	None	65		

7. Heads: (a) SA403 WPW 304L (b) \_\_\_\_\_  
(Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp.

	Location (Top, Bottom, End)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Nom.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	End	.120				2:1					X			
(b)														

If removable, bolts used (describe other fastening) \_\_\_\_\_  
(Mat'l Spec. No., Grade, size, No.)

8. Type of jacket \_\_\_\_\_ Jacket closure \_\_\_\_\_  
(Describe as open & weld, bar, etc.)

If bar, give dimensions \_\_\_\_\_ If bolted, describe or sketch.

9. MAWP 150 psi at max. temp. 400 °F Min. design metal temp. 20 °F at 150 psi.  
(internal) (external) (internal) (external)

10. Impact test No  
(Indicate yes or no and the component(s) impact tested)

11. Hydro., pneu., or comb. test press. 261 Proof test \_\_\_\_\_

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: SA240 304 5.34 .750 Bolted  
Stationary (Mat'l Spec. No.) Dia., in. (subject to press.) Nom. thk., in. Corr. Allow., in. Attachment (welded or bolted)

SA240 304 .750 18 GA 4 "U"  
Floating (Mat'l Spec. No.) Dia., in. Nom. thk., in. Corr. Allow., in. Attachment Type (Straight or U)

13. Tubes: \_\_\_\_\_

Items 14-18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s) \_\_\_\_\_ (b) Overall length (ft & in.): \_\_\_\_\_

Course(s)	Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment			
	No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

15. Heads: (a) SA240 304L (b) \_\_\_\_\_  
(Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp.

	Location (Top, Bottom, End)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Nom.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	End	1.06							9"					
(b)														

If removable, bolts used (describe other fastening) SA193 B7 (8) 5/8" dia. Studs  
(Mat'l Spec. No., Grade, size, No.)

16. MAWP 150 (internal) (external) psi at max. 400 (internal) (external) °F. Min. design m. 20 °F at 150 psi.

17. Impact test No

18. Hydrc., pneu., or comb. test press. 261 (Indicate yes or no and the component(s) impact tested)  
 19. Nozzles, inspection, and safety valve openings: Proof test

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material		Nozzle Thickness		Reinforcement Material	How Attached		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In & Out	2	1"	150FL	SA312 304	SA182 304	Sch 40			Welded	Welded	Head
In & Out	2	1"	150FL	SA312 304	SA182 304	Sch 40			Welded	Welded	Shell
Vent/Drain	2	3/4"	NPT	SA182 304		3000#			Welded		Shell

20. Supports: Skirt    (Yes or no) Lugs    (No.) Legs    (No.) Others (2) Saddles Attached Welded To Shell (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:  
 (List the name of part, item number, mfg's. name and identifying number)

22. Remarks: TAG #ICCF-HX-1 RUBICON MODEL WC4BU4-72H  
IMPACT TEST EXEMPT PER UG 20 (f)

NAME PLATE LOC: 0° & 19" From T.S.

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.

U Certificate of Authorization No. 19,483 Expires JUNE 18, 19 93

Date 3/17/93 Name RUBICON INDUSTRIES CORP. Signed F. O'Connell  
(Manufacturer) (Representative)

**CERTIFICATE OF SHOP INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of NEW YORK and employed by ARKWRIGHT MUTUAL INS. CO.\* of NORWOOD, MA have inspected the pressure vessel described in this Manufacturer's Date Report on March 17, 19 93, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

**\*FACTORY MUTUAL ENGINEERING ASSOCIATION**  
 Date 3/17/93 Signed John O'Mearly Commissions NB 8608-A  
(Authorized Inspector) (Nat'l Board incl. endorsement, State, Province and No.)

**CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE**

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1.

U Certificate of Authorization No.    Expires   , 19   

Date    Name    Signed     
(Assembler) (Representative)

**CERTIFICATE OF FIELD ASSEMBLY INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of    and employed by    of    have compared the statements in this Manufacturer's Date Report with the described pressure vessel and state that parts referred to as date items   , not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of    psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date    Signed    Commissions     
(Nat'l Board incl. endorsement, State, Province and No.)

**FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS**  
 (Alternative Form for Single Chamber, Completely Shop-Fabricated Vessels Only)  
 As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by Dusenbery Engineering Co., Inc. 309 E. Hanover Ave.  
(Name and address of manufacturer) Morristown, NJ 07962

2. Manufactured for Glitsch, Inc. 1055 Parsippany Blvd. Parsippany, NJ 07054  
(Name and address of purchaser)

3. Location of installation Multi-Power Associates 9640 Eastport Rd. Jacksonville, FL 3221  
(Name and address)

4. Type: Vert. Column 871A - D-7877-08-01-0 2952 1993  
(Horiz. or vert., tank) (Mfg'r's serial No.) (CRN) (Drawing No.) (Nat'l. Bd. No.) (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 1992  
Year

to 12/91 - None  
Addenda (Date) Code Case Nos. Special Service per UG-120(d)

6. Shell: SA-106B 3/8" 1/8" 1'-0" 39'-1"  
Mat'l. (Spec. No., Grade) Nom. Thk. (in.) Corr. Allow. (in.) Diam. I.D. (ft. & in.) Length (overall) (ft. & in.)

7. Seams: Smls Pipe - 85 - - SBW - 4  
Long. (Welded, Dbl., Sngl., Lap, Butt) R.T. (Spot or Full) Eff. (%) H.T. Temp. (°F) Time (hr) Girth (Welded, Dbl., Sngl., Lap, Butt) R.T. (Spot, Partial, or Full) No. of Courses

8. Heads: (a) Mat'l. SA-234 WPB (b) Mat'l. -  
(Spec. No., Grade) (Spec. No., Grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	Top&Bot	.328"	1/8"	-	-	2:1	-	-	-	Concave
(b)		(.375" nom.)								

If removable, bolts used (describe other fastenings) \_\_\_\_\_  
(Mat'l., Spec. No., Gr., Size, No.)

MAWP 150 400 psi at max. temp. \_\_\_\_\_ °F  
 Min. design metal temp. -20 °F at 150 psi. Hydro., pneu., or comb. test pressure 250 psi.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No.	Diam. or Size	Type	Mat'l.	Nom. Thk.	Reinforcement Mat'l.	How Attached	Location
In/Outlet	3	3", 4"	150#F1	SA-106B	S80,40	-	Welded	Hd, Sh
Spare/Out	2	1", 2"	"	"	S160	-	"	Sh, Hd
Instr.	5	3/4"	"	"	XXH	-	"	Shell
Insp.	4	6"	"	"	S40	-	"	Shell

11. Supports: Skirt No Lugs 4 Legs - Other - Attached Welded to shell.  
(Yes or no) (No.) (No.) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: \_\_\_\_\_  
(Name of part, item number, Mfg'r's name and identifying stamp)

Vessel tested in horizontal position. Vessel used for chemicals. Exempt from impact testing per para. UG-20(f). Vessel consists of (4) sections joined with 12" 150# RFSO flgs using 7/8" dia. SA-193-B7 studs, SA-194-2H nu

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 1005 expires 3/31, 19 95.

Date 4/1/93 Co. name Dusenbery Engineering Co., Inc. Signed [Signature]  
(Manufacturer) (Representative)

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**CERTIFICATE OF SHOP INSPECTION**

Vessel constructed by Dusenbery Engineering Co., Inc. at Morristown, NJ

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State of NJ and employed by Commercial Union Insurance Company

have inspected the component described in this Manufacturer's Data Report on 4/1, 1993, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 4/1/93 Signed [Signature] Commissions MB5776-NYS2288  
(Authorized Inspector) (Nat'l Board (incl. endorse/agent), State, Prov. and No.)

	NAT'L. NO. 2952
	CERTIFIED BY
	DUSENBERY ENG'G CO. INC.
	MAX. ALLOWABLE WORKING PRESSURE
	50 P.S.I.G. AT 400 °F
	MINIMUM DESIGN METAL TEMPERATURE
	20 °F AT 150 P.S.I.G.
	NEG. SERIAL NUMBER 871A
	YEAR 1993
	CORROSION ALLOWANCE 1/8"



# HACKNEY, INC.

A DIVISION OF TRINITY INDUSTRIES  
P.O. Box 58887 • 2525 Stemmons Freeway  
Dallas, Texas 75356-8887 • (214) 634-2850

FAX (201) 485-6422

871A HEADS

YOUR ORDER NUMBER	REFERENCE	CUSTOMER NO.	INVOICE NO.	INVOICE DATE	DATE SHIPPED
LORRIE		305620			

SOLD TO: GUYON-VAN LEEUWEN CO.  
900 FRANK ROGERS BLVD S.  
HARRISON, NJ. 07029

SHIP TO:

## CERTIFIED TEST REPORT

TRI 414 (R 6/91)

ITEM	QUANTITY	DESCRIPTION/SPECIFICATION	HEAT CODE
		12 STD W/C A516-70 TUSCL 5859784	AYYJ
		A234-90A/SA234 WPB	

CHEMICAL ANALYSIS													
HEAT CODE	C	Mn	P	S	Si	Cr	Mo	Cu	Ni	V	Nb	C.E. =	
AYYJ	.25	1.01	.017	.014	.21	.01	.00	.01	.01	.00	.00	.42	

PHYSICAL PROPERTIES							CHARPY RESULTS			
HEAT CODE	TENSILE * KSI	YIELD KSI	% Elong. IN 2"	Hard- ness HB	Size MM x 10 mm	Temp. *F	FOOT POUNDS	LATERAL EXPANSION	% SHEAR	
AYYJ	78.5 T	53.4	32.0	197 MAX						

\*L - LONGITUDINAL, T - TRANSVERSE

AYYJ CONFORMS TO THE REQUIREMENTS OF NACE MR0175-92

The above items were heat treated in accordance with the requirements of the specification to which they were manufactured.

We certify that the products covered by this report comply with the applicable requirements of ASTM and/or ASME specifications, as noted for each item.

I hereby certify that the above figures are correct, as contained in the records of the Company.

By: *Shanda L. Flowers*

*WJ* 3/15/93



USS  
A division of USX Corporation

871A SHELL

TUBULAR PRODUCTS

12<sup>th</sup> PAGE OF 16  
901 10.26.59

METALLURGICAL TEST REPORT

REQ. JOB, CONTRACT NO.

P.O. DATE

PURCHASE ORDER NO.

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFG., SAMPLED, TESTED, AND/OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.  
APPROVED BY OFFICE OF:  
D.S. DABKOWSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

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USS TUBULAR PRODUCTS

SHIPPERS NO.

W137317HR

T16890

DR34135 06

INVOICE NO.

VEHICLE IDENTITY

AA46985

GUYON  
DIV OF VAN LEEUWEN PIPE & TUBE  
900 ROGERS BLVD SOUTH  
HARRISON NJ 07029-2497

GUYON  
DIV OF VAN LEEUWEN PIPE & TUBE  
900 ROGERS BLVD SOUTH  
HARRISON NJ 07029-2497

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DATE 12/10/92

SPEC & INSP.

871A

ITEM NO.	MATERIAL DESCRIPTION			MATL.	HEAT/ LOT NO.	MIN. HYDRO PSI	YIELD STR. PSI	TENSILE STR. PSI	ELONG. % IN 2"	GAGE WIDTH IN.	FLAT	BEND
	SIZE	WALL	SPECIFICATION & GRADE									
06	12 3/4	.375	ASTM A53-90BGR.B ASME SA53 GR.B 89ED.91 ADD ASTM A106 91 GR.B ASME SA106 GR.B 89 ED.91 ADD. API 5L GR.B/X42 39TH ED. 6/91	SML	RX2246	2100	50100	76000	37.0	1 1/2	OK	

ITEM NO.	HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CS	CO
06	RX2246	HEAT	17	106	012	007	27	01	02	03	01				001				
06	RX2246	PROD	14	103	010	008	24	01	02	04	01				002				
** END OF DATA THIS SHEET *** ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.																			

WJ 3/15/93

**FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS**  
**As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1**

1. Manufactured and certified by Dusenbery Engineering Co., Inc. 309 E. Hanover Ave.  
(Name and address of Manufacturer) Morristown, NJ 07962

2. Manufactured for Glitsch, Inc. 1055 Parsippany Blvd. Parsippany, NJ 07054  
(Name and address of Purchaser)

3. Location of Installation Multi-Power Associates 9640 Eastport Rd. Jacksonville, FL 32211  
(Name and address)

4. Type: Vert. Tank Jacketed Vessel 872A  
(Horiz., vert., or sphere) (Tank, separator, jkt. vessel, heat exh., etc.) (Mfg's serial No.)

- D-7877-09-01 rev.0 2955 1993  
(CRN) (Drawing No.) (Mat'l. Bd. No.) (Year built)

5. ASME Code, Section VIII, Div. 1 1992, 12/91 - None  
Edition and Addenda (date) Code Case No. Special Service per UG-120(d)

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) No. of course(s): n/a (b) Overall length (ft & in.): n/a

Course(s)			Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type		Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

7. Heads: (a) SA-516-70 Normalized\* (b) -  
(Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. \* 1650F for 30 mins. (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	Bot.	7/16"	1/8"	-	-	2:1	-	-	-		X	Sm1s head	85	
(b)														

If removable, bolts used (describe other fastening) -  
(Mat'l Spec. No., Grade, size, No.)

8. Type of jacket Type 3, 36" OD, 2" S.F. Jacket closure Fig. 9-5, i-1(b)  
(Describe as ogee & weld, bar, etc.)

If bar, give dimensions - If bolted, describe or sketch.  
 9. MAWP 200 0 psi at max. temp. 500 - °F Min. design metal temp. -20 °F at 200 psi.  
(internal) (external) (internal) (external)

10. Impact test Not required per para. UG-20(f).  
(Indicate yes or no and the component(s) impact tested)

11. Hydro., pneu., or comb. test press. 300 PSIG Proof test -

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: Stationary (Mat'l Spec. No.) Dis., in. (subject to press.) Nom. thk., in. Corr. Allow., in. Attachment (welded or bolted)  
Floating (Mat'l Spec. No.) Dis., in. Nom. thk., in. Corr. Allow., in. Attachment

13. Tubes: Mat'l Spec. No., Grade or Type O.O., in. Nom. thk., in. or gauge Number Type (Straight or U)

Items 14-18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s) 2 (b) Overall length (ft & in.): 9'-2"

Course(s)			Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type		Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	36" OD	2'-11 1/2"	SA-285C		3/8"	1/8"	1	Spot	85	1	Spot	85	-	-
2	36" OD	6'-2 1/2"	"		"	"	"	"	"	2	None	65	-	-

15. Heads: (a) SA-516-70 Normalized\* (b) -  
(Mat'l Spec. No., Grade or Type) H.T. - Time & Temp. \* 1650F for 30 mins. (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp.

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	Top	5/16"	1/8"	-	-	2:1	-	-	-		X	Sm1s head	85	
(b)	Bot.	3/4"	1/8"	-	-	2:1	-	-	-	X	X	Sm1s head	85	

If removable, bolts used (describe other fastening) -  
(Mat'l Spec. No., Grade, size, No.)

FORM U-1 (Back)

16. MAWP 150 0 Shell 200\* psi at max. temp. 500 500 °F. Min. design metal temp. -20 °F at 150 psi.  
(internal) (external) (internal) (external)

17. Impact test None required per para. UG-20(f). \*Bottom head only.  
(Indicate yes or no and the component(s) impact tested)

18. Hydro., pneu., or comb. test press. 235 Proof test -

19. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material		Nozzle Thickness		Reinforcement Material	How Attached		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Out	1	3"	150#	SA106B	SA105	S160	1/8"	-	Welded	Welded	Top Hd.
Relief	1	1"	"	"	"	XXH	"	-	"	"	" "
Instr.	2	3/4"	"	"	"	"	"	-	"	"	" "
Insp.	2	6"	"	"	"	S80	"	-	"	"	Shell
Drain	1	1"	"	"	"	XXH	"	-	"	"	Bot. Hd.
In/Out	2	1"	300#	"	"	"	"	-	"	"	Jacket

20. Supports: Skirt No Lugs - Legs 4 Others - Attached Welded to shell.  
(Yes or no) (No.) (No.) (Describe) (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:  
(List the name of part, item number, mfg's. name and identifying number)

22. Remarks: Vessel tested in horizontal position. Vessel used for chemicals. Note that the 3/4" Tk bottom internal head has a total corrosion allowance of .125".

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.

U Certificate of Authorization No. 1005 Expires 3/31, 19 95

Date 4/12/93 Name Dusenbery Engineering Co., Inc. Signed [Signature]  
(Manufacturer) (Representative)

**CERTIFICATE OF SHOP INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of NJ and employed by Commercial Union Insurance Company of Boston, MA have inspected the pressure vessel described in this Manufacturer's Data Report on 4/12, 19 93, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 4/12/93 Signed William A. Haland Commissions NB5776-NYS2258  
(Authorized Inspector) (Nat'l Board incl. endorsement, State, Province and No.)

**CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE**

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1.

U Certificate of Authorization No. \_\_\_\_\_ Expires \_\_\_\_\_, 19 \_\_\_\_\_



Date \_\_\_\_\_ Name \_\_\_\_\_ Signed \_\_\_\_\_  
(Assembler) (Representative)

**CERTIFICATE OF FIELD ASSEMBLY INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of \_\_\_\_\_ and employed by \_\_\_\_\_ of \_\_\_\_\_ have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items \_\_\_\_\_, not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of \_\_\_\_\_ psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date \_\_\_\_\_ Signed \_\_\_\_\_ Commissions \_\_\_\_\_  
(Authorized Inspector) (Nat'l Board incl. endorsement, State, Province and No.)



	NATEL BD: 2955
W	CERTIFIED BY
RT-4	DUSENBERY ENGR. CO., INC.
	MAX. ALLOWABLE WORKING PRESSURE
	SHELL - 150 PSIG AT 500 °F
	MINIMUM DESIGN METAL TEMPERATURE
	-20 °F AT 150 PSIG
JKT-	MAWP: 200 PSIG AT -20 TO +500
	REG. SERIAL NUMBER 872 A
	YEAR 1993
	CORROSION ALLOWANCE 1/8
	6J-7877 ICCF-RVR-1

TRINITY INDUSTRIES, INC.



872A  
TOP HEAD

DUSENBERY ENG CO INC  
PO BOX 1001  
MORRISTOWN, NJ 07962

ATTENTION : PHILLIP WILLIAMS

REFERENCE : CUSTOMER P/O 9275  
TRINITY S/O 3-24697

GENTLEMEN :

ATTACHED ARE COPIES OF MILL TEST REPORTS FOR THE FOLLOWING MATERIAL PROVIDED ON YOUR REFERENCED PURCHASE ORDER.

- HEADS FROM STOCK
- 1-SA516-70 ELLIPTICAL HEAD 36.0000 OD 0.3750 THICK WITH 2.0000 SF.

CODE	QTY	Thickness	Producer	Melt	Slab	Grade
UICC	1.	.3750	GULF STATES	7423544	T7332	SA516-70

TRINITY INDUSTRIES, INC. certifies that heads manufactured from material represented by this report were normalized at 1650F for 30 minutes per inch of thickness.

THE ITEMS LISTED ABOVE WERE FORMED IN STRICT ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS OF THE ASME BOILER AND PRESSURE VESSEL CODE SECTION VIII, DIV. 1. COLD FORMED HEADS COMPLY WITH PARAGRAPH UCS-79(D). ALL HEADS COMPLY WITH UG-81.

ATTACHED MILL TEST REPORTS ARE IN COMPLIANCE TO ASME CODE SECTION II STANDARD SPECIFICATION SA20/SA20M - 87A PARA. 7.1.1 AND/OR ASME CODE CASE 2053.

IF YOU HAVE ANY FURTHER QUESTIONS, PLEASE CONTACT ME IN NAVASOTA, TEXAS AT 1-800-231-6574.

VERY TRULY YOURS,

ANISSA MCGILL  
TRINITY INDUSTRIES, INC.  
HEAD DIVISION

MILL TEST REPORTS TO GO WITH SHIPMENT.  
030893

# Gulf States Steel, Inc. GADSDEN, AL 35904-1935

Y765-01	CONTROL CARD	REF. JOB CONTRACT NO.	PURCHASE ORDER DATE 02/17/92	PURCHASE ORDER NO. HBN-30886-GS	RELEASE
<h2>CERTIFICATE OF TESTS</h2>			CUSTOMER IDENTIFICATION		GSS ORDER NO. M.F.O. ITEM NO. G 24089 742
			OFFICE DIST	INVOICE DATE	INVOICE NUMBER
			LE	ACCOUNT NUMBER	TERMS
			742	30-3/4-10	742-12840
			75378201	30-3/4-10	

TRINITY INDUSTRIES HEAD DIVISION P O BOX 938 NAVASOTA TX 77868	TRINITY INDUSTRIES HEAD DIVISION HWY 6 SOUTH NAVASOTA TX 77868
---	---

DATE SHIPPED 07 06 92	FROM ALA CITY	ROUTE/VEHICLE IDENTIFICATION SOU 116153	SHEET NO.
--------------------------	------------------	--	-----------

I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

**LEONARD A. TROMAN**  
DIR. QUALITY ASSURANCE AND METALLURGY

ITEM NO.	MATERIAL DESCRIPTION	P/C	QUANTITY SHIPPED	
02	PLATE CARBON ASME SA 516 DATE 07 01 89 GRD 70 ASTM A-516-90 GRD 70 AS ROLLED PVQ ADDITIONAL TEST NORM TEST SPEC  3750 X 96.0000 SHEARED EDGE X A 192.0000 IN HT 7423544 T 7326 4PCSUITC HT 7423544 T 7327 4PCSUITC HT 7423544 T 7328 4PCSUITC HT 7423544 T 7329 4PCSUITC HT 7423544 T 7330 4PCSUITC HT 7423544 T 7331 4PCSUITC HT 7423544 T 7332 4PCSUITC HT 7423544 T 7333 4PCSUITC		62720	HT. # <u>74 23544</u> MTR. APPROVED DATE <u>8/25/92</u> ISP <u>Quissance</u> QUALITY CONTROL DEPT.
CH	C 27MX MN 85/1.20 P 035MX S 035MX SI 15/40 AL 020IN CU 40MX NI 40MX CR 30MX MO 12MX CB 02MX V 03MX			
MR	YLD 38000 MIN TEN 70/90000 % ELONG MIN 2 IN 21 OR 8 IN 17 PHY ON AR & NORM TST SPEC SEE NOTES			

TRINITY INDUSTRIES  
 JUL 15 1992  
 PLANT # 56

The plates as listed are furnished in the "as rolled" condition. The test results shown are those obtained on coupons after they were normalized by heating to 1650 degrees F. and held at temperature for 30 minutes per inch of thickness, followed by air cooling to 300° F or below.

ITEM NO.	HEAT NO.	GRAIN	CARBON	MANG	PHOS	SUL	SIL	COPPER	NICKEL	CHROME	MOLY	VAN	CB	AL	
															YIELD KSI
ANALYSIS															
02	7423544		.19	1.13	.006	.020	.207	0.06	0.12	0.13	.02	.00	.004	.032	
TEST RESULTS	HEAT NUMBER	TESTOR PIECE IDENTITY NO.	YIELD KSI	TENSILE KSI	ELONG		GALV COATING	BEND TEST	HARD.	CHARPY IMPACT: V NOTCH FT. LBS. AT					
	7423544	7326	52	76	28		AR			TEST NO.	SPEC SIZE	1	2	3	AVG.
	"	"	51	71	27		NORM								
	"	7327	50	75	26		AR								
	"	"	52	74	25		NORM								
	"	7328	51	76	25		AR								
	"	"	50	73	26		NORM								
"	7329	50	75	27		AR									
"	"	50	73	26		NORM									

*Handwritten:* 3/12/93

# Gulf States Steel, Inc. GADSDEN, AL 35904-1835

Y765-01	CONTROL CARD	REQ. JOB CONTRACT NO.	PURCHASE ORDER DATE 02/17/92	PURCHASE ORDER NO. HBN-30886-GS	RELEASE
<b>CERTIFICATE OF TESTS</b>			CUSTOMER IDENTIFICATION		GSS ORDER NO. NUMBER <b>24089</b> MFG. NO. <b>742</b>
			OFFICE DIST <b>BR</b>	INVOICE DATE	INVOICE NUMBER <b>742-12840</b>
			LE ACCOUNT NUMBER <b>75378201</b>	TERMS <b>30-3/4-10.</b>	

TRINITY INDUSTRIES HEAD DIVISION P O BOX 938 NAVASOTA TX 77868	TRINITY INDUSTRIES HEAD DIVISION HWY 6 SOUTH NAVASOTA TX 77868
---	---

DATE SHIPPED 07 06 92	FROM ALA CITY	ROUTE/VEHICLE IDENTIFICATION SOU 116153	SHEET NO.
--------------------------	------------------	--	-----------

I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

**LEONARD A. TROMAN**  
DIR. QUALITY ASSURANCE AND METALLURGY

ITEM NO.	MATERIAL DESCRIPTION	P/C	QUANTITY SHIPPED
TI 3 TR 1	W/SHIPMENT		

HT. # 7423544

MTR. APPROVED

DATE 9/25/92

ISP Amisa M. ...

QUALITY CONTROL DEPT.

The plates as listed are furnished in the "as rolled" condition. The test results shown are those obtained on coupons after they were normalized by heating to 1650 degrees F. and held at temperature for 30 minutes per inch of thickness, followed by air cooling to 300°F or below.

ITEM NO.	HEAT NO.	GRAIN	CARBON	MANG	PHOS	SUL	SIL	COPPER	NICKEL	CHROME	MOLY	VAN	CB	AL	
															YIELD KSI
				2"	8"					TEST NO.	SPEC SIZE	1	2	3	AVG.
02	7423544		.19	1.13	.006	.020	.207	0.06	0.12	0.13	.02	.00	.004	.032	
TEST RESULTS	7423544	7330	58	76		27	AR								
	"		50	73		26	NORM								
	"	7331	49	75		27	AR								
	"		50	74		27	NORM								
	"	<u>7332</u>	56	77		29	AR								
	"		48	71		28	NORM								
	7333	57	77		25	AR									
		51	72		26	NORM									

LF 3/12/93

TRINITY INDUSTRIES, INC.



872A  
BOTTOM HEAD

DUSENBERY ENG CO INC  
PO BOX 1001  
MORRISTOWN, NJ 07962

ATTENTION : PHILLIP WILLIAMS

REFERENCE : CUSTOMER P/O 9275  
TRINITY S/O 3-24699

GENTLEMEN :

ATTACHED ARE COPIES OF MILL TEST REPORTS FOR THE FOLLOWING MATERIAL PROVIDED ON YOUR REFERENCED PURCHASE ORDER.

- LABOR & MATERIAL
- 1-SA516-70 ELLIPTICAL HEAD 36.0000 OD 0.7500 THICK WITH 2.0000 SF.

CODE	QTY	Thickness	Producer	Melt	Slab	Grade
UJYR	1.	.7500	GULF STATES	7417641	T7854	SA516-70

TRINITY INDUSTRIES, INC. certifies that heads manufactured from material represented by this report were normalized at 1650F for 30 minutes per inch of thickness.

THE ITEMS LISTED ABOVE WERE FORMED IN STRICT ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS OF THE ASME BOILER AND PRESSURE VESSEL CODE SECTION VIII, DIV. 1. COLD FORMED HEADS COMPLY WITH PARAGRAPH UCS-79(D). ALL HEADS COMPLY WITH UG-81.

ATTACHED MILL TEST REPORTS ARE IN COMPLIANCE TO ASME CODE SECTION II STANDARD SPECIFICATION SA20/SA20M - 87A PARA. 7.1.1 AND/OR ASME CODE CASE 2053.

IF YOU HAVE ANY FURTHER QUESTIONS, PLEASE CONTACT ME IN NAVASOTA, TEXAS AT 1-800-231-6574.

VERY TRULY YOURS,

ANISSA MCGILL  
TRINITY INDUSTRIES, INC.  
HEAD DIVISION

MILL TEST REPORTS TO GO WITH SHIPMENT.

3/24/93



**Gulf States Steel, Inc.** GALVESTON, AL 35004-1935

32-B149-01	CONTROL CARD	REQ. JOB CONTRACT NO.	PURCHASE ORDER DATE 06/02/92	PURCHASE ORDER NO. HBN-31091-GS	RELEASE	
<h1>CERTIFICATE OF TESTS</h1>			CUSTOMER IDENTIFICATION		OBS ORDER NO. DIST: G 25544 MFG: 742 ITEM NO. 6	
			T E C M A L 12	OFFICE DIST DR	INVOICE DATE	INVOICE NUMBER 742-17601
			LE	ACCOUNT NUMBER 75378201	TERMS 30-3/4-10	
S TRINITY INDUSTRIES L HEAD DIVISION P O BOX 938 O NAVASOTA TX 77868			TRINITY INDUSTRIES HEAD DIVISION HWY 6 SOUTH NAVASOTA TX 77868			
DATE SHIPPED 09 18 92		FROM ALA CITY	ROUTE/VEHICLE IDENTIFICATION NS-101540		SHEET NO.	
I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.				LEONARD A. TROMAN DIR. QUALITY ASSURANCE AND METALLURGY		

ITEM NO.	MATERIAL DESCRIPTION	P/C	QUANTITY SHIPPED
TI 3	TR 1 W/SHIPMENT		

*WJ 3/24/93*

The plates as listed are furnished in the "as rolled" condition. The test results shown are those obtained on coupons after they were normalized by heating to 1650 degrees F. and held at temperature for 30 minutes per inch of thickness, followed by air cooling to 300°F or below.

ANALYSIS	ITEM NO.	HEAT NO.	GRAIN	CARBON	MANG	PHOS	SUL	SIL	COPPER	NICKEL	CHROME	MOLY	VAN	Cb	AL
	ITEM NO.	HEAT NUMBER	TESTOR PIECE IDENTITY NO.	YIELD KSI	TENSILE STGTH KSI	ELONG		GALV. COATING	BEND TEST	HARD.	CHARPY IMPACT: V NOTCH FT. LBS. AT				
TEST RESULTS	5	7417641	7854	51	81		26	AR							
		"		51	75		28	NORM							
		"	7855	59	80		25	AR							
		"		50	75		30	NORM							

TRINITY INDUSTRIES, INC.



872A  
JACKET HEAD

DUSENBERY ENG CO INC  
PO BOX 1001  
MORRISTOWN, NJ 07962

ATTENTION : PHILLIP WILLIAMS

REFERENCE : CUSTOMER P/O 9275  
TRINITY S/O 3-24698

GENTLEMEN :

ATTACHED ARE COPIES OF MILL TEST REPORTS FOR THE FOLLOWING MATERIAL PROVIDED ON YOUR REFERENCED PURCHASE ORDER.

- HEADS FROM STOCK
- 1-SA516-70 ELLIPTICAL HEAD 36.0000 OD 0.5000 THICK WITH 2.0000 SF.

CODE	QTY	Thickness	Producer	Melt	Slab	Grade
UDLB	1.	.5000	UNITED STATE	D40473	74-2	SA516-70

TRINITY INDUSTRIES, INC. certifies that heads manufactured from material represented by this report were normalized at 1650F for 30 minutes per inch of thickness.

THE ITEMS LISTED ABOVE WERE FORMED IN STRICT ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS OF THE ASME BOILER AND PRESSURE VESSEL CODE SECTION VIII, DIV. 1. COLD FORMED HEADS COMPLY WITH PARAGRAPH UCS-79(D). ALL HEADS COMPLY WITH UG-81.

ATTACHED MILL TEST REPORTS ARE IN COMPLIANCE TO ASME CODE SECTION II STANDARD SPECIFICATION SA20/SA20M - 87A PARA. 7.1.1 AND/OR ASME CODE CASE 2053.

IF YOU HAVE ANY FURTHER QUESTIONS, PLEASE CONTACT ME IN NAVASOTA, TEXAS AT 1-800-231-6574.

VERY TRULY YOURS,

ANISSA MCGILL  
TRINITY INDUSTRIES, INC.  
HEAD DIVISION

MILL TEST REPORTS TO GO WITH SHIPMENT.

030893

CINCINNATI OFFICE: 11861 MOSTELLER RD. • CINCINNATI, OHIO 45241 • (513) 771-2300 • EASY LINK: 6294-2674 • FAX: (513) 771-2404

NAVASOTA OFFICE: HIGHWAY 6 SOUTH • P. O. DRAWER 938 • NAVASOTA, TEXAS 77868 • (409) 825-6581 • EAY LINK: 6285-7812 • FAX: (409) 825-6470

TUSCALOOSA OFFICE: 916 KICKER ROAD • TUSCALOOSA, ALABAMA 35404 • (205) 556-4040 • FAX: (205) 556-7970





A DIVISION OF USX CORPORATION

01.000.0772 (REV. 4/87)

WDLB  
WDLB

Metallurgical  
Test Report



REQ., JOB, CONTRACT NO.		P.O. DATE	PURCHASE ORDER NO. HBN308737		BEING DULY SWORN ACCORDING TO LAW, DEPOSES AND SAYS PRODUCT DESCRIBED HEREIN WAS MFGD., SAMPLED, TESTED AND/OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.  PREPARED BY THE OFFICE OF: <u>B. Lucas</u> G. D. LUKES GEN. MGR. G. A.
VENDOR GARY WORKS GARY, INDIANA 46402	SHIPPERS NO.	MILL ORDER NO.	INVOICE NO.		
	HO6051 02 17 92	GF03955	154-137099		
SOLD TO TRINITY INDUSTRIES INC NAVASOTA HEAD DIV ATTN - PURCHASING DEPT DRAWER 93B NAVASOTA TX 77868 PART NO: PT#STK--		VEHICLE IDENTITY EJE 006271	H6051		

SPEC. & INSP. PLATE CARBON ASTM A516-~~x~~1986 GRADE 70 ASME SA516-~~x~~1989 EDITION-1990 ADDENDA DECEMBER 31, 1990 GRADE 70 PRESSURE VESSEL QUALITY PLATE AS ROLLED NORMALIZE TEST SPECIMENS ONLY

STATE OF INDIANA  
COUNTY OF LAKE  
SUBSCRIBED AND SWORN TO BEFORE ME  
THIS 17TH DAY OF FEBRUARY A. D., 1992

INSP: 01 MILL SWORN T/R MAILED - FURNISH CERTIFIED T/R WITH LOAD ANALYSIS 1 T/R TO HACKNEY INC ATTN CORNELL CLEPPER DRAWER 938 NAVASOTA TX 77868

NOTARY PUBLIC Berlin Blum  
MY COMMISSION EXPIRES Jan 24, 1996

ITEM NO.	MATERIAL DESCRIPTION			QUAN-TITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT. KSI	TENSILE STR. KSI	ELONGATION%		% RED. OF AREA	BEND
	THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH							IN 8"	IN 2"		
02	1/2 " STEEL-TYPE	96.0000 = CAST	192" REDUCTION RATIO = 24.0 TO 1	07	18298	D40473	74 2						
						WDLB	74 2	*	53.5	75.0	28.0	48.0	
02	1/2 " STEEL-TYPE	96.0000 = CAST	192" REDUCTION RATIO = 24.0 TO 1	07	18298	D40473	74 3						
						WDLB	74 3	*	53.0	75.0	30.0	50.0	
***END OF DATA***													

Handwritten notes: # D.40473, 3-10-92, and signature.

\*YIELD STRENGTH @ 0.5% E. U. L.

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
D40473	HEAT	20	109	016	008	20	02	01	03	00		030		000				000
***END OF DATA***																		

WJ 3/12/93

FINE GRAIN  
FEB 24 1992  
PLANT # 56



A DIVISION OF USX CORPORATION

01.000.0772 (REV. 4/87)

Metallurgical Test Report



REQ., JOB, CONTRACT NO.		P.O. DATE	PURCHASE ORDER NO. HBN308737		BEING DULY SWORN ACCORDING TO LAW, DEPOSES AND SAYS PRODUCT DESCRIBED HEREIN WAS MFGD., SAMPLED, TESTED AND/OR INSPI IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS. <i>B. G. Luke</i> PREPARED BY THE OFFICE OF: G. D. LUKES GEN. MGR. Q. A.
VENDOR GARY WORKS GARY, INDIANA 46402  SOLD TO TRINITY INDUSTRIES INC NAVASOTA HEAD DIV ATTN - PURCHASING DEPT DRAWER 938 NAVASOTA TX 77868 PART NO: PT#STK--	SHIPPERS NO.	MILL ORDER NO.	INVOICE NO.		
	H06051 02 17 92	GF03955	154-137099		
	VEHICLE IDENTITY	H6051			
	EJE 006271				

SPEC. & INSP. PLATE CARBON ASTM A516-\*1986 GRADE 70 ASME SA516-\*1989 EDITION-1990 ADDENDA DECEMBER 31, 1990 GRADE 70 PRESSURE VESSEL QUALITY PLATE AS ROLLED NORMALIZE TEST SPECIMENS ONLY

INSP: 01 MILL SWORN T/R MAILED - FURNISH CERTIFIED T/R WITH LOAD ANALYSIS 1 T/R TO HACKNEY INC ATTN CORNELL CLEPPER DRAWER 938 NAVASOTA TX 77868

STATE OF INDIANA  
COUNTY OF LAKE  
SUBSCRIBED AND SWORN TO BEFORE ME THIS 17TH DAY OF FEBRUARY A. D., 1992

NOTARY PUBLIC *Barbara Blinn*  
MY COMMISSION EXPIRES *Jan 24 1994*

ITEM NO.	MATERIAL DESCRIPTION			QUANTITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT.	TENSILE STR.	ELONGATION%		% RED. OF AREA	BE:
	THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH							IN 8"	IN 2"		
	TEST SPECIMENS NORMALIZED AT 1650 DEG F. HELD AT TEMPERATURE 0030 MINUTES. COOLING COMPLETED IN STILL AIR ***END OF DATA***												

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
***END OF DATA***																		

*WJ 3/12/92* TRINITY INDUSTRIES  
FEB 24 1992



# TEST CERTIFICATE

CUSTOMER P.O.: 8971  
DESCRIPTION:

Best Available Copy

PAGE NO. 01 OF 01  
FILE NO. 402-01-01  
DATE 1/03/92  
MILL ORDER NO: 53959-001

2 - RECTANGLE .375 -X- 80.5 -X- 394.6875

SOLD TO:  
DUSENBERY ENGR. CO., INC.  
HANOVER AVE.  
P.O. BOX 1001  
MORRISTOWN NJ 07962-1001

SEND TO:  
DUSENBERY ENGR. CO., INC.  
HANOVER AVE.  
P.O. BOX 1001  
MORRISTOWN NJ 07962-1001

SHIP TO:  
DUSENBERY ENGR. CO., INC.  
HANOVER AVE.  
P.O. BOX 1001  
MORRISTOWN, NJ 07962-1001

THIS MATERIAL HAS BEEN MANUFACTURED AND TESTED IN ACCORDANCE WITH PURCHASE ORDER REQUIREMENTS AND SPECIFICATIONS:

ASTM A285 GR. C YR. 82

LT/SLAB		CHEMICAL ANALYSIS														PRACTICES	
		C	MN	P	S	CU	SI	NI	CR	MO	V	TI	B	CB			
R5848	/6A	.08	.54	.014	.021	.21		.20	.14	.06	.001			.001			
R5848																	

TENSILES				CHARPY V IMPACTS				OTHER TESTS PERFORMED				
TYPE	YLD (PSI)	TENS (X 100)	% ELONG	% R.A.	TYPE	TEMP	MILS LATERAL EXPANSION		% SHEAR			
BX	481	644	27.0									

## INFORMATION

WEIGHT PER PIECE = 3379 LBS. 1536 KG.  
B/L #92066 TORNETTA'S MOTOR TRUCKS

*Wf 2/10/92*

## HEAT TREAT CYCLES - MATL. OR TESTS - DEG

MATL	TEST	NOM TEMP	MIN TEMP	MAX TEMP	HOLD MINS.	COOL METHOD	

## HEAT TREAT CYCLES - TESTS ONLY - DEG

START END TEMP	NOM TEMP	MIN TEMP	MAX TEMP	HOLD MINS.	HEAT RATE MAX	

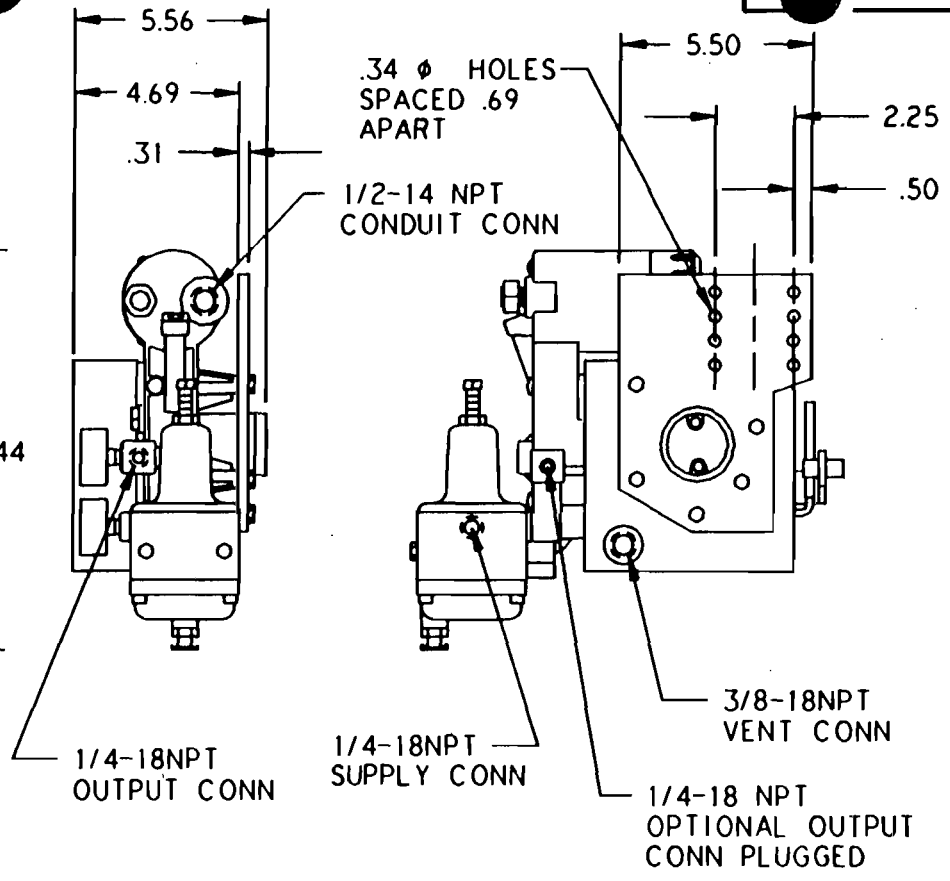
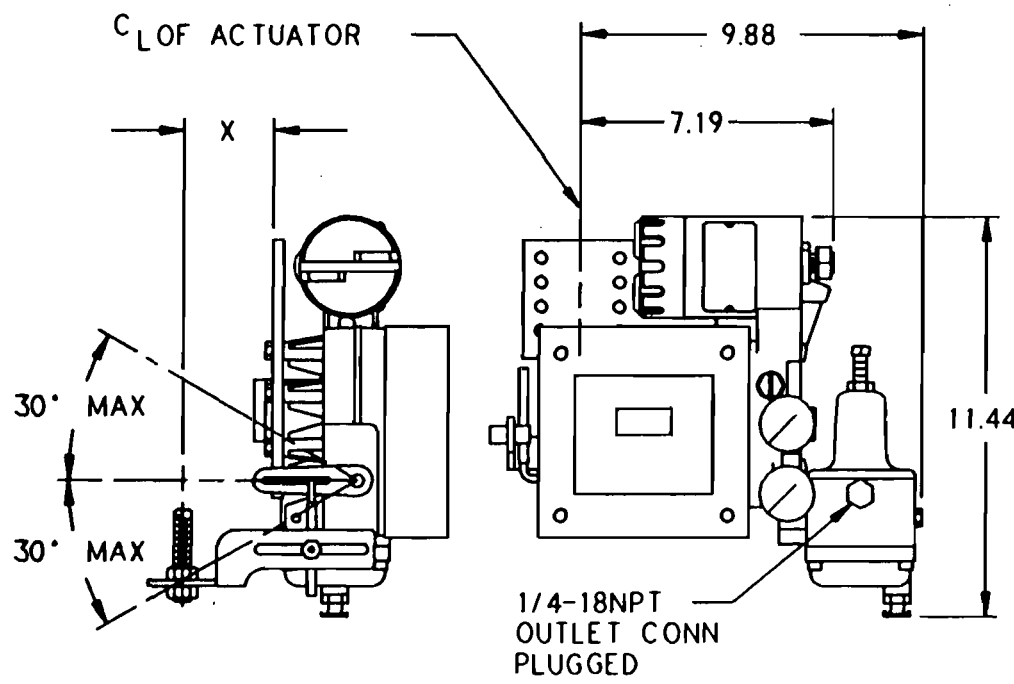
WE HEREBY CERTIFY THE ABOVE INFORMATION IS CORRECT:

Quality Assurance Laboratory  
Coatesville, PA 19320

*Herald G. Weaver*  
SUPERVISOR - TEST REPORTING

BEST AVAILABLE COPY  
 FEATURES PICTORIALY TYPICAL - ORIENTATION MAY DIFFER

11B6519



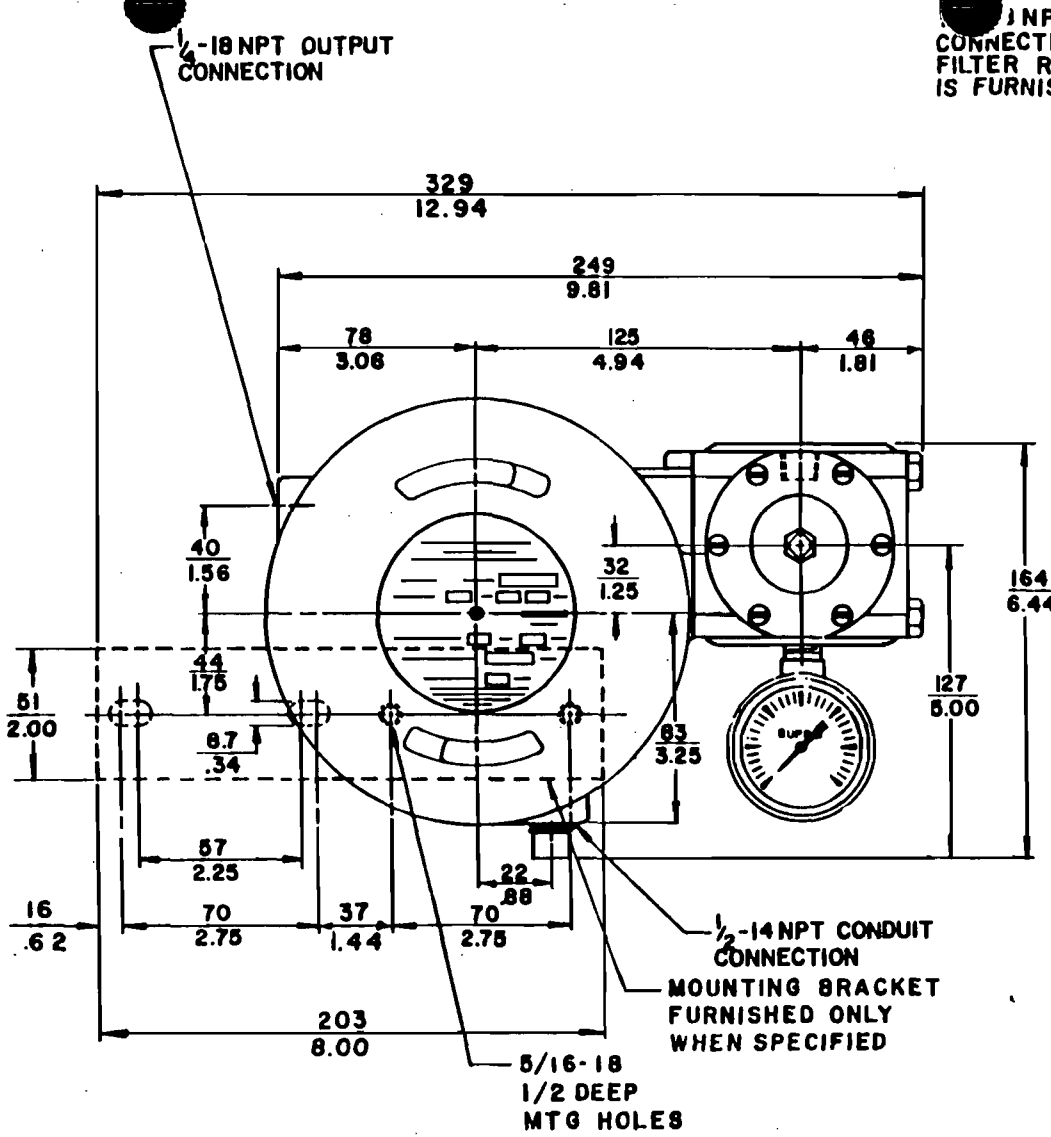
STEM TRAVEL	X		
	3/8 STEM Ø	1/2 STEM Ø	3/4 STEM Ø
1 1/8 OR LESS	3.19	3.44	3.94
1 1/2	3.56	3.81	4.31
2	4.00	4.25	4.75
2 1/2	4.44	4.69	5.19
3	4.88	5.12	5.62
3 1/2	5.31	5.56	6.06
4	5.75	6.00	6.50

ENVELOPE DIMENSIONS ARE ± .25

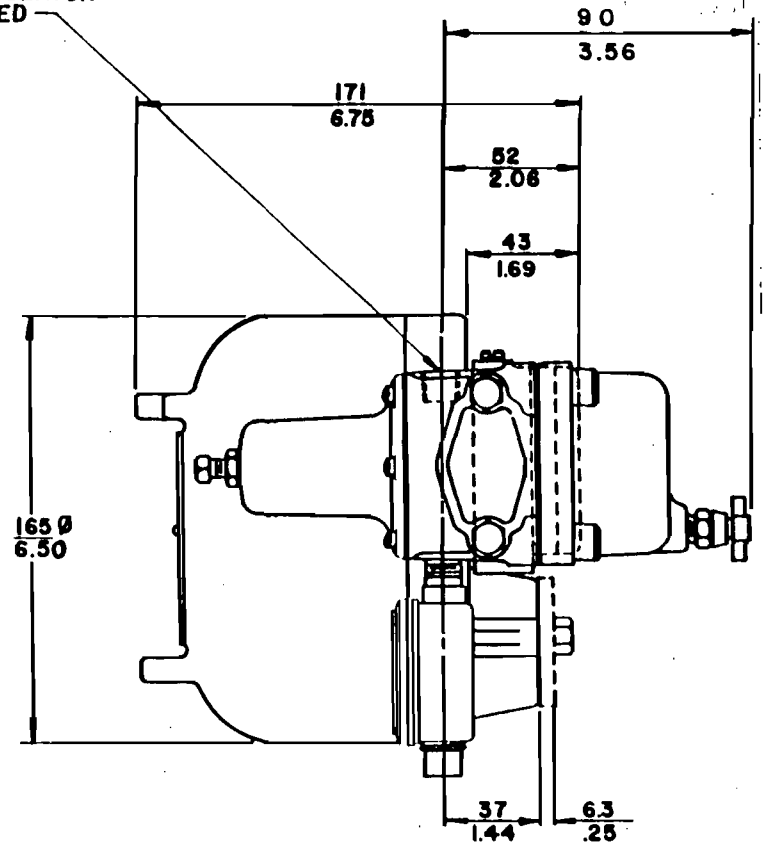
CUSTOMER GLITSCH PACKAGE PLANTS		P.O. NO. 19375 C.O. 1		TAG NO.		
SERIAL NO. 12659034,35			ORDER NO. 001 -A1002173B		INFORMATION CERTIFIED CORRECT DATE <u>5-3-88</u> BY <u>Sm</u>	
<b>FISHER</b>	DWN.	KLR	2-8-88	I/P POSITIONER		TYPE 35821/67AFR
	CHKD.	MJH	2-8-88			DWG. NO. 11B6519
	APVD.	BJB	2-9-88			REV. E
Fisher Controls Marshalltown, Iowa, USA		CODE 22508	SCALE-NONE	E	MMS	4-22-92
© Fisher Controls 1988,1992			REVISIONS			

FEATURES PICTORIALLY TYPICAL—ORIENTATION MAY DIFFER

477



1/2 NPT SUPPLY CONNECTION WHEN FILTER REGULATOR IS FURNISHED



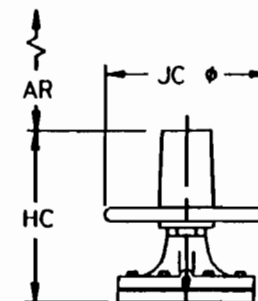
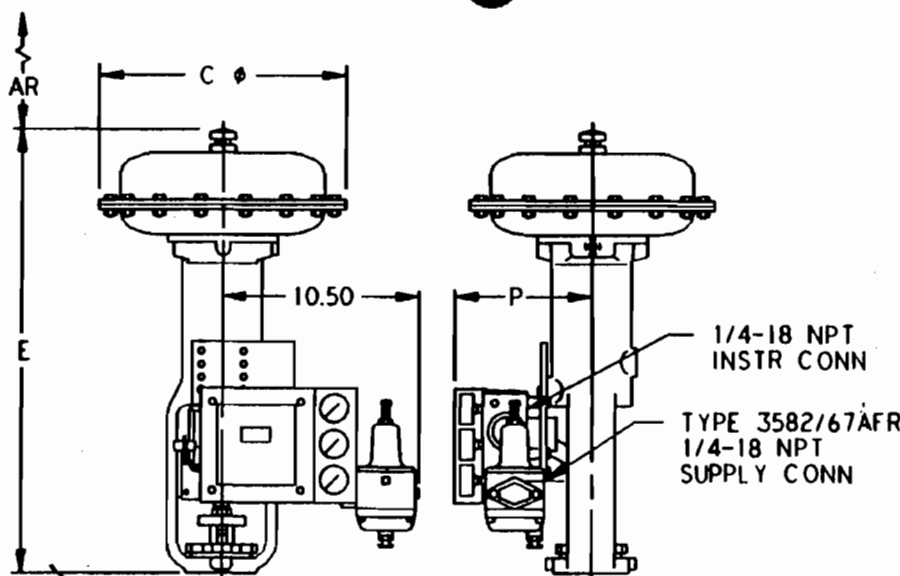
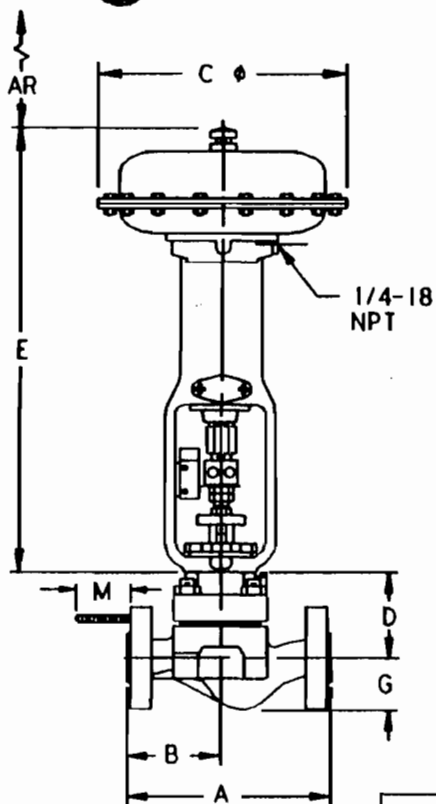
UNIT OF MEASURE: MILLIMETER/INCH  
ENVELOPE DIMENSIONS ± 6.4/25

C  
E  
M  
N  
Y  
K  
Y  
R

CUSTOMER GLITSCH PACKAGE PLANTS		P.O. NO. 19375		TAG NO. 1CLF-ACV-104, 1CCF-ACV-102		
SERIAL NO. 12637566, 12637366			ORDER NO. 001 -A1002173A		INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY <i>LM</i>	
<p><b>Fisher Controls</b> Marshalltown, Iowa, USA</p>	DWN. <i>MBC</i> 1-8-65	ELECTRO-PNEUMATIC TRANSDUCER			TYPE 546	DD
	CHKD. <i>RHD</i> 1-13-65				APVD.	DWG NO. ▲ AP6477
	CODE 22508	SCALE—NONE	H <i>DB</i> 7-24-91	REVISIONS		
© Fisher Controls 1983, 1991						

FEATURES PICTORIALLY TYPICAL - ORIENTATION MAY DIFFER

B8401



HANDJACK

INCREASING PRESSURE TO DIAPHRAGM  
OPENS VALVE PLUG  
VALVE PLUG CLOSES ON AIR FAILURE  
FLANGES PER ANSI  
AR = ACTUATOR REMOVAL CLEARANCE  
ENVELOPE DIMENSIONS ARE ± .25

WARNING: BODY RATING MAY EXCEED  
FLANGE JOINT RATING

NOTE: C/W 546, YOKE MTD

SIZE	E	C Ø	P	HC	JC Ø	AR
30	18.81	11.38	7.06	7.12	6.75	5.00
34	22.56	13.12	7.25	8.69	8.75	5.00
40	23.38	13.12	7.31	8.69	8.75	6.88
45	30.25	16.00	7.75	9.31	8.75	6.88
46	30.25	18.62	7.75	9.31	8.75	6.88

SIZE	A	B	G	D		STEM CONN Ø	FLANGE BOLTING								
				STD BONNET	EXT BONNET		CLASS 150			CLASS 300			CLASS 600		
							M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS
1/2	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.25	1/2	4	3.50	1/2	4
3/4	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1	8.50	3.94	2.12	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1 1/2	9.50	4.44	2.75	3.81	7.69	3/8	3.25	1/2	4	4.25	3/4	4	4.50	3/4	4
2	11.50	4.75	3.44	4.88	8.56	3/8	3.50	5/8	4	4.00	5/8	8	4.50	5/8	8
3	14.00	5.75	4.94	6.25	9.62	1/2	4.00	5/8	4	4.75	3/4	8	5.00	3/4	8
4	17.00	6.50	6.25	7.31	10.19	1/2	4.25	5/8	8	5.00	3/4	8	6.00	7/8	8

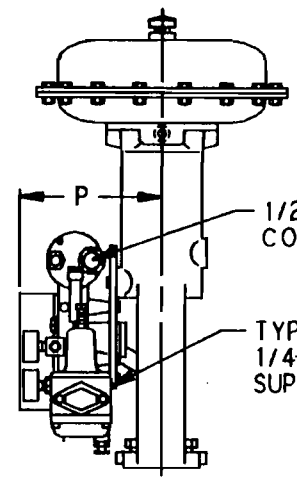
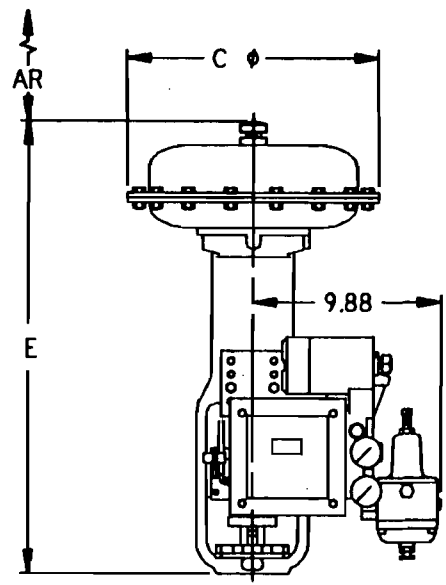
NOTE: A & B DIMENSIONS REMAIN THE SAME FOR RF OR FF CONSTRUCTION.

CUSTOMER GLITSCH PACKAGE PLANTS		P.O. NO. 19375		TAG NO. 1CLF-ACV-104					
SERIAL NO. 12637566		ORDER NO. 001 -A1002173A		INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY <i>SM</i>					
	DWN.	MMS	2-17-86	DIAPHRAGM ACTUATED CONTROL VALVE		TYPE	667 - CE	IN	
	CHKD.	KAL	2-20-86			DWG. NO.	10B8401	REV..	F
	APVD.	CH	2-20-86			SCALE-NONE	F	MMS	7-24-92
Fisher Controls Marshalltown, Iowa, USA		CODE 22508		© Fisher Controls 1986, 1992					

FEATURES PICTORIALY TYPICAL- ORIENTATION MAY DIFFER

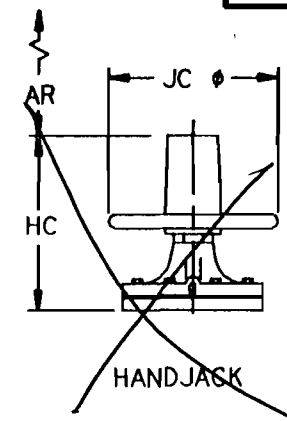
BEST AVAILABLE COPY

4633



1/2-14 NPT  
CONDUIT CONN

TYPE 3582i/67AFR  
1/4-18 NPT  
SUPPLY CONN



SIZE	E	C $\phi$	P	HC	JC $\phi$	AR
✓ 30	18.81	11.38	7.06	7.12	6.75	5.00
34	22.56	13.12	7.25	8.69	8.75	5.00
40	23.38	13.12	7.31	8.69	8.75	6.88
45	30.25	16.00	7.75	9.31	8.75	6.88
46	30.25	18.62	7.75	9.31	8.75	6.88
50	30.88	16.00	7.88	9.31	8.75	9.12
60	30.88	18.62	7.88	9.31	8.75	9.12
70	36.75	21.12	11.19	16.25	14.00	9.12
76	34.81	18.62	11.19	9.31	8.75	9.12

INCREASING PRESSURE TO DIAPHRAGM  
OPENS VALVE PLUG  
CLOSES

VALVE PLUG  
OPENS ON AIR FAILURE  
CLOSES

AR = ACTUATOR REMOVAL CLEARANCE  
ENVELOPE DIMENSIONS ARE  $\pm .25$

C

CUSTOMER GLITSCH PACKAGE PLANTS	P.O. NO. 19375	TAG NO. ICCF ACV-1007,2007,3007
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SERIAL NO. 12637363,64,65	ORDER NO. 001 -A1002173A	INFORMATION CERTIFIED CORRECT DATE 4-7-93 BY <i>DM</i>
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DWN.	SHULTZ	2-20-90
CHKD.	KAL	3-8-90
APVD.	SRG	3-12-90

DIAPHRAGM ACTUATOR

TYPE  
667  
W/3582i

IN

Fisher Controls  
Marshalltown, Iowa, USA

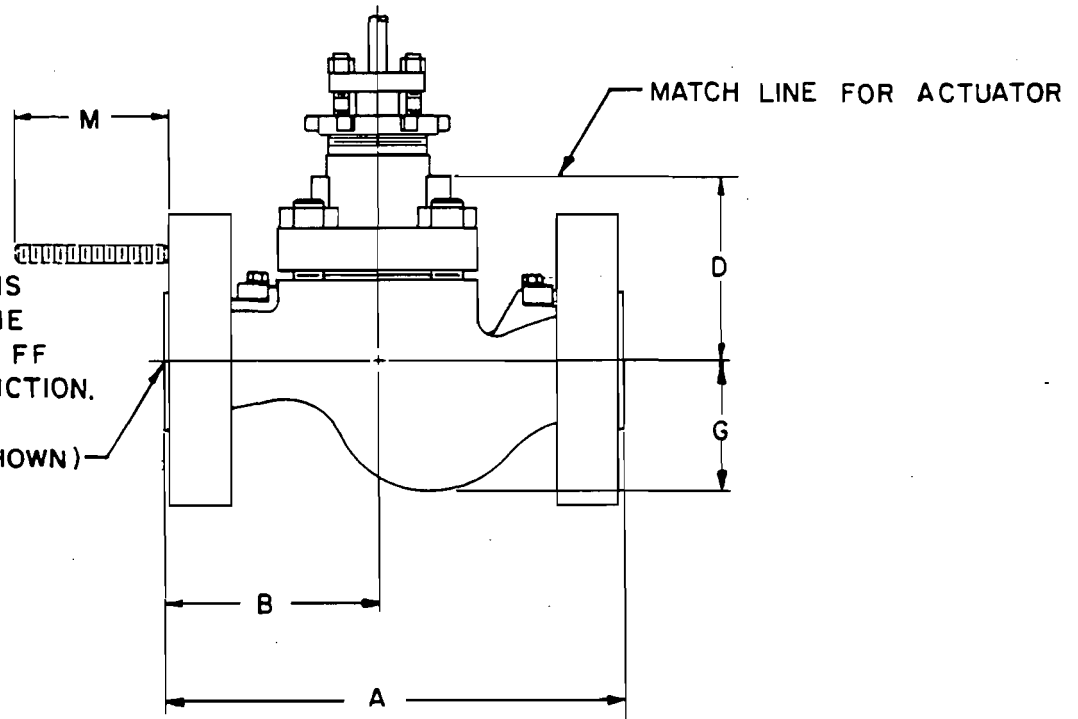
CODE 22508  
© Fisher Controls 1990

SCALE-NONE C MMS 12-3-90

DWG. NO.  
12B4633

REV.  
C

REVISIONS



NOTE: A & B DIMENSIONS  
REMAIN THE SAME  
FOR RF AND/OR FF  
FLANGE CONSTRUCTION.  
(RF FLANGE  
CONSTRUCTION SHOWN)

SEPARABLE FLANGES MATE PER ANSI

\* LINE FLANGE BOLTING NOT SUPPLIED WITH ASSEMBLY  
DIMENSIONS SUPPLIED ONLY FOR INFORMATION

SIZE	A	B	G	D		STEM CONN Ø	FLANGE BOLTING *								
							CL 150			CL 300			CL 600		
				STD BONNET	EXT BONNET		M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS
1/2	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.25	1/2	4	3.50	1/2	4
3/4	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1	8.50	3.94	2.12	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1 1/2	9.50	4.44	2.75	3.81	7.69	3/8	3.25	1/2	4	4.25	3/4	4	4.50	3/4	4
2	11.50	4.75	3.44	4.88	8.56	3/8	3.50	5/8	4	4.00	5/8	8	4.50	5/8	8
3	14.00	5.75	4.94	6.25	9.62	1/2	4.00	5/8	4	4.75	3/4	8	5.00	3/4	8
4	17.00	6.50	6.25	7.31	10.19	1/2	4.25	5/8	8	5.00	3/4	8	6.00	7/8	8

WARNING:  
BODY RATING MAY EXCEED FLANGE JOINT RATING

UNIT OF MEASURE: INCH  
ENVELOPE DIMENSIONS ± .25

© Fisher Controls 1982, 1990

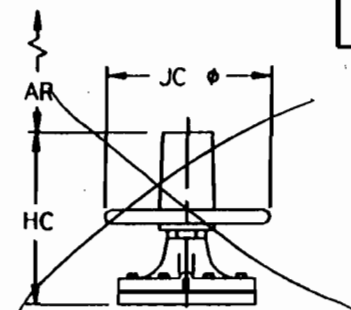
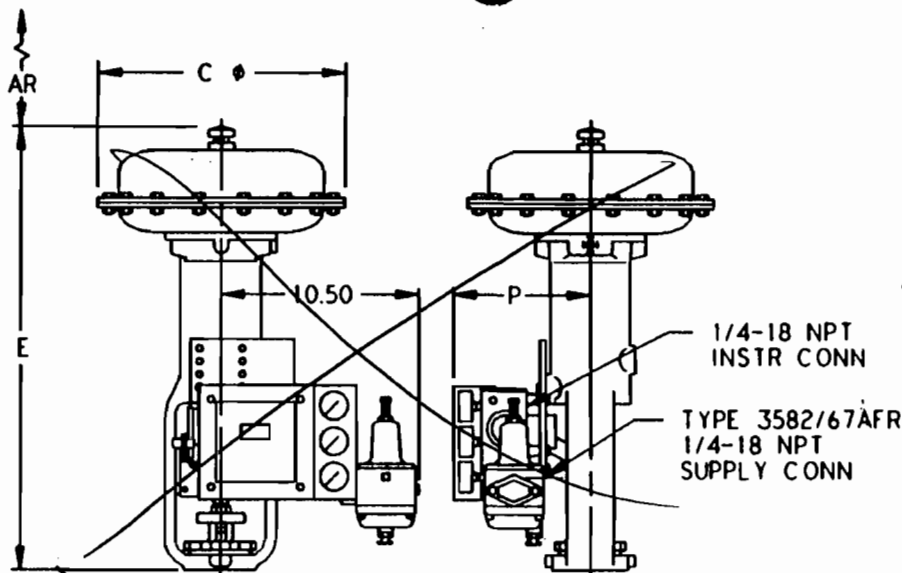
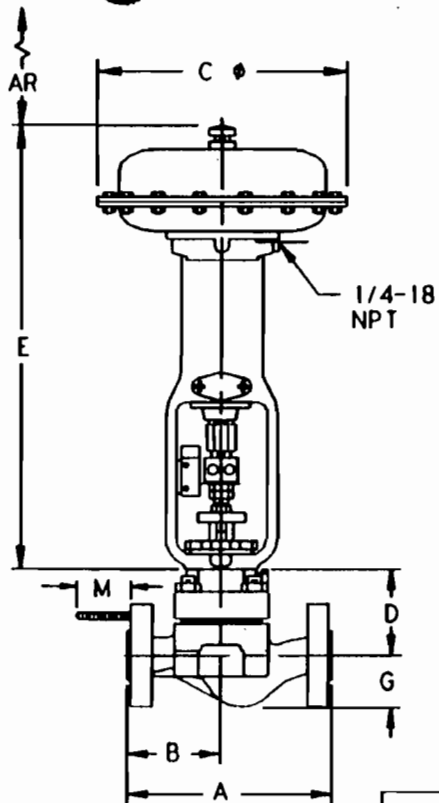
CUSTOMER GLITSCH PACKAGE PLANTS		P.O. NO. 19375		TAG NO. ICCF ACV-1007, 2007,3007	
SERIAL NO. 12637363,64,65		ORDER NO. 001 -A1002173A		INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY <i>DM</i>	

<p><b>Fisher Controls</b> Marshalltown, Iowa, USA</p>	VALVE BODY						TYPE DESIGN CE	IN
	SCALE NONE	F <i>DB</i> 8-3-89	DWN	PLK	G-15-82	DWG NO.	REV	
	CODE 22508	G <i>DB</i> 12-6-90	CHKD.	KAL	G-16-82	18A5965	G	
		REVISIONS	APVD.	DBS	G-17-82			



FEATURES PICTORIALLY TYPICAL - ORIENTATION MAY DIFFER

B8401



INCREASING PRESSURE TO DIAPHRAGM  
OPENS VALVE PLUG  
VALVE PLUG CLOSSES ON AIR FAILURE  
FLANGES PER ANSI  
AR = ACTUATOR REMOVAL CLEARANCE  
ENVELOPE DIMENSIONS ARE ± .25

WARNING: BODY RATING MAY EXCEED  
FLANGE JOINT RATING

SIZE	E	C Ø	P	HC	JC Ø	AR
30	18.81	11.38	7.06	7.12	6.75	5.00
34	22.56	13.12	7.25	8.69	8.75	5.00
40	23.38	13.12	7.31	8.69	8.75	6.88
45	30.25	16.00	7.75	9.31	8.75	6.88
46	30.25	18.62	7.75	9.31	8.75	6.88

NOTE: C/W 546, YOKE MTD

SIZE	A	B	G	D		STEM CONN Ø	FLANGE BOLTING								
				STD BONNET	EXT BONNET		CLASS 150			CLASS 300			CLASS 600		
							M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS
1/2	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.25	1/2	4	3.50	1/2	4
3/4	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1	8.50	3.94	2.12	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1 1/2	9.50	4.44	2.75	3.81	7.69	3/8	3.25	1/2	4	4.25	3/4	4	4.50	3/4	4
2	11.50	4.75	3.44	4.88	8.56	3/8	3.50	5/8	4	4.00	5/8	8	4.50	5/8	8
3	14.00	5.75	4.94	6.25	9.62	1/2	4.00	5/8	4	4.75	3/4	8	5.00	3/4	8
4	17.00	6.50	6.25	7.31	10.19	1/2	4.25	5/8	8	5.00	3/4	8	6.00	7/8	8

NOTE: A & B DIMENSIONS REMAIN THE SAME FOR RF OR FF CONSTRUCTION.

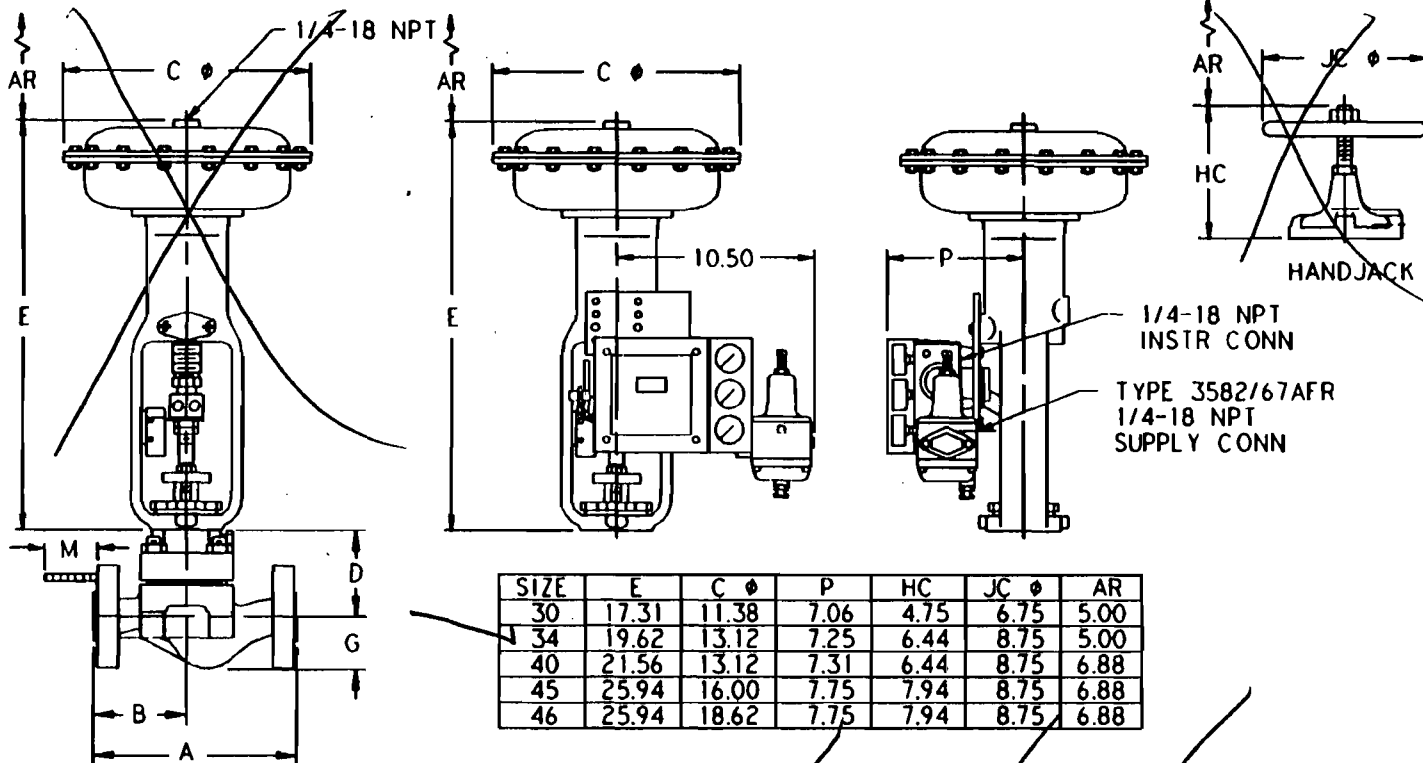
CUSTOMER GLITSCH PACKAGE PLANTS	P.O. NO. 19375	TAG NO. ICCF-ACV-102
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SERIAL NO. 12637366	ORDER NO. 001 -A1002173A	INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY AM
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<b>FISHER</b>	DWN. MMS 2-17-86	DIAPHRAGM ACTUATED CONTROL VALVE	TYPE 667 - CE IN
	CHKD. KAL 2-20-86		
	APVD. CH 2-20-86		
Fisher Controls Marshalltown, Iowa, USA	CODE 22508	SCALE-NONE F MMS 7-24-92	DWG. NO. 10B8401
© Fisher Controls 1986, 1992	REVISIONS		REV. F

FEATURES PICTORIALY TYPICAL - ORIENTATION MAY DIFFER

10B8400



INCREASING PRESSURE TO DIAPHRAGM CLOSSES VALVE PLUG  
 VALVE PLUG OPENS ON AIR FAILURE  
 FLANGES PER ANSI  
 AR = ACTUATOR REMOVAL CLEARANCE  
 ENVELOPE DIMENSIONS ARE ± .25

WARNING: BODY RATING MAY EXCEED FLANGE JOINT RATING

SIZE	E	C $\phi$	P	HC	JC $\phi$	AR
30	17.31	11.38	7.06	4.75	6.75	5.00
34	19.62	13.12	7.25	6.44	8.75	5.00
40	21.56	13.12	7.31	6.44	8.75	6.88
45	25.94	16.00	7.75	7.94	8.75	6.88
46	25.94	18.62	7.75	7.94	8.75	6.88

SIZE	A	B	G	D		STEM CONN $\phi$	FLANGE BOLTING								
							CLASS 150			CLASS 300			CLASS 600		
				STD BONNET	EXT BONNET		M	BOLT $\phi$	NO. OF BOLTS	M	BOLT $\phi$	NO. OF BOLTS	M	BOLT $\phi$	NO. OF BOLTS
1/2	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.25	1/2	4	3.50	1/2	4
3/4	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1	8.50	3.94	2.12	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1 1/2	9.50	4.44	2.75	3.81	7.69	3/8	3.25	1/2	4	4.25	3/4	4	4.50	3/4	4
2	11.50	4.75	3.44	4.88	8.56	3/8	3.50	5/8	4	4.00	5/8	8	4.50	5/8	8
3	14.00	5.75	4.94	6.25	9.62	1/2	4.00	5/8	4	4.75	3/4	8	5.00	3/4	8
4	17.00	6.50	6.25	7.31	10.19	1/2	4.25	5/8	8	5.00	3/4	8	6.00	7/8	8

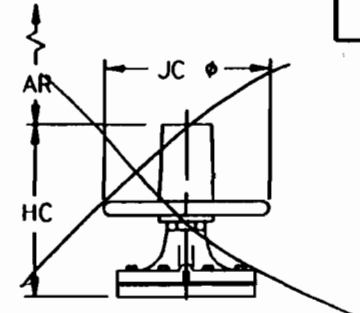
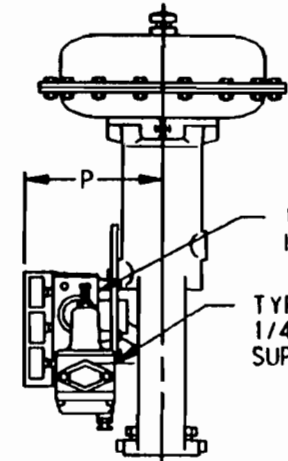
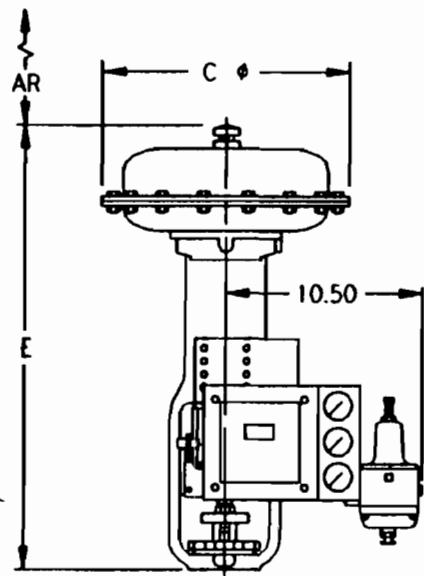
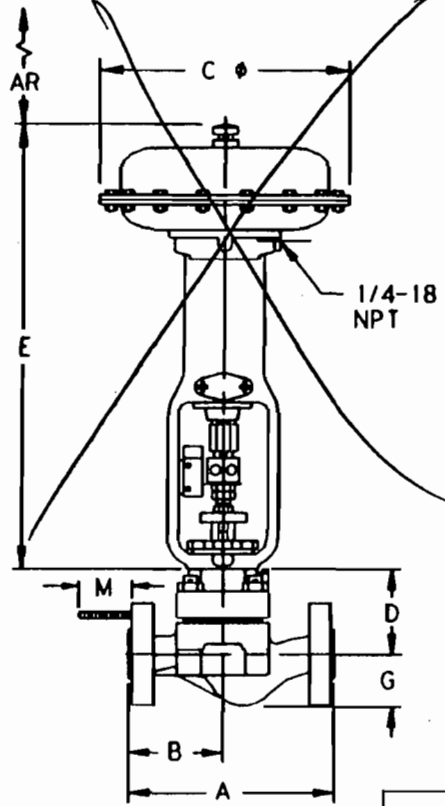
NOTE: A & B DIMENSIONS REMAIN THE SAME FOR RF OR FF CONSTRUCTION.

CUSTOMER GLITSCH PACKAGE PLANTS		P.O. NO. 19375		TAG NO. ICCF-ACV-105	
SERIAL NO. 12637367		ORDER NO. 001 -A1002173A		INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY <i>dm</i>	

<b>FISHER</b>	DWN.	MMS	2-17-86	DIAPHRAGM ACTUATED CONTROL VALVE				TYPE	657 - CE	IN	
	CHKD.	KAL	2-20-86					DWG. NO.	10B8400	REV.	F
	APVD.	CH	2-20-86					SCALE-NONE	F	MMS	7-24-92
Fisher Controls Marshalltown, Iowa, USA			CODE 22508	© Fisher Controls 1986, 1992							

FEATURES PICTORIALLY TYPICAL - ORIENTATION MAY DIFFER

10B8401



HANDJACK

INCREASING PRESSURE TO DIAPHRAGM  
OPENS VALVE PLUG  
VALVE PLUG CLOSES ON AIR FAILURE  
FLANGES PER ANSI  
AR = ACTUATOR REMOVAL CLEARANCE  
ENVELOPE DIMENSIONS ARE ± .25

1/4-18 NPT  
INSTR CONN  
TYPE 3582/67AFR  
1/4-18 NPT  
SUPPLY CONN

WARNING BODY RATING MAY EXCEED  
FLANGE JOINT RATING

SIZE	E	C	P	HC	JC	AR
30	18.81	11.38	7.06	7.12	6.75	5.00
34	22.56	13.12	7.25	8.69	8.75	5.00
40	23.38	13.12	7.31	8.69	8.75	6.88
45	30.25	16.00	7.75	9.31	8.75	6.88
46	30.25	18.62	7.75	9.31	8.75	6.88

SIZE	A	B	G	D		STEM CONN	FLANGE BOLTING								
				STD BONNET	EXT BONNET		CLASS 150			CLASS 300			CLASS 600		
							M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS	M	BOLT Ø	NO. OF BOLTS
1/2	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.25	1/2	4	3.50	1/2	4
3/4	8.50	3.94	2.06	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1	8.50	3.94	2.12	3.56	7.56	3/8	3.00	1/2	4	3.50	5/8	4	3.75	5/8	4
1 1/2	9.50	4.44	2.75	3.81	7.69	3/8	3.25	1/2	4	4.25	3/4	4	4.50	3/4	4
2	11.50	4.75	3.44	4.88	8.56	3/8	3.50	5/8	4	4.00	5/8	8	4.50	5/8	8
3	14.00	5.75	4.94	6.25	9.62	1/2	4.00	5/8	4	4.75	3/4	8	5.00	3/4	8
4	17.00	6.50	6.25	7.31	10.19	1/2	4.25	5/8	8	5.00	3/4	8	6.00	7/8	8

NOTE: A & B DIMENSIONS REMAIN THE SAME FOR RF OR FF CONSTRUCTION.

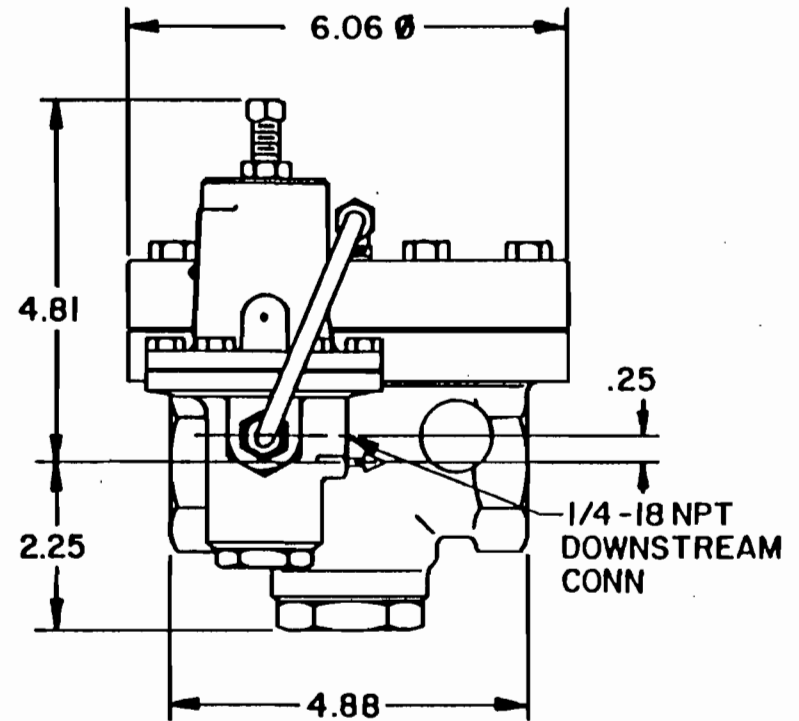
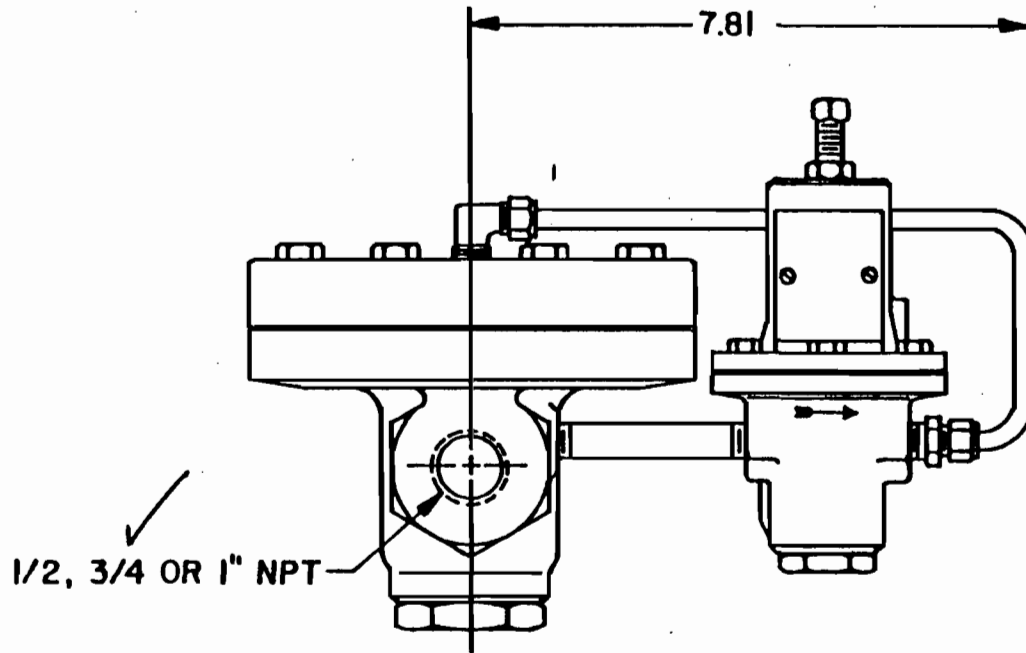
CUSTOMER GLITSCH PACKAGE PLANTS	P.O. NO. 19375	TAG NO. 1CCF-ACV-109
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SERIAL NO. 12637368	ORDER NO. 001 -A1002173A	INFORMATION CERTIFIED CORRECT DATE 4-6-93 BY <i>DM</i>
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<b>FISHER</b>	DWN. MMS 2-17-86	DIAPHRAGM ACTUATED CONTROL VALVE	TYPE 667 - CE	IN
	CHKD. KAL 2-20-86			
	APVD. CH 2-20-86			
Fisher Controls Marshalltown, Iowa, USA	CODE 22508	SCALE-NONE	F MMS 7-24-92	DWG. NO. 10B8401
© Fisher Controls 1986, 1992			REVISIONS	REV. F

FEATURES PICTORIALY TYPICAL—ORIENTATION MAY DIFFER

16A3176



IRON  
STEEL BODY

ENVELOPE DIMENSIONS ARE ± .25

C  
G  
M  
T

<b>CUSTOMER</b> GLITSCH PACKAGE PLANTS	<b>P.O. NO.</b> 19375	<b>TAG NO.</b> ICCF-PRV-060
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<b>SERIAL NO.</b> 12637567	<b>ORDER NO.</b> 001 -A1002173A	<b>INFORMATION CERTIFIED CORRECT</b> DATE 4-6-93 BY <i>JM</i>
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<b>FISHER®</b>	<b>DWN.</b> GEX 4-11-79	<b>PILOT OPERATED STEAM REGULATOR</b>				<b>TYPE</b> 92C-6392
	<b>CHKD.</b> STDL 4-12-79					
	<b>APVD.</b> PSM 4-12-79	<b>CODE</b> 22508	<b>SCALE</b> —NONE	<b>C</b> WATER 5-27-82	<b>D</b> WATER 6-22-82	<b>DWG NO.</b> 16A3176
<b>Fisher Controls</b>					<b>REV</b> D	

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375 C.O.1	001 -A1002173B	04/20/93	12659034

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0001 TAG	ITEM-QTY
	TYPE 3582I, TYPE 582 I/P MODULE, TYPE 3580	1
	SERIES MTG PARTS, TYPE 67AFR REGULATOR SIZE	
	1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1			
	R3580XRS012	KIT,REPLACEMNT RELAY		1	EA 145.00
		3580,3582 RELAY ASSY STD TEMP			
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583 SPARES			
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I SPARES			
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L RELAY SPARES			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375 C.O.1	001 -A1002173B	04/20/93	12659034

ITEM 0001 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A	VALVE POSITIONER			*COMP CONTINUED*	
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
B	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-161				
	3580X2-A27-B48-C168-D4-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375 C.O.1	001 -A1002173B	04/20/93	12659035

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0002 TAG	ITEM-QTY
	TYPE 3582I, TYPE 582 I/P MODULE, TYPE 3580	1
	SERIES MTG PARTS, TYPE 67AFR REGULATOR SIZE	
	1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1			
	R3580XRS012	KIT,REPLACEMNT RELAY		1	EA 145.00
		3580,3582 RELAY ASSY STD TEMP			
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583 SPARES			
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I SPARES			
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L RELAY SPARES			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375 C.O.1	001 -A1002173B	04/20/93	12659035

ITEM 0002 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A	VALVE POSITIONER				*COMP CONTINUED*
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG, VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET, TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	
	11B4040X012	GAUGE, PRES, 1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
B	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-158				
	3580X2-A1-B48-C168-D4-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT, REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE, 17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE, DRAIN	BRASS	1	
	19A7667X012	SEAT, VVE, DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG, VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PAGE 2 OF 2



CUSTOMER ORDER NUMBER 19375 REPRESENTATIVE PO CO 001 -A1002173A ORDER DATE 03/25/93 SERIAL NUMBER 12637566

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM 0001 TAG 1CLF-ACV-104 ITEM-QTY  
TYPE CE VALVE BODY ASSEMBLY SIZE 1 1/2, TYPE 1  
667 DIAPHRAGM ACTUATOR SIZE 30, TYPE 546  
ELEC-PNEUMATIC TRANSDUCER, TYPE 546 MTG  
PARTS, TYPE 67AFR REGULATOR SIZE 1/4, TYPE  
NAMEPLATE - ACCESSORY X45

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A	DESIGN CE VALVE BODY/BONNET ASSY FSCE-25/SST1/T2/*HT2 CEX2-A19-B5-C1-D11-E11-F5-G3-H16-J8-K5-L11-M5-N1 -9B1-9D1-9E6-9F1				
	1P3905X0172	PACKING,RING	GRAPH FMS 17D19	2	EA 14.50
	11B1155X012	BUSHING,COATED	S31600/CR CT	2	EA 205.00
	18A0810X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 67.00
	18A0887X012	GASKET, SPIRAL WOUND	N06600/17N3	1	EA 24.50
	18A0899X022	GASKET	GRAPH/SST,17F46	1	EA 9.50
	18A0908X012	PACKING,RING	GR 17D29,ZN	2	EA 49.00
	28A0848X012	SEAT RING	S31600,FMS20B20	1	EA 165.00
	28A2088X012	PLUG/STEM,M-FORM	S31603	1	EA 360.00
B	TYPE 667 DIAPHRAGM ACTUATOR SIZE 30 FS667-85 667X1-A1-B13-C9-D10-E4-F7-H1-J1-K1-9A31-9B1-9C16 R667X000302 KIT,REPAIR 1 EA 4.50 667 SPARES W/O DIAPH SZ 30				
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C	ELECTRO-PNEUMATIC TRANSDUCER FS546-64/ISR 546X1-A5-B1-C34-F1-G8-9D4-9E1-9F1 R546X000022 KIT,REPAIR 1 EA 22.50 546 & 546S SPARES				

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

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CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637566

ITEM 0001 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	ELECTRO-PNEUMATIC TRANSDUCER			*COMP CONTINUED*	
	1C782206992	O-RING	NITRILE-DS52-1	1	
	1D444806992	O-RING	NITRILE-DS52-1	1	
	1D687506992	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1P4242000A2	TUBING ASSY	BRASS / COPPER	1	
	R82X0000022	KIT,REPAIR,RELAY 82 RELAY SPARES		1	EA 47.00
	0L078343062	SCREEN	18-8 SST	1	
	1D134606992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	2	
	1P419514012	PLUG,VALVE	BRS C36000(B16)	1	
	1P4197X0032	DIAPHRAGM ASSY	AL/BR/NITRILE	1	
	1P420437022	SPRING	302	1	
	1P420606992	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	2	
	19A3199X012	RELAY ALIGNMENT TOOL	BRS C36000(B16)	1	
	26A5657X012	DIAPHRAGM,UPPER	VENDOR	1	
	1U3958000A2	BELLOWS ASSY	BRASS	1	EA 33.00
	1U8160X0012	ORIFICE ASSY	BRS/SYN SAPPHIR	1	EA 10.50
D	TYPE 546 MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG-55/F85				
	546X2-A1-B23-C37-D28-9A1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A33-9C3				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60
	11B8582X012	GAUGE,PRESS,2	ABS/BRS WET PTS	1	EA 15.00
E	TYPE 546 MOUNTING PARTS				
	*DE-RATING N/P				

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3

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CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637566

ITEM 0001 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
E		TYPE 546 MOUNTING PARTS			*COMP CONTINUED*
		ACCESSX45-A1			
		NO UNIT SPARE PARTS INDICATED FOR THIS COMPONENT			

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CUSTOMER ORDER NUMBER REPRESENTATIVE PO CO ORDER DATE SERIAL NUMBER  
19375 001 -A1002173A 03/25/93 12637363

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM 0002 TAG 1CCF ACV-1007 ITEM-QTY  
TYPE CE VALVE BODY ASSEMBLY SIZE 1 1/2, TYPE 1  
667 DIAPHRAGM ACTUATOR SIZE 30, TYPE 3582I,  
TYPE 582 I/P MODULE, TYPE 3580 SERIES MTG  
PARTS, TYPE 67AFR REGULATOR SIZE 1/4

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY FSCE-25/SST1 CEX2-A19-B5-C1-D11-E11-F1-G4-H16-J8-K1-L1-M1-N1 -9A1-9B1-9D1-9E6-9F1			
	RCEX0000022	KIT,REPAIR		1	EA 225.00
		CE 1-1/2" GASKETS & PACKING			
	12A9016X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0820X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0868X012	WIPER	FELT SAE F3	1	
	18A0872X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0882X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0899X022	GASKET	GRAPH/SST,17F46	1	
	18A0810X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 67.00
	28A0848X012	SEAT RING	S31600,FMS20B20	1	EA 165.00
	28A2088X012	PLUG/STEM,M-FORM	S31603	1	EA 360.00
B		TYPE 667 DIAPHRAGM ACTUATOR SIZE 30 FS667-31 667X1-A1-B13-C10-D10-E4-F7-H1-J1-K1-9A31-9B1-9C12			
	R667X000302	KIT,REPAIR		1	EA 4.50
		667 SPARES W/O DIAPH SZ 30			
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C		VALVE POSITIONER			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

BEST AVAILABLE COPY

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637363

ITEM 0002 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1 R3580XRS012 KIT,REPLACEMNT RELAY			1	EA 145.00
		3580,3582 RELAY ASSY STD TEMP			
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583 SPARES			
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I SPARES			
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L RELAY SPARES			
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637363

ITEM 0002 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER			*COMP CONTINUED*	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
D	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-158/F85				
	3580X2-A1-B72-C31-D11-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637364

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0003 TAG 1CCF ACV-2007	ITEM-QTY
	TYPE CE VALVE BODY ASSEMBLY SIZE 1 1/2, TYPE	1
	667 DIAPHRAGM ACTUATOR SIZE 30, TYPE 3582I,	
	TYPE 582 I/P MODULE, TYPE 3580 SERIES MTG	
	PARTS, TYPE 67AFR REGULATOR SIZE 1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY			
		FSCE-25/SST1			
		CEX2-A19-B5-C1-D11-E11-F1-G4-H16-J8-K1-L1-M1-N1			
		-9A1-9B1-9D1-9E6-9F1			
	RCEX0000022	KIT,REPAIR		1	EA 225.00
		CE 1-1/2" GASKETS & PACKING			
	12A9016X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0820X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0868X012	WIPER	FELT SAE F3	1	
	18A0872X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0882X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0899X022	GASKET	GRAPH/SST,17F46	1	
	18A0810X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 67.00
	28A0848X012	SEAT RING	S31600,FMS20B20	1	EA 165.00
	28A2088X012	PLUG/STEM,M-FORM	S31603	1	EA 360.00
B		TYPE 667 DIAPHRAGM ACTUATOR SIZE 30			
		FS667-31			
		667X1-A1-B13-C10-D10-E4-F7-H1-J1-K1-9A31-9B1-9C12			
	R667X000302	KIT,REPAIR		1	EA 4.50
		667 SPARES W/O DIAPH SZ 30			
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C		VALVE POSITIONER			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637364

ITEM 0003 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1			*COMP CONTINUED*	
	R3580XRS012	KIT,REPLACEMNT RELAY		1	EA 145.00
		3580,3582 RELAY ASSY STD TEMP			
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583 SPARES			
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I SPARES			
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L RELAY SPARES			
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3



CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637364

ITEM 0003 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER			*COMP CONTINUED*	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
D	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-158/F85				
	3580X2-A1-B72-C31-D11-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637365

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0004 TAG 1CCF ACV-3007	ITEM-QTY
	TYPE CE VALVE BODY ASSEMBLY SIZE 1 1/2, TYPE	1
	667 DIAPHRAGM ACTUATOR SIZE 30, TYPE 3582I,	
	TYPE 582 I/P MODULE, TYPE 3580 SERIES MTG	
	PARTS, TYPE 67AFR REGULATOR SIZE 1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY			
		FSCE-25/SST1			
		CEX2-A19-B5-C1-D11-E11-F1-G4-H16-J8-K1-L1-M1-N1			
		-9A1-9B1-9D1-9E6-9F1			
	RCEX0000022	KIT,REPAIR		1	EA 225.00
		CE 1-1/2" GASKETS & PACKING			
	12A9016X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0820X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0868X012	WIPER	FELT SAE F3	1	
	18A0872X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0882X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0899X022	GASKET	GRAPH/SST,17F46	1	
	18A0810X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 67.00
	28A0848X012	SEAT RING	S31600,FMS20B20	1	EA 165.00
	28A2088X012	PLUG/STEM,M-FORM	S31603	1	EA 360.00
B		TYPE 667 DIAPHRAGM ACTUATOR SIZE 30			
		FS667-31			
		667X1-A1-B13-C10-D10-E4-F7-H1-J1-K1-9A31-9B1-9C12			
	R667X000302	KIT,REPAIR		1	EA 4.50
		667 SPARES W/O DIAPH SZ 30			
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C		VALVE POSITIONER			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637365

ITEM 0004 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1 R3580XRS012 KIT,REPLACEMNT RELAY			1	EA 145.00
		3580,3582 RELAY ASSY	STD TEMP		
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583	SPARES		
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I	SPARES		
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L	RELAY SPARES		
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637365

ITEM 0004 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER			*COMP CONTINUED*	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
D	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-158/F85				
	3580X2-A1-B72-C31-D11-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637366

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0005 TAG ICCF-ACV-102	ITEM-QTY
	TYPE CE VALVE BODY ASSEMBLY SIZE 1, TYPE 667	1
	DIAPHRAGM ACTUATOR SIZE 30, TYPE 546	
	ELEC-PNEUMATIC TRANSDUCER, TYPE 546 MTG	
	PARTS, TYPE 67AFR REGULATOR SIZE 1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY			
		FSCE-17/SST1			
		CEX1-A59-B25-C5-D21-E91-F1-G4-H16-J8-K1-L1-M1-N1			
		-9A1-9B1-9D1-9E9-9F1			
	RCEX0000012	KIT,REPAIR		1	EA 225.00
		CE 1/2"-1" GASKETS & PACKING			
	12A9016X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0820X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0868X012	WIPER	FELT SAE F3	1	
	18A0872X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0881X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0898X022	GASKET	GRAPH/SST,17F46	1	
	18A0808X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 52.00
	28A0845X012	SEAT RING	S31600,FMS20B20	1	EA 130.00
	28A2073X012	PLUG/STEM,M-FORM	S31603	1	EA 315.00
B		TYPE 667 DIAPHRAGM ACTUATOR SIZE 30			
		FS667-31			
		667X1-A1-B13-C10-D10-E4-F7-H1-J1-K1-9A31-9B1-9C12			
	R667X000302	KIT,REPAIR		1	EA 4.50
		667 SPARES W/O DIAPH SZ 30			
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C		ELECTRO-PNEUMATIC TRANSDUCER			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637366

ITEM 0005 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	ELECTRO-PNEUMATIC TRANSDUCER			*COMP CONTINUED*	
	FS546-64/ISR				
	546X1-A5-B1-C34-F1-G8-9D4-9E1-9F1				
	R546X000022	KIT,REPAIR		1	EA 22.50
		546 & 546S SPARES			
	1C782206992	O-RING	NITRILE-DS52-1	1	
	1D444806992	O-RING	NITRILE-DS52-1	1	
	1D687506992	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1P4242000A2	TUBING ASSY	BRASS / COPPER	1	
	R82X000022	KIT,REPAIR,RELAY		1	EA 47.00
		82 RELAY SPARES			
	0L078343062	SCREEN	18-8 SST	1	
	1D134606992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	2	
	1P419514012	PLUG,VALVE	BRS C36000(B16)	1	
	1P4197X0032	DIAPHRAGM ASSY	AL/BR/NITRILE	1	
	1P420437022	SPRING	302	1	
	1P420606992	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	2	
	19A3199X012	RELAY ALIGNMENT TOOL	BRS C36000(B16)	1	
	26A5657X012	DIAPHRAGM,UPPER	VENDOR	1	
	1U3958000A2	BELLOWS ASSY	BRASS	1	EA 33.00
	1U8160X0012	ORIFICE ASSY	BRS/SYN SAPPHIR	1	EA 10.50
D	TYPE 546 MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG-55/F85				
	546X2-A1-B23-C37-D28-9A1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A33-9C3				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60
	11B8582X012	GAUGE,PRESS,2	ABS/BRS WET PTS	1	EA 15.00

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PAGE 2 OF 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637367

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0006 TAG 1CCF-ACV-105	ITEM-QTY
	TYPE CE VALVE BODY ASSEMBLY SIZE 2, TYPE 657	1
	DIAPHRAGM ACTUATOR SIZE 34, TYPE 3582I, TYPE	
	582 I/P MODULE, TYPE 3580 SERIES MTG PARTS,	
	TYPE 67AFR REGULATOR SIZE 1/4	

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY			
		FSCE-30/SST1			
		CEX3-A19-B5-C1-D11-E21-F1-G4-H16-J8-K1-L1-M1-N1			
		-9A1-9B1-9D1-9E6-9F1			
	RCEX0000032	KIT,REPAIR		1	EA 260.00
		CE 2" GASKETS & PACKING PARTS			
	12A8995X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0822X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0869X012	WIPER	FELT SAE F3	1	
	18A0873X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0883X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0900X022	GASKET	GRAPH/SST,17F46	1	
	18A0812X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 83.00
	28A0851X012	SEAT RING	S31600,FMS20B20	1	EA 200.00
	28A0892X012	PLUG/STEM,EQ%	S31603	1	EA 520.00
B		TYPE 657 DIAPHRAGM ACTUATOR			
		FS657-503			
		657X3-A15-B1-C10-D40-E12-F7-G1-H1-9A65-9B1-9C6			
	2E670002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 72.00
C		VALVE POSITIONER			
		I/P CONVERTER			
		FS3582I-3			
		3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80			
		582IX1-A17-B2-F1-G1-H2-J1			
	R3580XRS012	KIT,REPLACEMNT RELAY		1	EA 145.00
		3580,3582 RELAY ASSY STD TEMP			
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637367

ITEM 0006 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER			*COMP CONTINUED*	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR		1	EA 25.00
		3580,3581,3582 & 3583 SPARES			
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR		1	EA 11.50
		582I SPARES			
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY		1	EA 22.50
		83L RELAY SPARES			
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00

D MOUNTING PARTS  
1/4 PRESSURE REGULATOR

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3



CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637367

ITEM 0006 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
D	MOUNTING PARTS				*COMP CONTINUED*
	FSMTG3582-119/F85				
	3580X2-A1-B72-C14-D11-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637567

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM	0008 TAG 1CCF-PRV-060	ITEM-QTY
	TYPE 92C REGULATOR SIZE 1	1

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		TYPE 92C STEAM REGULATOR BODY			
		FS92C-12/*300RF			
		92CX1-A*-B1-C2			
	R92CX000012	KIT,REPAIR		1	EA 120.00
		92C MAIN VALVE 3/4 ORIFICE			
	1E398146172	PLUG,VALVE	S41600 FGS 2B8	1	
	1E398837022	SPRING,VALVE PLUG	302	1	
	1E399236012	DIAPHRAGM	302/SPG T	2	
	16A1526X012	GASKET,TO 302F/150C	COMP/17A5	3	
	16A1528X012	ORIFICE	S41600 FGS 2B8	1	
	1A440135012	BUSHING	S17400 H925	1	EA 155.00

CUSTOMER ORDER NUMBER 19375 REPRESENTATIVE PO CO 001 -A1002173A ORDER DATE 03/25/93 SERIAL NUMBER 12637368

SOLD TO  
GLITSCH PACKAGE PLANTS  
1055 PARSIPPANY BLVD  
SUITE 503  
PARSIPPANY, NJ

SHIP TO  
MCABEE CONSTRUCTION INCORP.  
5724 21ST STREET  
TUSCALOOSA, AL

35403

07054

ITEM 0007 TAG 1CCF-ACV-109 ITEM-QTY 1  
TYPE CE VALVE BODY ASSEMBLY SIZE 1, TYPE 667  
DIAPHRAGM ACTUATOR SIZE 30, TYPE 3582I, TYPE  
582 I/P MODULE, TYPE 3580 SERIES MTG PARTS,  
TYPE 67AFR REGULATOR SIZE 1/4

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
A		DESIGN CE VALVE BODY/BONNET ASSY FSCE-17/SST1 CEX1-A59-B25-C5-D21-E91-F1-G4-H16-J8-K1-L1-M1-N1 -9A1-9B1-9D1-9E9-9F1 RCEX0000012	KIT,REPAIR	1	EA 225.00
		CE 1/2"-1" GASKETS & PACKING			
	12A9016X012	PACKING,SET	PTFE,FMS 17D7	2	
	18A0820X012	BUSHING,LINER	S31600/FMS 30B5	2	
	18A0868X012	WIPER	FELT SAE F3	1	
	18A0872X012	PACKING SPACER	S31600,FMS20B20	2	
	18A0881X012	GASKET,SEAT RING	PTFE/GL,17F16	1	
	18A0898X022	GASKET	GRAPH/SST,17F46	1	
	18A0808X012	SEAT RING RETAINER	CF8M FMS 20B58	1	EA 52.00
	28A0845X012	SEAT RING	S31600,FMS20B20	1	EA 130.00
	28A2073X012	PLUG/STEM,M-FORM	S31603	1	EA 315.00
B		TYPE 667 DIAPHRAGM ACTUATOR SIZE 30 FS667-31 667X1-A1-B13-C10-D10-E4-F7-H1-J1-K1-9A31-9B1-9C12 R667X000302	KIT,REPAIR	1	EA 4.50
		667 SPARES W/O DIAPH SZ 30			
	1C415706992	O-RING	NITRILE-DS52-1	1	
	1E591406992	O-RING	NITRILE-DS52-1	2	
	1E801204022	GASKET,TO 302F/150C	COMP/17A5	1	
	1E791214012	BUSHING,SEAL	BRS C36000(B16)	1	EA 45.00
	2E800002202	DIAPHRAGM	NBR/NYL 17E44	1	EA 49.00
C		VALVE POSITIONER			

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 2

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637368

ITEM 0007 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER I/P CONVERTER FS3582I-3 3582X1-A3-B4-E21-F7-G3-H5-J1-K1-N1-9A15-9B80 582IX1-A17-B2-F1-G1-H2-J1 R3580XRS012	KIT,REPLACEMNT RELAY 3580,3582 RELAY ASSY STD TEMP		1	EA 145.00
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1U901238982	SCREW,RELAY MTG	18-8 SST	2	
	17A6891X012	O-RING	NITRILE	1	
	32B0255X0A2	RELAY ASSY,83L		1	
	R3580X00022	KIT,REPAIR 3580,3581,3582 & 3583 SPARES		1	EA 25.00
	1C853806992	O-RING	NITRILE-DS52-2	1	
	1D134606992	O-RING	NITRILE	1	
	1D2899X0032	O-RING	NITRILE-DS52-4	1	
	1F463606992	O-RING	NITRILE-DS52-1	1	
	1H291906992	O-RING	NITRILE-DS52-2	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	1V606204132	GASKET,TYPE 3580	CORK FMS 17J2	1	
	10A0871X012	O-RING	NITRILE	2	
	20A8092X012	GASKET,COVER	NEOPRENE-BLACK	1	
	R582X000012	KIT,REPAIR 582I SPARES		1	EA 11.50
	1C8538X0022	O-RING	NITRILE-DS52-1	2	
	1E591406992	O-RING	NITRILE-DS52-1	1	
	1H8762X0012	O-RING	NITRILE-DS52-1	1	
	1P420706992	O-RING	NITRILE-DS52-1	1	
	1U907804132	GASKET,CASE	CORK FMS 17J2	1	
	11B5996X012	FILTER	SST	1	
	R83LX000012	KIT,REPAIR,RELAY 83L RELAY SPARES		1	EA 22.50
	1D134606992	O-RING	NITRILE	1	
	1D134706992	O-RING	NITRILE	1	
	1D687506992	O-RING	NITRILE-DS52-1	3	
	1P420437022	SPRING	302	1	
	1U901635032	PLUG,VALVE	S30300 COND A	1	
	1U9018000A2	DIAPHRAGM ASSY		1	
	1V557802032	DIAPHRAGM	NBR/NYL 17E37	1	
	1V557902032	GASKET,TYPE 83L	NBR/NYL 17E37	1	
	17A6891X012	O-RING	NITRILE	1	

LIST PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINUED ON PAGE 3

CUSTOMER ORDER NUMBER	REPRESENTATIVE PO CO	ORDER DATE	SERIAL NUMBER
19375	001 -A1002173A	03/25/93	12637368

ITEM 0007 \*ITEM CONTINUED\*

COMP	PART NUMBER	PART NAME	MATERIAL	QUANTITY	LIST PR/EA
C	VALVE POSITIONER			*COMP CONTINUED*	
	11B4040X012	GAUGE,PRES,1.5	ABS/BRS WET PTS	2	EA 15.00
	12A7360X012	BELLOWS ASSY	BRS C36000(B16)	1	EA 62.00
	15A9609X012	SHAFT ASSY	SST/STEEL	1	EA 33.00
D	MOUNTING PARTS				
	1/4 PRESSURE REGULATOR				
	FSMTG3582-158/F85				
	3580X2-A1-B72-C31-D11-E9-9B1				
	67X6-A3-B1-C1-D1-E3-F2-G1-9A37-9C1				
	R67AFRX0012	KIT,REPAIR	NITRILE/BRASS	1	EA 20.50
		67AFR SPARES, CELLULOSE FILTER			
	1C127337022	SPRING	302	1	
	1C128003012	GASKET	NEOPRENE,17G1	1	
	1F257706992	FILTER ELEMENT RIBON	PURCHASED PART	1	
	1K418918992	VALVE,DRAIN	BRASS	1	
	19A7667X012	SEAT,VVE,DIAPH ASSY	BRASS/FMS 17E39	1	
	20B9389X012	PLUG,VALVE	C36000(B16)NITR	1	
	1E591406992	O-RING	NITRILE-DS52-1	1	EA .60

Fisher Controls

Instruction Manual

**Type 92C Steam Regulator****FISHER®**

October 1982

Form 5135

**Introduction****Scope of Manual**

This instruction manual provides installation, maintenance, and parts ordering information for the Type 92C steam pressure-reducing regulator and the Type 6392 pilot. Both the pilot-operated and the pressure-loaded constructions are covered. The pressure-loading device and accessories used with the Type 92C regulator are covered in other manuals.

**Description**

The Type 92C steam regulator is a cast iron or steel pressure-reducing regulator for steam or hot air service. This regulator is available with a Type 6392 pilot for use as a pilot-operated regulator (figure 1) or without a pilot for use as a pressure-loaded regulator. The pilot-operated version uses inlet pressure as the operating medium; no separate air supply is required. The pressure-loaded version is used where remote adjustment of the regulator pressure setting is required; a 67 or 1301 Series regulator or 670 Series panel-mounted regulator may be used as the loading regulator.

**Specifications**

Specifications for the Type 92C regulator are listed in table 1. Additional specifications for an individual regulator are found on the regulator body and pilot nameplates (figure 2).

**Installation****WARNING**

**Personal injury, equipment damage, or leakage due to escaping steam or bursting of pressure-containing parts may result if**

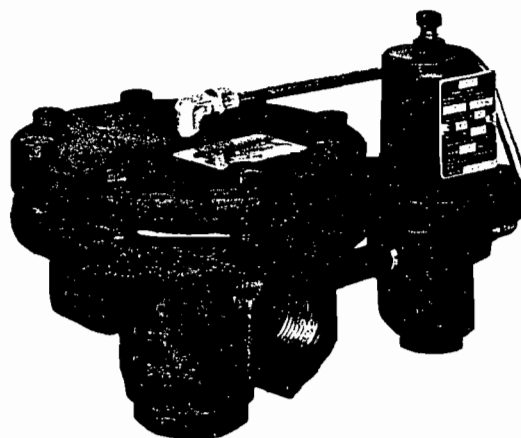


Figure 1. Type 92C Pilot-Operated Regulator

this regulator is overpressured or is installed where service conditions could exceed the limits given in table 1 and on the appropriate nameplate, or where conditions exceed any ratings of the downstream piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices to prevent service conditions from exceeding those limits. Type 92C regulators and their installations should be checked for compliance with all applicable codes such as the ANSI B31.1-1977 Power Piping standard and the ASME Boiler and Pressure Vessel code.

Use qualified personnel when installing, operating, and maintaining a Type 92C regulator. Make sure that there is no damage to or foreign material in the regulator and that all tubing and piping are clean and unobstructed. Install the regulator so that flow direction matches the arrow marked on the regulator body. Some typical Type 92C regulator installations are shown in figures 4 and 5.

Table 1. Specifications

<p><b>BODY SIZES AND END CONNECTION STYLE</b></p> <p><b>MAXIMUM ALLOWABLE INLET AND PILOT SUPPLY PRESSURES*</b></p> <p><b>REGULATOR PRESSURE DROPS*</b></p> <p><b>OUTLET CONTROL PRESSURE RANGE</b></p> <p><b>MAXIMUM OUTLET PRESSURES*</b></p> <p><b>LOADING PRESSURE FOR PRESSURE-LOADED REGULATOR*</b></p>	<p>■ 1/2, ■ 3/4, or ■ 1 in. NPT screwed</p> <p>Cast Iron Construction: 250 psig (17.2 bar) Steel Construction: 300 psig (20.7 bar)</p> <p>Minimum: 15 psi (1.0 bar) Maximum Operating: 150 psi (10.3 bar) for outlet pressure settings equal to or below 50 psig (3.4 bar); 200 psi (13.8 bar) for outlet pressure settings above 50 psig (3.4 bar) Maximum Emergency Cast Iron Construction: 250 psi (17.2 bar) Steel Construction: 300 psi (20.7 bar)</p> <p>■ 5 to 70 psig (0.3 to 4.8 bar) with green pilot control spring or ■ 20 to 150 psig (1.4 to 10.3 bar) with red pilot control spring</p> <p>Maximum Operating Outlet Pressure: 150 psig (10.3 bar) Maximum Emergency Outlet (Casing) Pressure Cast Iron Construction: 250 psig (17.2 bar) Steel Construction: 300 psig (20.7 bar)</p> <p>See figure 3 to determine loading pressure. Maximum allowable loading pressure is 250 psig (17.2 bar) for cast iron construction and 300 psig for steel construction; the</p>	<p>maximum allowable diaphragm differential pressure of 150 psi (10.3 bar) for cast iron and steel constructions must not be exceeded</p> <p>Cast Iron Construction: 406 °F (208 °C) Steel Construction: 500 °F (260 °C)</p> <p>Outlet pressure registers under the main valve diaphragm through a pitot tube in the main valve, or (for pilot-operated regulators) under the pilot diaphragm through a downstream control line</p> <p>1/4 in. NPT female in pilot body (downstream control line not required for pressure-loaded regulator)</p> <p>1/4 in. NPT female in main valve diaphragm flange (this connection is factory-piped to the pilot on pilot-operated regulator)</p> <p>3/32 in. (2.4 mm) drilled hole</p>																																		
	<p><b>MAXIMUM MATERIAL TEMPERATURE CAPABILITIES*</b></p> <p><b>PRESSURE REGISTRATION</b></p> <p><b>DOWNSTREAM CONTROL LINE CONNECTION</b></p> <p><b>LOADING PRESSURE CONNECTION</b></p> <p><b>PILOT SPRING CASE VENT</b></p> <p><b>APPROXIMATE WEIGHT</b></p>	<p>Cast Iron Construction: 406 °F (208 °C) Steel Construction: 500 °F (260 °C)</p> <p>Outlet pressure registers under the main valve diaphragm through a pitot tube in the main valve, or (for pilot-operated regulators) under the pilot diaphragm through a downstream control line</p> <p>1/4 in. NPT female in pilot body (downstream control line not required for pressure-loaded regulator)</p> <p>1/4 in. NPT female in main valve diaphragm flange (this connection is factory-piped to the pilot on pilot-operated regulator)</p> <p>3/32 in. (2.4 mm) drilled hole</p>																																		
		<table border="1"> <thead> <tr> <th rowspan="3">SIZE, IN.</th> <th colspan="4">WITH PILOT</th> <th colspan="4">WITHOUT PILOT</th> </tr> <tr> <th colspan="2">Cast Iron</th> <th colspan="2">Steel</th> <th colspan="2">Cast Iron</th> <th colspan="2">Steel</th> </tr> <tr> <th>Lb</th> <th>Kg</th> <th>Lb</th> <th>Kg</th> <th>Lb</th> <th>Kg</th> <th>Lb</th> <th>Kg</th> </tr> </thead> <tbody> <tr> <td>1/2, 3/4 &amp; 1</td> <td>20</td> <td>9.1</td> <td>20</td> <td>9.1</td> <td>16</td> <td>7.3</td> <td>16</td> <td>7.3</td> </tr> </tbody> </table>	SIZE, IN.	WITH PILOT				WITHOUT PILOT				Cast Iron		Steel		Cast Iron		Steel		Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	1/2, 3/4 & 1	20	9.1	20	9.1	16	7.3	16	7.3
SIZE, IN.	WITH PILOT				WITHOUT PILOT																															
	Cast Iron			Steel		Cast Iron		Steel																												
	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg																												
1/2, 3/4 & 1	20	9.1	20	9.1	16	7.3	16	7.3																												
		<p><b>ADDITIONAL SPECIFICATIONS</b></p>	<p>For construction materials, see the parts list section</p>																																	

\*Pressure/temperature limits in this manual and any applicable code limitations must not be exceeded.

The Type 92C regulator may be installed in any orientation. However, the regulator should not be installed in a tall vertical pipeline where condensate could collect and create a pressure head affecting regulator performance.

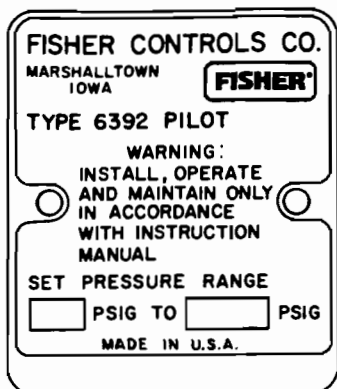
Apply steam-compatible pipe compound to the male pipeline threads. Then, using acceptable piping procedures, install the regulator into the pipeline.

If continuous operation of the system is required during inspection and maintenance, install a three-valve bypass

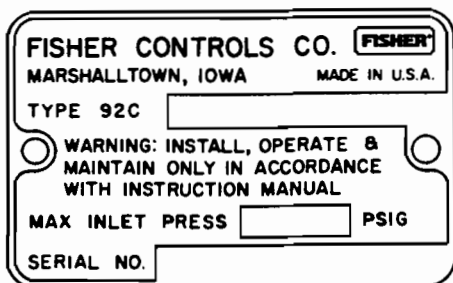
around the regulator. If the flowing medium contains solids, install a proper size strainer upstream of the regulator.

### Pilot-Operated Regulator

The Type 6392 pilot has three 1/4-inch NPT connections located in the pilot body. For proper operation of a pilot-operated regulator, the pilot supply and the regulator loading connections should be installed parallel to the



TYPE 6392 PILOT NAMEPLATE



TYPE 92C REGULATOR NAMEPLATE

Figure 2. Type 92C Regulator Nameplates

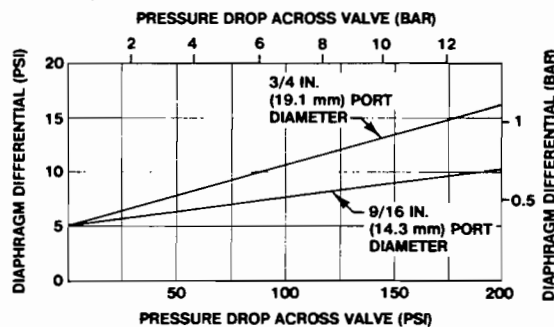
flow direction arrow marked on the pilot body as shown in figure 10, and the downstream control line should be installed in the pilot body connection as shown in figures 4 and 10. If a pilot-operated regulator is ordered, the pilot supply and the regulator loading connections will be made at the factory.

**Note**

Since a clogged vent may cause improper regulator functioning, install and maintain the Type 92C regulator so that the Type 6392 pilot spring case vent remains clear and unobstructed.

To install a pilot-operated regulator:

1. Connect a downstream control line of at least 1/4-inch (6.4 mm) diameter pipe bushed down to the 1/4-inch NPT control line connection in the pilot body.
2. For both body-sized and swaged pipelines, locate the pipeline control line connection in a section of straight pipe at least 10 pipe diameters away from the regulator or swage.
3. Do not locate the pipeline control line connection in an elbow, swage, or other area where turbulence or abnormal velocities may occur.



NOTE: TO DETERMINE REQUIRED LOADING PRESSURE, ADD THE DIAPHRAGM DIFFERENTIAL PRESSURE TO THE DESIRED OUTLET PRESSURE SETTING

Figure 3. Diaphragm Differential Pressure for Pressure-Loaded Regulator

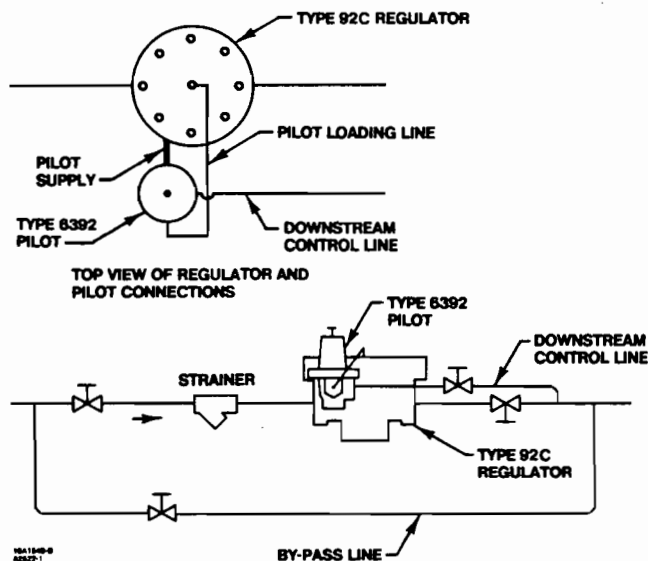


Figure 4. Typical Pilot-Operated Type 92C Regulator Installation

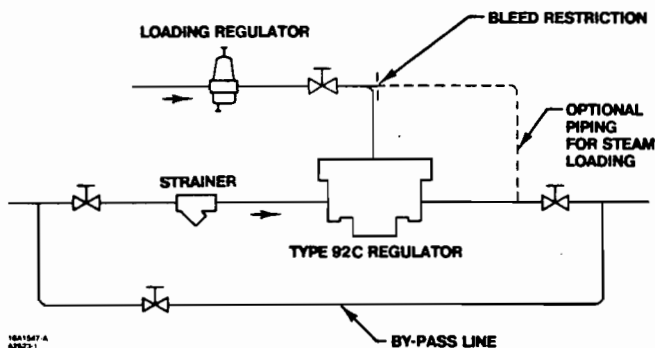


Figure 5. Typical Pressure-Loaded Type 92C Regulator Installation



4. If the pilot is mounted with the control line in a position other than horizontal, make sure the control line is sloped away from the pilot so that condensate can drain into the pipeline.

5. Install a shutoff valve (not a needle valve) in the control line to completely isolate the pilot during maintenance.

6. Install a pressure gauge in the control line or near the regulator to aid in setting the outlet pressure.

Each pilot-operated regulator is factory-set for the pressure setting specified on the order. If no setting is specified, the unit is factory-set at 30 psig (2.1 bar). In all cases, check the spring setting to make sure it is correct for the application.

## Pressure-Loaded Regulators

To install a pressure-loaded regulator:

1. Install a shutoff valve in the pressure-loading piping or tubing.

2. Connect the piping or tubing to the 1/4-inch NPT connection in the diaphragm flange (key 2, figure 8).

If the loading regulator used with the pressure-loaded regulator does not provide internal relief, an atmospheric bleed (e.g., No. 60 drill size) is required if the loading supply is air, or a downstream bleed line is required if the loading supply is steam. This installation is shown in figure 5.

The pressure setting of a pressure-loaded regulator is adjusted and determined by the pressure-loading device. In all cases, check the pressure setting to make sure it is correct for the application.

## Startup

The maximum inlet pressure for a specific construction is stamped on the main valve nameplate. Use pressure gauges to monitor upstream and downstream pressures during startup.

To put the regulator into operation:

1. Open the control line shutoff valve.
2. For a pilot-operated regulator, open the downstream block valve.

For a pressure-loaded regulator, open the shutoff valve in the pressure-loading piping or tubing.

3. Slowly open the upstream block valve.

4. If a bypass line is used, slowly close the bypass line block valve.

5. To adjust the downstream pressure, follow the appropriate procedure:

a. For a pilot-operated regulator, loosen the jam nut (key 15, figure 9). Turn the adjusting screw (key 16, figure 9) into the spring case to increase the downstream pressure. Turn the adjusting screw out of the spring case to decrease the downstream pressure. When the required downstream pressure is maintained for several minutes, tighten the jam nut to lock the adjusting screw in position.

b. For a pressure-loaded regulator, refer to the instruction manual of the pressure-loading device for downstream pressure adjustment procedures.

## Shutdown

To take the regulator out of operation:

1. If a bypass line is used, slowly open the bypass line block valve while monitoring the downstream pressure.
2. Close the upstream block valve.
3. For a pilot-operated regulator, close the downstream block valve.

For a pressure-loaded regulator, close the shutoff valve in the pressure-loading piping or tubing.

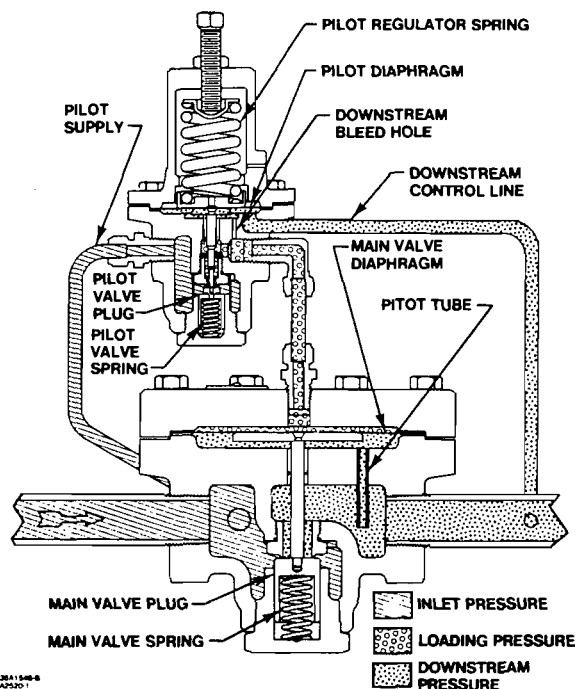
4. Close the control line shutoff valve.
5. Vent the regulator, the control line, and the pilot supply line to release any trapped pressure.

## Principle of Operation

### Pilot-Operated Regulator

Refer to the schematic in figure 6. Pilot supply pressure is piped from the inlet side of the main valve to the pilot inlet connection. Downstream pressure registers under the main valve diaphragm through the pitot tube and under the pilot diaphragm through the downstream control line.

When downstream pressure decreases to a value below the setting of the pilot regulator spring, the pilot spring forces the pilot valve plug open, increasing the loading



Note:  
Pilot is shown here above the main valve body for illustration purposes only. See figures 1 and 10 for actual pilot position and appearance of pilot-supply line and loading-pressure tubing.

Figure 6. Operation of Pilot-Operated Type 92C Regulator

pressure on the top of the main valve diaphragm. The increased loading pressure on top of the main valve diaphragm and decreased downstream pressure under the main valve diaphragm force the main valve diaphragm and stem downward. This opens the main valve plug, and increases flow to the downstream system, thus restoring downstream pressure to the setting of the pilot regulator spring.

When downstream pressure increases it registers under the pilot diaphragm and overcomes the force of the pilot spring. This allows the pilot valve spring to close the pilot valve plug and causes excess loading pressure to bleed to the downstream system through the pilot bleed hole. At the same time, increased downstream pressure registers under the main valve diaphragm. The decreased loading pressure on top of the main valve diaphragm and increased downstream pressure under the main valve diaphragm force the main valve diaphragm upward. This allows the main valve plug spring to close the main valve plug, reducing flow to the downstream system.

### Pressure-Loaded Regulator

Refer to the schematic in figure 7. With a pressure-loaded regulator, a remote, adjustable loading regulator provides loading pressure to the top of the main valve

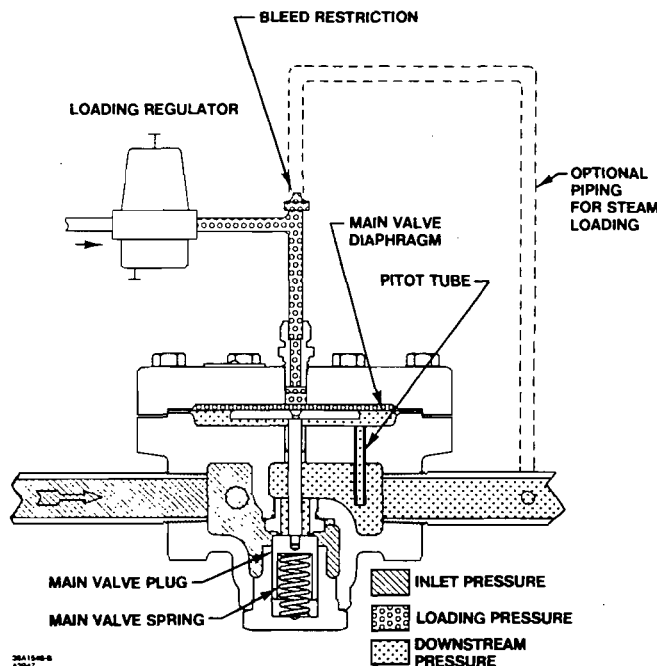


Figure 7. Operation of Pressure-Loaded Type 92C Regulator

diaphragm. Downstream pressure registers under the main valve diaphragm through the pitot tube.

When downstream pressure decreases, it registers under the diaphragm and allows the stem and plug to move downward, thereby opening the valve to increase downstream pressure.

When downstream pressure increases, it registers under the diaphragm and forces the stem and plug to move upward. The upward force of the spring causes the valve to close, which decreases flow to the downstream system thus decreasing downstream pressure. In hot air service, supply air above the diaphragm becomes compressed and is vented to the atmosphere. If a steam supply is used, the steam is vented downstream.

### Maintenance

Regulator parts are subject to normal wear and must be inspected periodically and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions and upon applicable Federal, state, and local codes and regulations.

**WARNING**

Avoid personal injury or property damage from sudden release of pressure or uncontrolled steam or other process fluid. Before starting disassembly:

- Isolate the regulator from the process,
- Release process pressure, and
- Vent the pilot supply and main valve loading pressures.

This section contains separate procedures for regulator and pilot maintenance.

**Type 92C Regulator**

Perform these procedures if replacing the diaphragm, the stem assembly, the valve plug, or the seat ring. Refer to the correct section for the required instructions. Key numbers refer to figure 8 unless otherwise indicated.

The regulator may remain in the pipeline during maintenance procedures unless the valve body is to be replaced or removed for repairs. For pilot-operated regulators, the pilot may remain on the pipe nipple (key 23, figure 10) unless the pilot body (key 1, figure 9) is to be removed or the entire pilot replaced as a unit.

**Replacing Diaphragm and Stem Assembly**

1. For the pilot-operated regulator, unscrew the elbow and connector (keys 25 and 24, figure 10) so that the loading tubing (key 22, figure 10) can be removed.

For the pressure-loaded regulator, unscrew the loading tubing (customer supplied) from the 1/4-inch NPT connection in the regulator diaphragm flange (key 2).

2. Remove the cap screws (key 12) and the diaphragm flange (key 2).

Lift out the upper diaphragm gasket (key 9), the diaphragms (key 8), the lower diaphragm gasket, and for steel constructions, the diaphragm ring (key 15), and the diaphragm gasket (key 9).

3. Lift out the stem assembly (key 11) consisting of the pusher plate and the stem. Check that the pitot tube (key 10) is clear and free of obstructions. Clean the parts. Check for wear, scratches, nicks and other damage, and replace parts as necessary.

4. Install the stem assembly (key 11) in the stem guide bushing (key 6). Place one diaphragm gasket (key 9) in the regulator body (key 1).

For steel constructions, place the diaphragm ring (key 15) and another diaphragm gasket (key 9) on top of the first gasket.

For all constructions, place the two molded diaphragms (key 8) with the raised circle up, another diaphragm gasket, and the diaphragm flange (key 2) on the body. Insert and tighten the cap screws (key 12).

5. For the pilot-operated regulator, reconnect the elbow, the loading tubing, and the connector (keys 25, 22, and 24, figure 10).

For the pressure-loaded regulator, reconnect the pressure-loading tubing.

6. When maintenance is completed, refer to the Startup section to put the regulator back in operation and to adjust the pressure setting.

**Replacing Valve Plug and Seat Ring**

1. Remove the valve plug guide (key 5).

2. Remove the valve plug (key 4) and the valve plug spring (key 7). Inspect the valve plug seating surface for nicks or scratches. Replace as necessary.

3. Unscrew the seat ring (key 3), and inspect the seating surface for nicks and scratches. Replace if necessary.

4. Clean the valve plug guide, the valve plug, the valve plug spring, and the seat ring (keys 5, 4, 7, and 3, respectively).

5. Coat the seat ring threads with Never-Seez\* or equivalent lubricant (key 20). Then, being careful not to damage the seating surface, thread the seat ring (key 3) into the regulator body (key 1).

6. Place the valve plug spring (key 7) into the valve plug guide (key 5). Then slide the valve plug (key 4) over the spring and into the valve plug guide.

7. Apply John Crane Plastic Lead Seal† sealant or equivalent (key 21) to the valve plug guide threads, and screw the valve plug guide (key 5) with attached parts into the regulator body (key 1).

8. When maintenance is completed, refer to the Startup section to put the regulator back in operation and to adjust the pressure setting.

**Type 6392 Pilot**

Perform this procedure if inspecting, cleaning, or replacing any pilot parts. Key numbers refer to figure 9 unless otherwise specified.

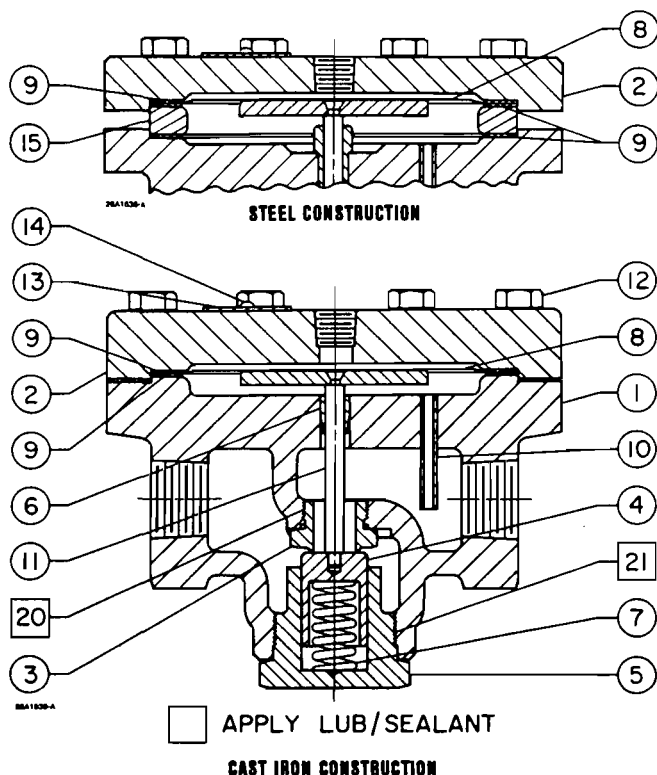


Figure 8. Type 92C Regulator

All pilot maintenance may be performed with the pilot body (key 1) attached to the pipe nipple and connector (keys 23 and 24, figure 10) unless the pilot body must be removed or the pilot is to be replaced as a unit.

1. Loosen the jam nut (key 15), and turn the adjusting screw (key 16) counterclockwise until all compression is removed from the control spring (key 13). Remove the loading tubing from the pilot outlet connection. Remove the cap screws (key 17), spring case (key 2), control spring, and upper spring seat (key 14) from the body.

2. Remove the lower spring seat (key 9), the diaphragm (key 7), and the diaphragm gasket (key 8) from the body. Lift out the stem assembly (key 6) consisting of the stem

and the pusher plate. Clean the 1/16-inch (1.6 mm) diameter pilot bleed hole. Clean and replace parts as necessary, and assemble the stem assembly, the gasket, the diaphragm, and the spring seat in the order shown in figure 9.

3. Install the control spring (key 13), the lubricated upper spring seat (key 14), and the spring case (key 2). Insert and tighten the cap screws (key 17). Lubricate the adjusting screw (key 16) with Never-Seez or equivalent lubricant (key 20), and thread it into the spring case.

4. Unscrew the valve plug guide (key 5). Remove the strainer screen (key 12), the valve plug (key 4), the valve plug cap (key 26), and the valve plug spring (key 11). Unscrew the seat ring (key 3). Clean and replace parts as necessary. Apply Never-Seez or equivalent lubricant (key 20) to the seat ring threads, and screw the seat ring into place.

5. Place the valve plug spring (key 11) into the valve plug guide (key 5). Insert the valve plug cap (key 26) into the valve plug (key 4), and then slide both parts over the spring and into the valve plug guide. Place the strainer screen (key 12) onto the valve plug guide. Apply John Crane Plastic Lead Seal sealant or equivalent (key 21) to the valve plug guide threads, and screw the valve plug guide with the attached parts into the pilot body (key 1).

6. When maintenance is completed, refer to the Startup section to put the regulator back into operation, and adjust the pressure setting.

## Parts Ordering

When corresponding with your Fisher sales office or sales representative about this equipment, always specify the equipment serial number as found on the regulator nameplate.

When ordering replacement parts, specify the complete 11-character part number of each needed part as found in the following parts list.

## Parts List

### Regulator

Key	Description	Part Number
1	Regulator Body Assembly w/bushing (see key 6 for bushing)	
	Cast iron	
	1/2 in.	36A1539 X0A2
	3/4 in.	36A1540 X0A2
	1 in.	36A1541 X0A2
	Steel	
	1/2 in.	36A1542 X0A2
	3/4 in.	36A1543 X0A2
	1 in.	36A1544 X0A2

Key	Description	Part Number	Key	Description	Part Number
2	Diaphragm Flange		5	Valve Plug Guide	
	Cast iron	26A1533 X012		Brass (for cast iron body)	1E3982 14012
	Steel	26A1534 X012		416 stainless steel (for steel body)	1E3982 35132
3	Seat Ring, heat-treated 416 stainless steel		6	Stem Guide Bushing, heat-treated 416 stainless steel (included in key 1)	
	For 1/2 in. body			For cast iron body	1E3985 35132
	9/16 in. (14.3 mm)	16A1529 X012		For steel body	16A1530 X012
	For 3/4 & 1 in. bodies		7	Valve Plug Spring, stainless steel	1E3988 37022
	9/16 in. (14.3 mm)	16A1529 X012	8*	Diaphragm, stainless steel (2 req'd)	1E3992 36012
	3/4 in. (19.1 mm) (standard)	16A1528 X012			
4	Valve Plug, heat-treated 416 stainless steel	1E3981 46172			

\*Recommended spare part.

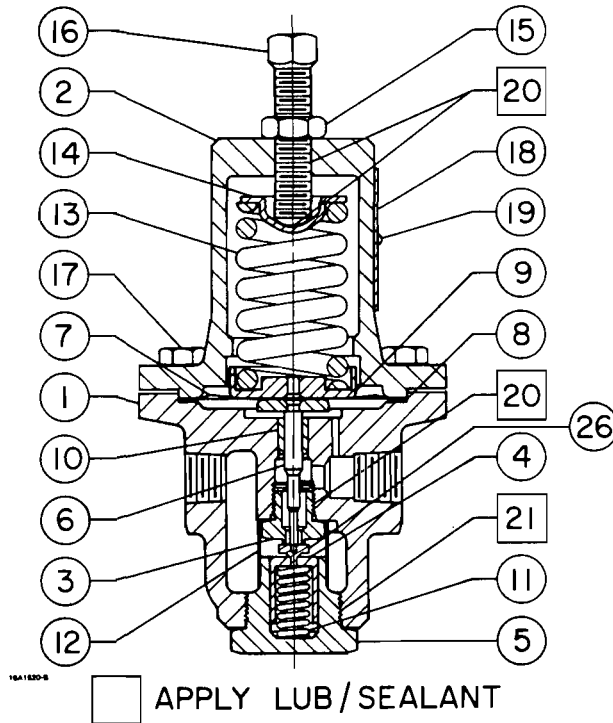


Figure 9. Type 6392 Pilot

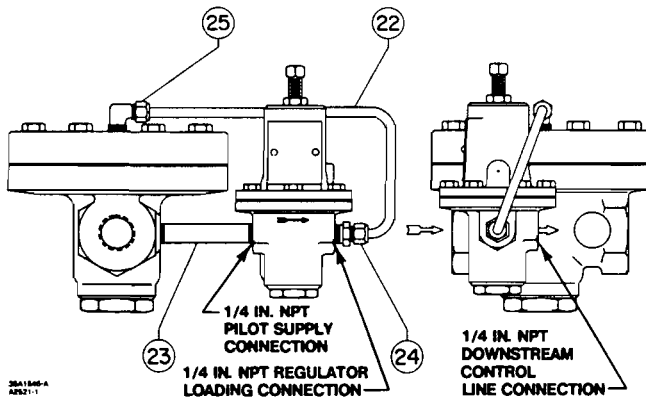


Figure 10. Type 6392 Pilot Mounting Parts

Key Description Part Number

**Type 6392 Pilot**

1	Pilot Body Cast iron Steel	26A1518 X012 26A1517 X012
2	Spring Case Cast iron Steel	2E3912 19012 2J1275 22012
3	Seat Ring, heat-treated 416 stainless steel	16A1511 X012
4	Valve Plug, heat-treated 416 stainless steel	16A1516 X012
5	Valve Plug Guide Brass (for cast iron pilot) Heat-treated 416 stainless steel (for steel pilot)	1E3918 14012 1E3918 35132
6	Stem Assembly, 416 stainless steel	16A1515 X012
7	Diaphragm, stainless steel (2 req'd)	1E3928 36012
8*	Diaphragm Gasket, asbestos	1E3931 04022
9	Lower Spring Seat, aluminum	1E3923 09012
10	Stem Guide Bushing, 416 stainless steel	1E3922 35132
11	Valve Plug Spring, stainless steel	1E3924 37022
12	Strainer Screen, stainless steel	16A1512 X012
13	Control Spring, zn pl steel 5 to 70 psig (0.3 to 4.8 bar), green 20 to 150 psig (1.4 to 10.3 bar), red	1E3926 27012 1E3927 27142
14	Upper Spring Seat, zn pl steel	1B7985 25062
15	Jam Nut, pl steel	1A3522 24122
16	Adjusting Screw, pl steel	1E6399 28992
17	Cap Screw, pl steel (6 req'd)	1A4078 24052
18	Nameplate, aluminum	16A1521 X012
19	Drive Screw, stainless steel (2 req'd)	1A3682 28982
20	Never Seez Lubricant 1 gal (3.81 L) can (not furnished with pilot)	1M5239 06992
21	John Crane Plastic Lead Seal Sealant 1 lb (0.453 kg) can (not furnished with pilot)	1M3307 06992
26	Valve Plug Cap, heat-treated 416 stainless steel	16A1549 X012

Key	Description	Part Number	Key	Description	Part Number
9*	Diaphragm Gasket, asbestos (2 req'd for cast iron body; 3 req'd for steel body)	16A1526 X012	13	Nameplate, aluminum	16A1532 X012
10	Pitot Tube, copper For cast iron body For steel body	16A1525 X012 1E3994 17012	14	Drive Screw, stainless steel (2 req'd)	1A3682 28982
11	Stem Assembly, 416 stainless steel	16A1524 X012	15	Diaphragm Ring, steel (use with steel body only)	16A1531 X012
12	Cap Screw, pl steel (8 req'd) For cast iron body For steel body	1A9145 24052 1A7820 24052	20	Never Seez Lubricant 1 gal (3.81 L) can (not furnished with regulator)	1M5239 06992
			21	John Crane Plastic Lead Seal Sealant 1 lb (0.453 kg) can (not furnished with regulator)	1M3307 06992

\*Recommended spare part.

**Pilot Mounting Parts**

22	Loading Tubing, copper	16A1527 X012
23	Pipe Nipple, steel	1N5842 26022
24	Connector, brass	1A6368 14012
25	Elbow, brass	1A3971 18992

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**3582 Series Valve Positioners,  
Type 3582i Valve Positioner, and  
3583 Series Valve Stem  
Position Transmitters**



February 1993

Form 5054

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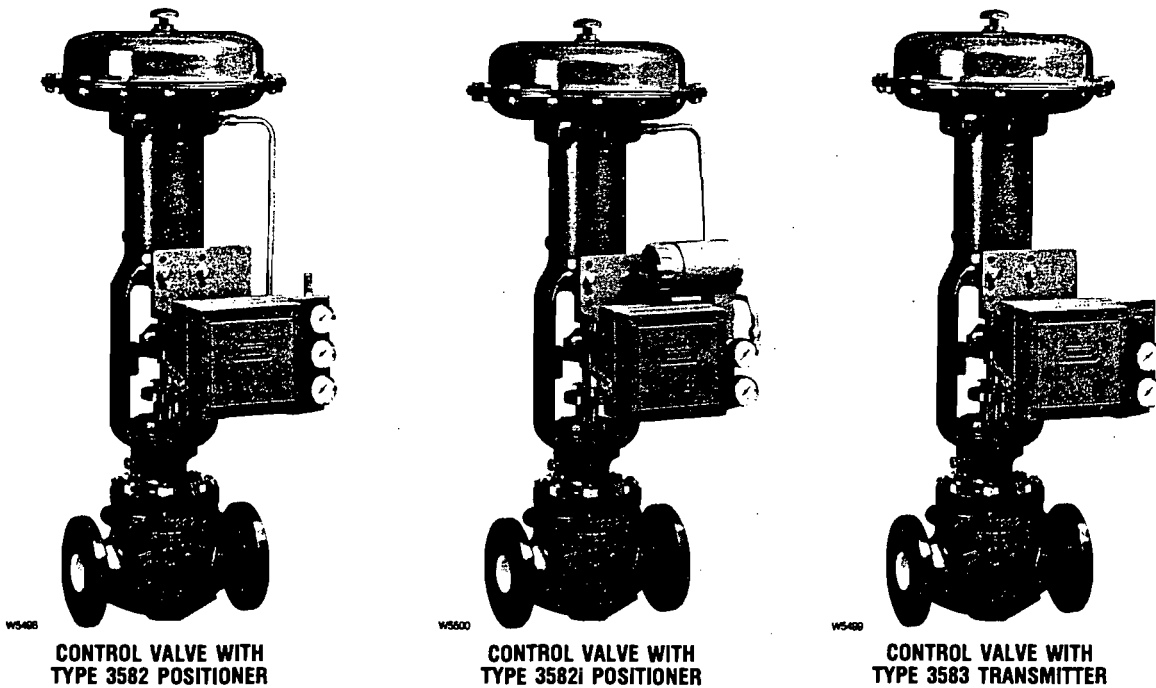


Figure 1. Typical Mounting for the 3582 Series, Type 3582i, and 3583 Series Positioners and Transmitters



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**Introduction**

**Scope of Manual**

This instruction manual includes installation, operation, calibration, maintenance, and parts ordering information for the 3582 Series pneumatic valve positioners, the Type 3582i electro-pneumatic valve positioner, and the 3583 Series pneumatic valve stem position transmitters. Refer to separate instruction manuals for information on the control valve, actuator, and accessories.

Only personnel qualified through training or experience should install, operate, or maintain the valve positioner or valve stem position transmitter. If there are any questions concerning the instructions in this manual, contact your Fisher sales office or representative before proceeding.

**Description**

The 3582 Series pneumatic valve positioners and the Type 3582i electro-pneumatic valve positioner shown in figure 1 are used with diaphragm-actuated, sliding-stem control valve assemblies. The pneumatic valve positioners receive a pneumatic input signal from a control device and modulate the supply pressure to the control valve actuator. The positioner adjusts the actuator supply pressure to maintain a valve stem position proportional to the pneumatic input signal.

The Type 3582i is an electro-pneumatic valve positioner, consisting of a Type 582i electro-pneumatic converter installed on a Type 3582 pneumatic valve positioner. The Type 3582i valve positioner provides an accurate valve stem position that is proportional to a dc current input signal.

The Type 582i electro-pneumatic converter is a modular unit that can be installed at the factory or in the field. However, do not plan to install a Type 582i converter on an existing positioner until you contact your Fisher sales office or representative for application assistance.

The Type 582i converter receives the dc current input signal and, through a nozzle/flapper arrangement, provides a proportional pneumatic output signal. This pneumatic output signal provides the input signal to the pneumatic valve positioner, eliminating the need for a remote-mounted transducer.

The 3583 Series pneumatic valve stem position transmitters are for use with sliding-stem diaphragm actuators. These units provide an output signal that is directly proportional to the valve stem position.

Refer to the type number description for a detailed explanation of type numbers.

**Type Number Descriptions**

The following descriptions provide specific information on the different valve positioner or valve stem position transmitter constructions. If the type number is not known, refer to the nameplate on the positioner. For the location of the nameplate, refer to key 25 in figure 20.

**Type 3582**—Pneumatic valve positioner with bypass and instrument, supply, and output pressure gauges.

**Type 3582A**—Pneumatic valve positioner without bypass and without pressure gauges

**Type 3582C**—Pneumatic valve positioner without bypass and with automotive tire valves instead of pressure gauges

**Type 3582D**—Pneumatic valve positioner with bypass and with automotive tire valves instead of pressure gauges

**Type 3582G**—Pneumatic valve positioner without bypass and with instrument, supply, and output pressure gauges

**Type 3582i**—Electro-pneumatic valve positioner without bypass; with Type 582i converter; and with: supply and output pressure gauges, automotive tire valves, or pipe plugs

**Type 582i**—Electro-pneumatic converter with: supply and output pressure gauges, automotive tire valves, or pipe plugs. Used for conversion of a 4 to 20 milliampere input signal to a 3 to 15 psig (0.2 to 1.0 bar) input signal for the pneumatic valve positioner

**Type 3583**—Pneumatic valve stem position transmitter with supply and output pressure gauges

**Type 3583C**—Similar to the Type 3583 valve stem position transmitter except with automotive tire valves in place of pressure gauges

**Specifications**

Specifications for the valve positioners are shown in table 1. Specifications for the valve stem position transmitters are shown in table 2.

Refer to the unit nameplate to determine the type of positioner or transmitter, supply pressure, etc. A typical nameplate is shown in figure 2.

Table 1. Specifications for 3582 Series and Type 3582i Valve Positioners

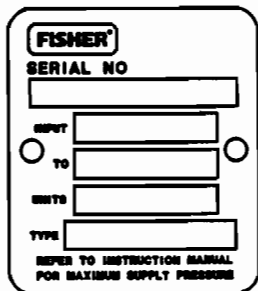
<p><b>Input Signal<sup>(1)</sup></b></p> <p><b>3582 Series:</b>                  ■ 3 to 15 psig (0.2 to 1.0 bar), ■ 5 to 25 psig (0.3 to 1.7 bar), ■ 6 to 30 psig (0.4 to 2.0 bar), or ■ split range, see table 5</p> <p><b>Type 3582i:</b>                  4 to 20 mA dc constant current with 30 V dc maximum compliance voltage, can be split range, see table 5</p> <p><b>Equivalent Circuit for Type 3582i</b></p> <p>The Type 582i converter equivalent circuit is 120 ohms, shunted by three 5.6-volt zener diodes (see figure 11)</p> <p><b>Output Signal<sup>(1)</sup></b></p> <p><b>Type:</b> Pneumatic pressure as required by actuator up to 95 percent of maximum supply</p> <p><b>Action<sup>(1)</sup>:</b> Field-reversible between ■ direct and ■ reverse within the pneumatic valve positioner</p> <p><b>Supply Pressure<sup>(1)</sup></b></p> <p><b>Recommended:</b> 5 psi (0.3 bar) above actuator requirement</p> <p><b>Maximum:</b> 50 psig (3.4 bar) or pressure rating of actuator, whichever is lower</p>	<p><b>Input Bellows Pressure Rating<sup>(2)</sup></b></p> <p>See table 4 for minimum and maximum pressure ratings (allowable input signal) for each available range spring</p> <p><b>Maximum Steady-State Air Consumption<sup>(1)(3)</sup></b></p> <p><b>For 3582 Series</b>                  20 Psig (1.4 bar) Supply: 14.0 scfh (0.38 normal m<sup>3</sup>/hr)                  30 Psig (2.0 bar) Supply: 18.0 scfh (0.48 normal m<sup>3</sup>/hr)                  35 Psig (2.4 bar) Supply: 20.0 scfh (0.54 normal m<sup>3</sup>/hr)</p> <p><b>For Type 3582i Only</b>                  20 Psig (1.4 bar) Supply: 17.2 scfh (0.46 normal m<sup>3</sup>/hr)                  30 Psig (2.0 bar) Supply: 21.4 scfh (0.58 normal m<sup>3</sup>/hr)                  35 Psig (2.4 bar) Supply: 23.8 scfh (0.64 normal m<sup>3</sup>/hr)</p> <p><b>Maximum Supply Air Demand<sup>(1)</sup></b></p> <p><b>For 3582 Series and Type 3582i</b>                  20 Psig (1.4 bar) Supply: 164.5 scfh (4.7 normal m<sup>3</sup>/hr)                  30 Psig (2.0 bar) Supply: 248.5 scfh (7.0 normal m<sup>3</sup>/hr)                  35 Psig (2.4 bar) Supply: 285.5 scfh (8.1 normal m<sup>3</sup>/hr)</p>
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- Continued -



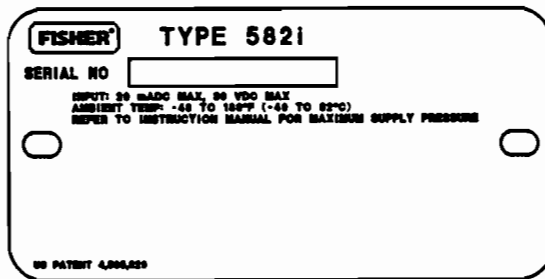
Table 1. Specifications for 3582 Series and Type 3582i Valve Positioners (Continued)

<p><b>Performance</b></p> <p><b>For 3582 Series</b>  <i>Independent Linearity</i><sup>(1)</sup>: ± 1 percent of output signal span  <i>Hysteresis</i><sup>(1)</sup>: 0.5 percent of span</p> <p><b>For Type 3582i Only</b>  <i>Independent Linearity</i><sup>(1)</sup>: ± 2 percent of output signal span  <i>Hysteresis</i><sup>(1)</sup>: 0.6 percent of span  <i>Electromagnetic Interference (EMI)</i><sup>(1)</sup>: When tested per SAMA Standard PMC 33.1-1978, change in steady-state deviation is less than ± 1% in an electromagnetic field classified as 3-abc with a field strength of 30 V/m. Positioner is tested with housing cap on and with external field wiring in rigid metal conduit.</p> <p><b>For 3582 Series and Type 3582i</b>  <i>Open Loop Gain (Output Signal)</i><sup>(1)</sup>:                  ■ 100 in the range of 3 to 15 psig (0.2 to 1.0 bar)                  ■ 55 in the range of 6 to 30 psig (0.4 to 2.0 bar)</p> <p><b>Operating Influences</b><sup>(1)</sup></p> <p><b>Supply Pressure, For 3582 Series Units:</b> Valve travel changes less than 0.25 percent per 2 psi (1.67 percent per bar) change in supply pressure  <b>Supply Pressure, For Type 3582i Units:</b> Valve travel changes less than 1.5 percent per 2 psi (3.62 percent per bar) change in supply pressure</p> <p><b>Operative Temperature Limits</b><sup>(1)</sup></p> <p><b>Standard Construction, For 3582 Series and Type 3582i Units:</b> - 40 to + 160°F (- 40 to + 71°C)  <b>High-Temperature Construction</b><sup>(2)</sup>, For Types 3582A and C Only: 0 to + 220°F (- 18 to + 104°C) without gauges</p> <p><small>1. This term is defined in ISA Standard S51.1-1979.                  2. Do not exceed any of the pressure or temperature limits in this instruction manual. Also, any applicable standard or code should not be exceeded.</small></p>	<p><b>Electrical Classification for Type 3582i</b></p> <p>Please refer to the Hazardous Area Classifications Bulletin for specific approvals. Also, refer to the nameplates shown in figure 2 for the location of positioner or transmitter classification information and approval descriptions.</p> <p><b>Housing Classification for Type 3582i</b></p> <p>NEMA 3, IEC 529 IP54: Mounting orientation requires vent location to be below horizontal</p> <p><b>Pressure Gauges</b></p> <p>1-1/2 inch (40 mm) diameter with plastic case and brass connection ■ triple scale (PSI, MPa, and bar) or ■ dual scale (PSI and kg/cm<sup>2</sup>)</p> <p><b>Pressure Connections</b></p> <p>1/4-inch NPT female</p> <p><b>Electrical Connection for Type 3582i</b></p> <p>1/2-14 NPT conduit connection</p> <p><b>Maximum Valve Stem Travel</b></p> <p>4-1/8 inches (105 mm); adjustable to obtain lesser travels with standard input signals</p> <p><b>Characterized Cams</b></p> <p>See characterized cams section</p> <p><b>Approximate Weight</b></p> <p><b>3582 Series Units:</b> 5-1/2 pounds (2.5 kg)  <b>Type 3582i:</b> 8 pounds (3.6 kg)</p> <p><small>3. Scfh—standard cubic feet per hour (60°F and 14.7 psia); normal m<sup>3</sup>/hr—normal cubic meters per hour (0°C and 1.01325 bar, absolute).</small></p>
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12B4376X0A2-B SHT 1

POSITIONER OR TRANSMITTER NAMEPLATE



11B5625X0A2-C SHT B

TYPE 582i CONVERTER NAMEPLATE

Figure 2. Typical Nameplates

Table 2. Specifications for 3583 Series Valve Stem Position Transmitters

<b>Input Signal<sup>(1)</sup></b> 4-1/8 inches (105 mm) of valve stem travel; adjustable to obtain full output signal with lesser stem travels	<b>Reference Accuracy<sup>(1)</sup></b> $\pm 1$ percent of output signal span
<b>Output Signal<sup>(1)</sup></b> <b>Type:</b> ■ 3 to 15 psig (0.2 to 1.0 bar), ■ 5 to 25 psig (0.3 to 1.7 bar), or ■ 6 to 30 psig (0.4 to 2.0 bar) pneumatic pressure <b>Action:</b> Field-reversible between direct and reverse	<b>Operating Influence<sup>(1)</sup></b> Output signal changes 0.23 percent per 2 psig (1.67 percent per bar) change in supply pressure
<b>Output Bellows Pressure Rating<sup>(2)</sup></b> See table 4 for minimum and maximum pressure ratings (allowable input signal) for each available range spring	<b>Operative Ambient Temperature Limits<sup>(1)</sup></b> <b>Standard Construction, 3583 Series:</b> - 40 to + 160 °F (- 40 to + 71°C) <b>High-Temperature Construction<sup>(2)</sup>, Type 3583C only:</b> 0 to + 220 °F (- 18 to + 104°C)
<b>Supply Pressure<sup>(1)</sup></b> <b>Recommended:</b> 5 psi (0.3 bar) above upper limit of output signal range <b>Maximum:</b> 35 psig (2.4 bar) or pressure rating of connected equipment, whichever is lower	<b>Pressure Connections</b> Supply and output pressure connections are 1/4-inch NPT female
<b>Maximum Steady-State Air Consumption<sup>(1)(3)</sup></b> <b>20 Psig (1.4 bar) Supply:</b> 14.0 scfh (0.38 normal m <sup>3</sup> /hr) <b>30 Psig (2.0 bar) Supply:</b> 18.0 scfh (0.48 normal m <sup>3</sup> /hr) <b>35 Psig (2.4 bar) Supply:</b> 20.0 scfh (0.54 normal m <sup>3</sup> /hr)	<b>Maximum Valve Stem Travel</b> 4-1/8 inches (105 mm); adjustable to obtain full output signal with lesser stem travels
<small>1. This term is defined in ISA Standard S51.1-1979.            2. Do not exceed any of the pressure or temperature limits in this instruction manual. Also, any applicable standard or code should not be exceeded.</small>	<b>Cam</b> Linear
	<b>Approximate Weight</b> 5-1/2 pounds (2.5 kg)
	<small>3. Scfh—standard cubic feet per hour (60°F and 14.7 psia); normal m<sup>3</sup>/hr—normal cubic meters per hour (0°C and 1.01325 bar, absolute).</small>

## Installation

### Note

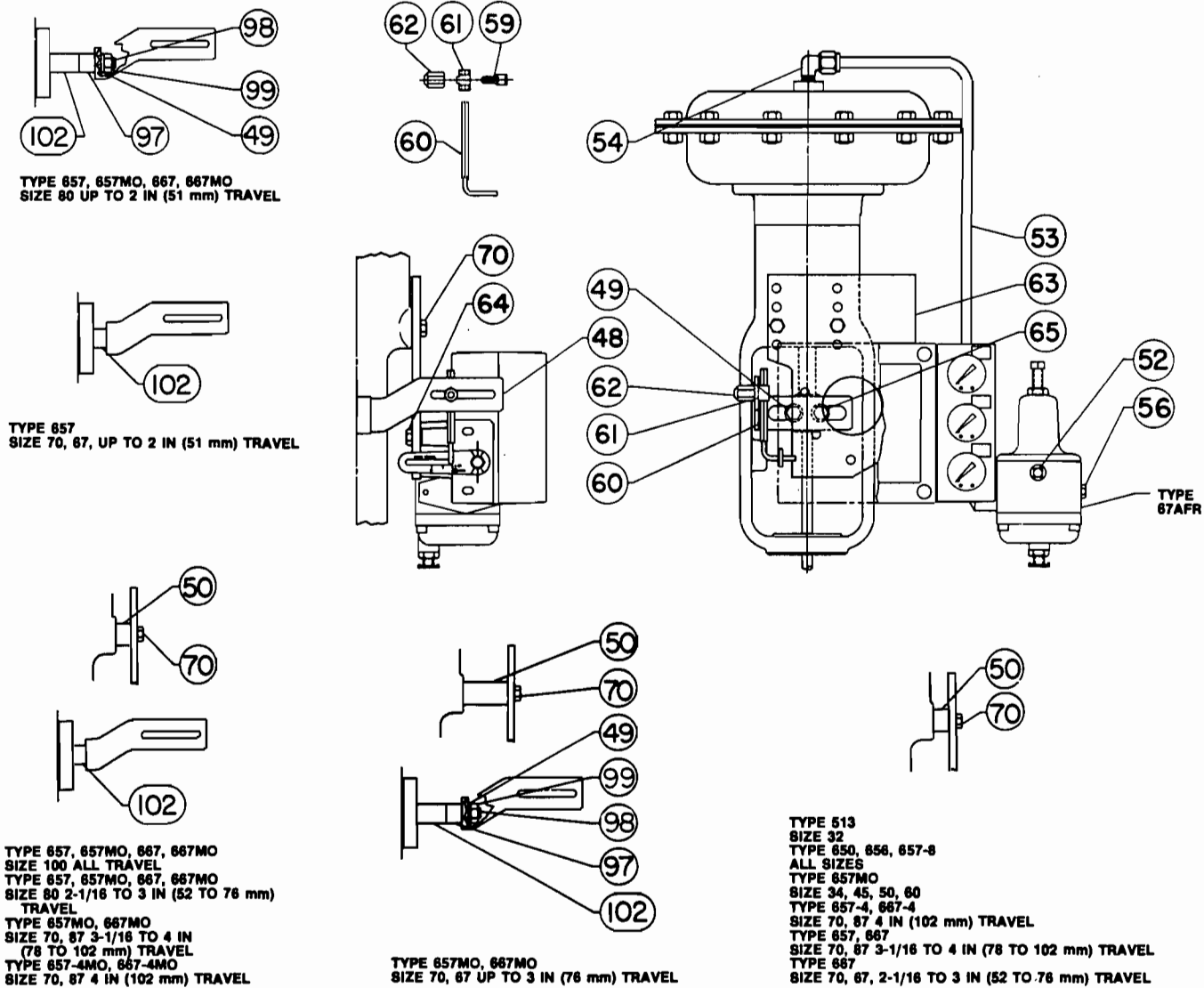
All valve positioners and valve stem position transmitters are shipped with foam rubber packing material inside the case. Remove the cover (key 33, figure 20) and the packing material before attempting to operate the unit. Make sure all vent openings are clear before installation of the unit and that they remain clear during use.

Typically, the positioner or transmitter is ordered with the actuator. If so, the factory mounts the valve positioner or valve stem position transmitter and connects the valve positioner output to the actuator. If a Type 67AFR filter-regulator is specified, it may be integrally mounted to the valve positioner or valve stem position transmitter.

### Note

In some cases, alignment and calibration of the valve positioner or valve stem position transmitter at the factory may not be possible, and field alignment and calibration is required. Before putting the valve positioner or valve stem position transmitter into service, check the operation of the unit to be sure it is calibrated. If the valve positioner or valve stem position transmitter requires alignment or calibration, refer to the appropriate calibration instructions in this manual.

If the valve positioner or valve stem position transmitter is ordered separately, disconnected, or removed from the actuator, refer to the appropriate sections of this manual for installation information.



NOTE:  
KEY 55 (TUBING CONNECTOR) NOT SHOWN  
41B9569-C BHT 1 AND 2

Figure 3. Mounting Assembly

**Mounting**

Key numbers used in this procedure are shown in figure 3 except where indicated.

1. Figure 3 shows the various mounting parts required for mounting on Fisher actuators. Mounting parts for Fisher actuators that require spacers have the spacers (key 50) included. Type 657 and 667 actuators, sizes 70 through 100, with or without a side-mounted handwheel, use spacers (keys 97 and 102) between the stem connector and the connector arm (key 48). On all other actuators that use spacers, place the spacers (key 50) between the mounting plate (key 63) and the actuator mounting boss.

When mounting the valve positioner or valve stem position transmitter on an actuator by another manufacturer,

provide spacers, if necessary, by cutting sections from 1/2- or 3/8-inch pipe so that the "X" dimension matches the value given in figure 6.

2. As shown in figures 3 and 4, attach the connector arm (key 48) to the stem connector so that the connector arm extends through the yoke legs on the side of the lower mounting boss.

3. Attach the valve positioner or valve stem position transmitter to the mounting plate (key 63) using the holes shown in figure 5.

4. Mount the Type 67AFR regulator:

● 3582 Series valve positioners and 3583 Series valve stem position transmitters, mount the regulator on the integral boss on the bypass block.

Table 3. 3582 and 3583 Series Mounting Information

ACTUATOR TYPE	ACTUATOR SIZE	MAXIMUM TRAVEL		MOUNTING HOLES SET NO.(1)	TRAVEL PIN POSITION(2)	ACTUATOR TYPE	ACTUATOR SIZE	MAXIMUM TRAVEL		MOUNTING HOLES SET NO.(1)		TRAVEL PIN POSITION(2)																					
		Inch	mm					Inch	mm	657	667																						
513 & 513R	20	3/4	19	2	Normal	657 & 667 Without Side Mounted Handwheel	30	3/4	19	3	4	Normal																					
	32	3/4	19	2	Normal		34	1-1/8	19	3	2	Normal																					
656	30	2	51	4	Inverted		40	1-1/2	38	2	3	Normal																					
	40	3-1/2	89	4	Inverted		45	3/4	19	1	4	Inverted(3)																					
	60	4	102	4	Inverted		45	2	51	1	1	Normal																					
657-4 Without Side-Mounted Handwheel	70	4	102	3	Inverted		50	2	51	1	2	Normal																					
							60	2	51	1	2	Normal																					
657-4 With Side-Mounted Handwheel	70	4	102	2	Inverted		70	2	51	2	1	Normal																					
								2-1/16-3	52-76	3	2	Normal																					
657-8	30	2-1/8	54	3	Normal		80	3-1/16-4	78-102	3	1	Inverted(4)																					
								40	3-1/8	79	3	Normal	87	2	51	2	2	Normal															
														2-1/16-3	52-76	2	2	Normal															
						3-1/16-4								78-102	3	1	Inverted(4)																
	46	3-1/8	79	2	Normal	100	4	102	4	4	Inverted																						
												46	4-1/8	105	2	Normal	34	3/4	19	2	2	Normal											
																							47	3-1/8	79	2	Inverted	40	1-1/2	38	1	2	Normal
	47	4-1/8	105	1	Inverted	50	2	51	4	1	Inverted(4)																						
												60	4-1/8	105	4	Inverted	60	2	51	3	1	Inverted(4)											
																							70	4-1/8	105	2	Inverted	70	4	102	2	2	Inverted
667-4 Without Side-Mounted Handwheel	70	4	102	1	Normal	87	3	76	2	2	Normal																						
												87	4	102	1	Normal	3-1/16-4	78-102	2	1	Inverted												

1. The indicated set number should be considered a reference point only, due to the variables related to making up the stem connection.  
 2. Normal position is shown in figure 4.

3. Travel pin position for Type 657 is normal.  
 4. Travel pin position for Type 667 is normal.

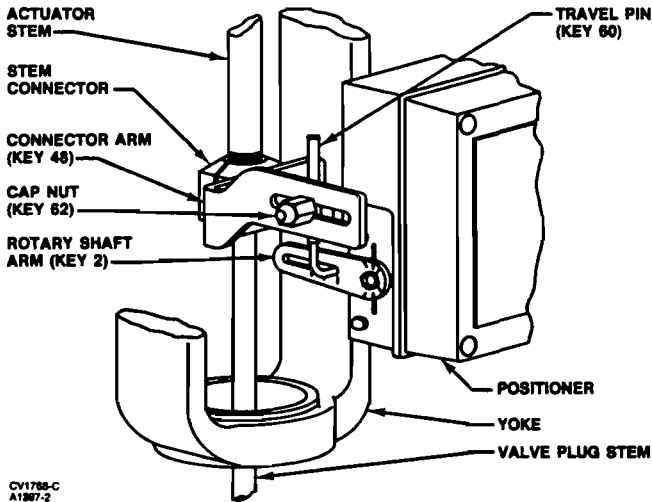


Figure 4. Isometric View Showing Motion Feedback Arrangement and Typical Stem Connection

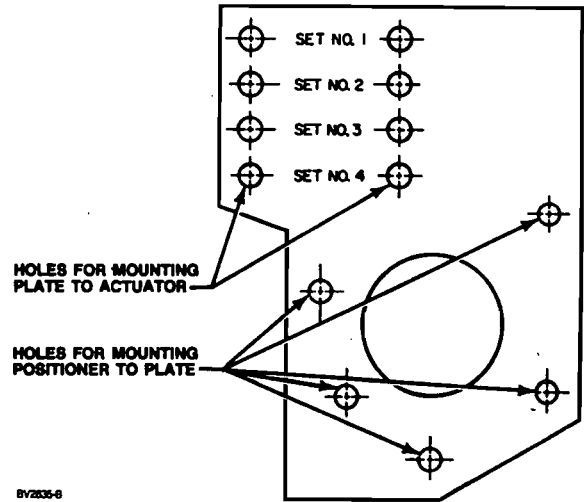


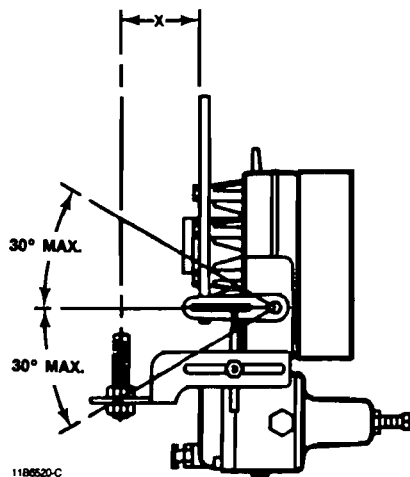
Figure 5. Mounting Plate Used with 3582 Series Valve Positioners and 3583 Series Motion Transmitters

● **Type 3582i valve positioners**, mount the regulator on the integral boss that is part of the Type 582i converter housing.

5. As shown in figure 5, the mounting bracket has four sets of holes for mounting the assembly to the actuator. Refer to table 3 to determine which set of mounting holes to use, then attach the assembly to the lower mounting pad on the actuator.

**CAUTION**

To avoid equipment damage, be certain the connector arm clears the valve positioner or valve stem position transmitter case as the actuator moves through its complete stroke.



STEM TRAVEL	X		
	3/8-Inch (9.5 mm) Stem	1/2-Inch (12.7 mm) Stem	3/4-Inch (19.1 mm) Stem
Inches			
1-1/8 or less	3.19	3.44	3.94
1-1/2	3.56	3.81	4.31
2	4.00	4.25	4.75
2-1/2	4.44	4.69	5.19
3	4.88	5.12	5.62
3-1/2	5.31	5.56	6.06
4	5.75	6.00	6.50
Millimeters			
29 or less	81	87	100
38	90	97	109
51	102	108	121
64	113	119	132
76	124	130	143
89	135	141	154
102	146	152	165

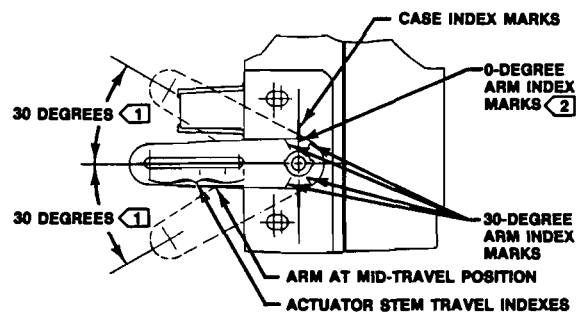
Figure 6. Spacing for Mounting on Other Than Fisher Actuators

6. Position the actuator to its mid-travel position using a handwheel or manual loading regulator.

7. Slip the round end of the travel pin (key 60) into the rotary shaft arm (key 2) slot as shown in figure 4.

8. Slide the square end of the travel pin into the pin holder and pin lock (keys 61 and 59). Place the pin lock and holder into the slot in the connector arm (key 48). Screw the cap nut (key 62) onto the pin lock (key 59), but do not tighten.

9. With the actuator at its mid-travel position, lift the rotary shaft arm so that the 0-degree index marks on the rotary shaft arm are aligned with the case index marks as shown in figure 7.



NOTES:  
 1 MAXIMUM ROTATION FROM MID-TRAVEL POSITION.  
 2 ALIGN INDEX MARKS AS SHOWN FOR MID-TRAVEL POSITION.  
 70CA0790-C  
 A2452-2

Figure 7. Rotary Shaft Arm and Case Index Marks

**CAUTION**

Never set the travel pin at a setting that is less than the actual actuator stroke. Setting the travel pin at a setting that is less than the actual actuator stroke will cause the cam to rotate more than 60 degrees, causing damage to the cam or other parts.

10. Position the travel pin so that it is perpendicular to the connector arm and aligns with the correct actuator stem travel index on the rotary shaft arm. Tighten the cap nut (key 62 in figure 4).

11. Check the travel pin setting using the following procedures:

- If a standard travel pin setting was made (that is, with the travel pin setting equal to total actuator travel), stroke the actuator to each end of its travel. At each end

of travel, the 30-degree index marks on the rotary shaft arm should align with the case index marks. If the index marks are not in line, loosen the cap nut (key 62) and slide the travel pin (key 60) in the rotary shaft arm slot until the 30-degree index marks align with the case index marks. Be sure the travel pin remains perpendicular to the connector arm. After making this adjustment, tighten the cap nut and re-check the arm at the mid-travel position. If the 0-degree index marks are not in line, repeat this procedure.

- If a special travel pin setting was made (that is, with the travel pin setting greater than total actuator travel), check the index marks using a procedure similar to that for standard settings. The arm will not rotate a full 60 degrees as the actuator is stroked, and the 30-degree index marks on the cam will be short of aligning with the case index marks. If necessary, adjust the travel pin position so that the 30-degree marks are the same distance from the respective case index mark at each end of actuator travel.

## Changing Cam Position

Refer to figure 20 for a typical cam illustration and key number locations.

### Note

- **For Valve Positioners:** The small arrow on the cam must point in the direction of stem movement with increasing actuator diaphragm pressure.

- **For Valve Stem Position Transmitters:** If the arrow on the cam points up toward the nozzle, output pressure increases with downward stem movement. If the arrow points down, output pressure decreases with downward stem movement.

If the arrow is pointing in the wrong direction, use the following procedure to remove, reverse, and re-install the cam.

When mounting a valve positioner or valve stem position transmitter, check to see if the correct cam (key 4) and cam position has been selected. To change the cam or cam position, unhook the extension spring (key 38), and remove the cam bolt and locking nut (keys 6 and 45). Remove the cam and spring retainer bracket (key 43).

To install the cam, screw the locking nut all the way onto the cam bolt. Attach the cam and spring retainer bracket to the shaft assembly with the cam bolt. Tighten the bolt to secure the cam. Then, tighten the locking nut against the spring retainer bracket. Hook the spring into the spring retainer bracket.

Details on cam characteristics can be found in the cam information portion of the operating information section.

## Pressure Connections

### WARNING

Valve positioners and valve stem position transmitters are capable of providing full supply pressure to connected equipment. To avoid personal injury and equipment damage, make sure the supply pressure never exceeds the maximum safe working pressure of any connected equipment.

Pressure connections are shown in figure 8. All pressure connections are 1/4-inch NPT female. Use 3/8-inch tubing for all pressure connections. After pressure connections have been made, turn on the supply pressure and check all connections for leaks.

## Supply Connection

### WARNING

Personal injury or property damage may occur from an uncontrolled process if the supply medium is not clean, dry, oil-free, or non-corrosive gas. Industry instrument air quality standards describe acceptable dirt, oil, and moisture content. Due to the variability in nature of the problems these influences can have on pneumatic equipment, Fisher Controls has no technical basis to recommend the level of filtration equipment required to prevent performance degradation of pneumatic equipment. A filter or filter regulator capable of removing particles 40 microns in diameter should suffice for most applications. Use of suitable filtration equipment and the establishment of a maintenance cycle to monitor its operation is recommended.

Supply pressure must be clean, dry air or noncorrosive gas. Use a Fisher Type 67AFR Filter Regulator, or equivalent, to filter and regulate supply air. The filter regulator can be mounted with the positioner. The supply pressure should be high enough to permit setting the regulator 5 psi (0.3 bar) above the upper limit of the appropriate pressure range, for example: 20 psig (1.4 bar) for a 3 to 15 psig (0.2 to 1.0 bar) range. However, do not exceed the maximum allowable supply pressure of 50 psig (3.4 bar) nor the pressure rating of any connected equipment.

Connect the nearest suitable supply source to the 1/4-inch NPT IN connection on the filter regulator (if furnished) or to the 1/4-inch NPT SUPPLY connection on the positioner block assembly.

## Output Connection

A factory mounted valve positioner has the valve positioner output piped to the supply connection on the actuator. If mounting the valve positioner in the field, connect 3/8-inch tubing between the 1/4-inch NPT valve positioner connection marked OUTPUT and the actuator supply pressure connection. Connect the valve stem position transmitter connection marked OUTPUT to an instrument that indicates valve stem position.

## Instrument Connection

For a 3582 Series pneumatic valve positioner connect 3/8-inch tubing from the control device to the 1/4-inch NPT INSTRUMENT connection. If the control device is mounted on the control valve assembly by the factory, this connection is made.

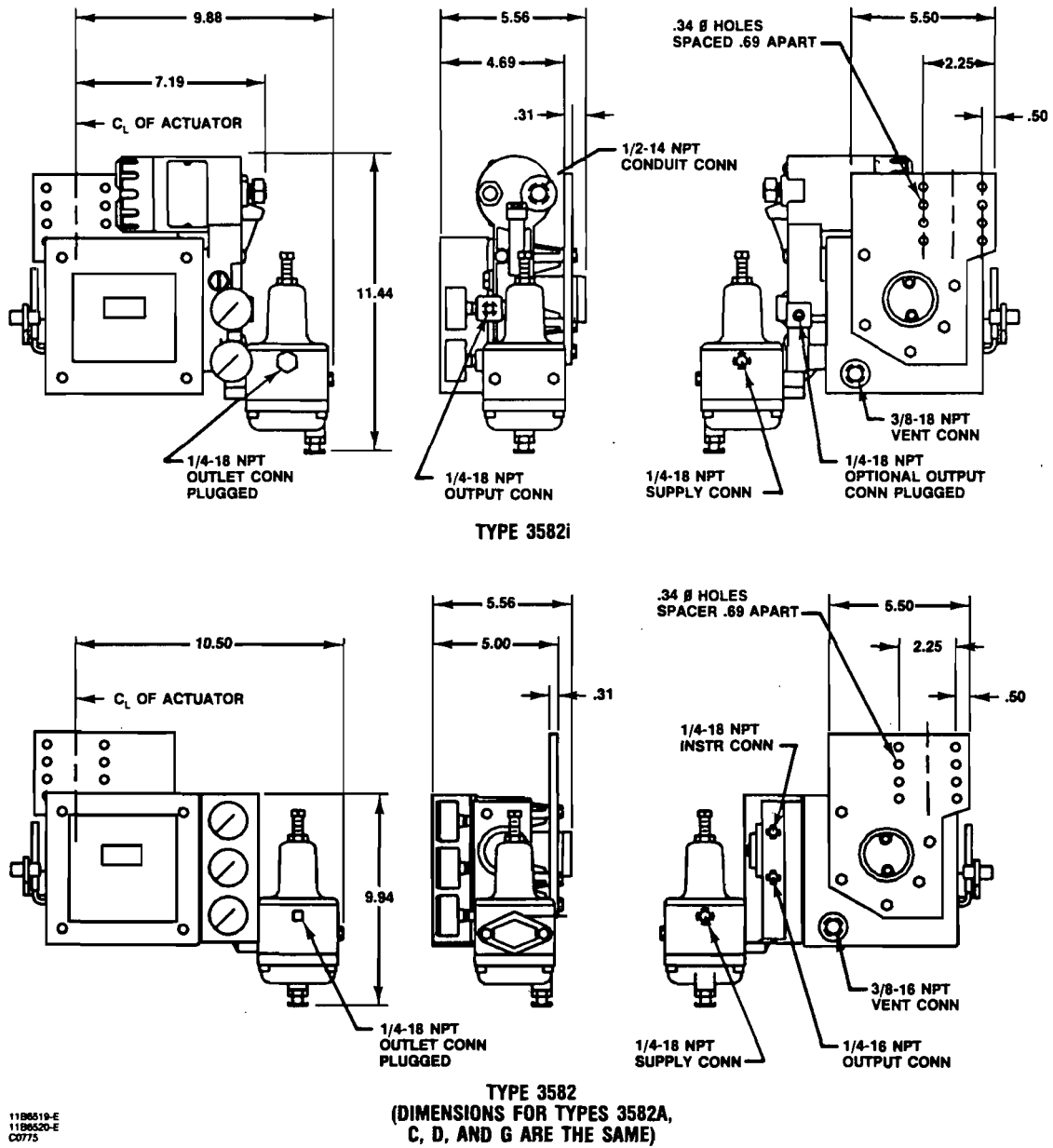


Figure 8. Typical Dimensions and Connections

The Type 3582i electro-pneumatic valve positioner requires a 4 to 20 milliampere dc current input signal from the control device. A 1/2-inch NPT conduit connection is provided for properly wiring electrical installations. For more information, see the electrical connections section.

**Diagnostic Connections**

To support diagnostic testing of valve/actuator/positioner/accessory packages, special connectors and hardware are available. The hardware used includes 1/8-inch NPT connector bodies and body protectors. If the diagnostic connectors are ordered for a positioner with gauges, 1/8-inch stems are also included.

Install the connectors on the 3582 block assembly or Type 582i housing as shown in figure 9. Before installing the connectors on the positioner, apply sealant to the threads. Sealant is provided with the diagnostic connections and hardware.

**Vent**

**WARNING**

If a flammable, toxic, or reactive gas is to be used as the supply pressure medium, personal injury or property damage could result from fire or explosion of accumulated

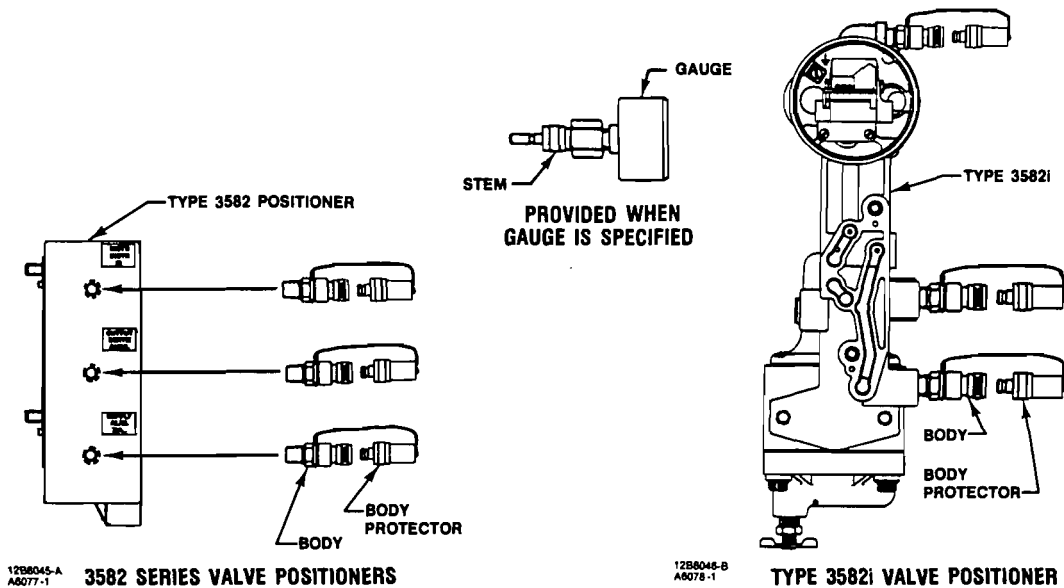


Figure 9. Flowscanner Connections

gas or from contact with toxic, or reactive gas. The positioner/actuator assembly does not form a gas-tight seal, and when the assembly is enclosed, a remote vent line, adequate ventilation, and necessary safety measures should be used. A remote vent pipe alone cannot be relied upon to remove all hazardous gas. Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

**CAUTION**

When installing a remote vent pipe, take care not to overtighten the pipe in the vent connection. Excessive torque will damage the threads in the connection.

The vent opening at the back of the case marked VENT should be left open to prevent pressure buildup inside the case and to provide a drain hole for any moisture that might collect inside the case. A screen is normally installed in this opening to prevent blockage from debris or insects.

If a remote vent is required, the vent line must be as short as possible with a minimum number of bends and elbows. The vent connection is 3/8-inch NPT female. To connect a remote vent, press out the screen and use 3/8-inch tubing to provide a remote vent. The 582i has a 1/4-inch NPT female vent connection.

Also, be certain that the exhaust holes in the relay (key 32 in figure 20) are kept open.

**Electrical Connections for Type 3582i Valve Positioner**

**WARNING**

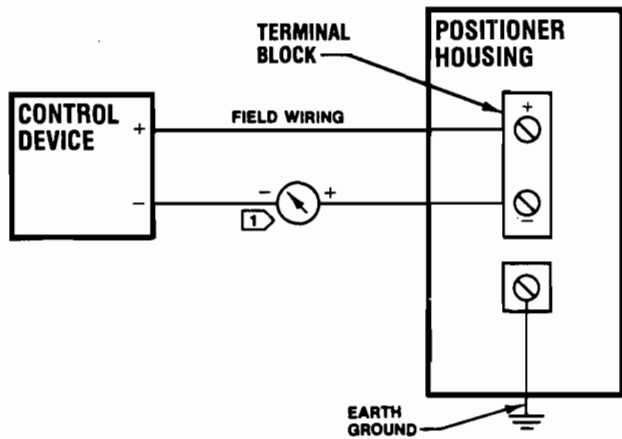
For explosion-proof applications, disconnect power before removing the converter housing cap.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 18 inches (457 mm) from the converter. Personal injury or property damage might result from explosion if the seal is not installed.

For intrinsically safe installations, refer to factory drawings or to instructions provided by the barrier manufacturer for proper wiring and installation.

Use the 1/2-inch NPT conduit connection on the Type 582i converter housing for installation of field wiring. For Class I, Division I explosion-proof applications, install rigid metal conduit and a seal no more than 18 inches (457 mm) from the converter. Also, install conduit according to local and national electrical codes which apply to the application.





NOTE:  
 ① FOR TROUBLESHOOTING OR MONITORING OPERATION, AN INDICATING DEVICE CAN BE A VOLTMETER ACROSS A 250 OHM RESISTOR OR A CURRENT METER.  
 AS875\*

Figure 10. Typical Field Wiring Diagram

Refer to figures 10, 11 and 12 when connecting field wiring from the control device to the converter. Connect the positive wire from the control device to the converter positive (+) terminal, and the negative wire from the control device to the converter negative (-) terminal. Do not overtighten the terminal screws. Maximum torque is 4 lbf-in. (0.45 N-m). Connect the converter grounding terminal to an earth ground.

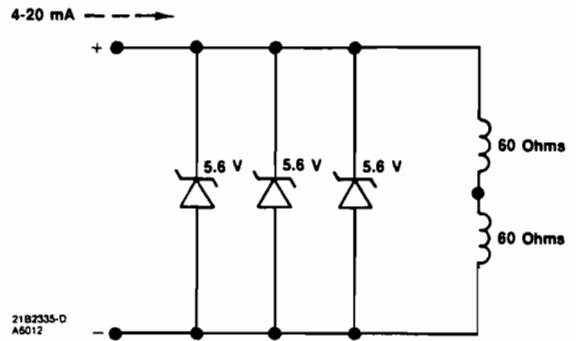


Figure 11. Type 582i Input Equivalent Circuit

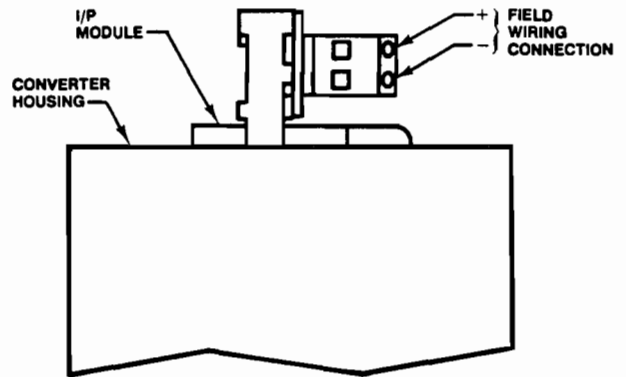


Figure 12. Type 582i Converter Wiring Connections

### Installation Of Type 582i Converter<sup>(1)</sup>

#### WARNING

Avoid personal injury from sudden release of process pressure. Before mounting the Type 582i converter:

- Disconnect any operating lines providing air pressure or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent actuator loading pressure and relieve any actuator spring precompression.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

#### Note

Before planning to retrofit an installed 3582 Series positioner, refer to the positioner mounting plate illustration shown in figure 5. Mounting plates with a three-hole mounting pattern (positioner to mounting plate) cannot support a Type 582i converter. Do not attempt to mount a Type 582i converter on an existing 3582 Series positioner which has a three-hole mounting pattern.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. Please contact your Fisher sales office or representative before planning to upgrade any existing 3582 Series valve positioner by field installation of a Type 582i electro-pneumatic converter. Also, refer to this section of the instruction manual which describes field installation of a Type 582i converter.

If a 3582 Series pneumatic valve positioner has previously been installed using a mounting plate with a five-hole mounting pattern (positioner to mounting plate), either at the factory or in the field, it can be upgraded to a Type 3582i electro-pneumatic valve positioner by installation of a Type 582i converter. To install a Type 582i converter, refer to the following instructions.

#### Note

**Inspect the existing valve positioner to determine the input signal range. If the input signal range is not 3 to 15 psig, refer to the appropriate sections of this manual describing input signal ranges and how to change the range spring.**

1. Inspect the positioner mounting plate. Be certain that five screws fasten the positioner to the mounting plate. Two additional screws fasten the plate to the actuator.

When the positioner is correctly attached to the mounting plate, proceed with the installation by taking the control valve/actuator/positioner package out of service.

2. Properly vent the actuator loading pressure and the supply pressure. Disconnect the pressure tubing connections to the valve positioner.

3. Remove the two screws (key 105 in figures 23 or 24) holding the bypass block (key 34A in figures 23 or 24) to the valve positioner case and remove the bypass block. Save the screws to reattach the Type 582i converter.

4. Remove and discard the existing gasket (key 104 in figures 23 or 24) between the bypass block and valve positioner case.

5. Unpack the Type 582i converter to be installed.

6. Position the new gasket on the Type 582i converter as shown in figure 26. Insert the existing screws (key 105 in figures 23 or 24) through the appropriate holes in the Type 582i converter housing and new gasket.

7. Mate the converter and new gasket to the side of the valve positioner case using the alignment pins on the converter housing.

8. Tighten the screws.

9. Reconnect the pressure connections according to the instructions given in the pressure connections section of this manual.

10. Make the electrical connections according to the instructions given in the electrical connections section of this manual.

11. Complete the standard calibration procedure described in the calibration section of this manual.

12. Return the control valve package to service.

## Operating Information

Instructions for setting the zero and span are found in the calibration section.

### Valve Positioner Cam Information

#### Note

**The small arrow on the valve positioner cam must point in the direction of stem movement with increasing actuator diaphragm pressure. If the arrow is pointing in the wrong direction, remove, reverse, and re-install the cam.**

**Isolate the control valve and shut off pressure lines to the valve positioner. Refer to figure 20 for key number locations. Unhook the spring (key 38), and remove the cam bolt and locking nut (keys 6 and 45). Remove the cam (key 4) and spring retainer bracket (key 43). To install the cam, screw the locking nut all the way onto the cam bolt. Attach the cam and spring retainer bracket with the cam bolt. Tighten the bolt to secure the cam. Then, tighten the locking nut against the spring retainer bracket. Hook the spring into the spring retainer bracket.**

When shipped from the factory, 3582 Series valve positioners and the Type 3582i valve positioner are equipped with three cams, marked A, B, and C. Cam A, the linear cam, is installed in the operating position. Cams B and C, the characterized cams are attached to the inside of the case.

Figure 13 shows resultant stem travel due to an incremental instrument pressure change for each cam. In figure 13, the curves are based on 60 degrees cam rotation for 100 percent stem travel. At 50 percent of the input signal span, for example, the stem will travel 50 percent with cam A, 68 percent with cam B, and 32 percent with cam C. Figure 14 shows how the flow characteristics change when using the cams with a valve that has equal percentage characteristics. Figure 15 shows how the flow characteristics change when using the cams with a valve that has linear characteristics.

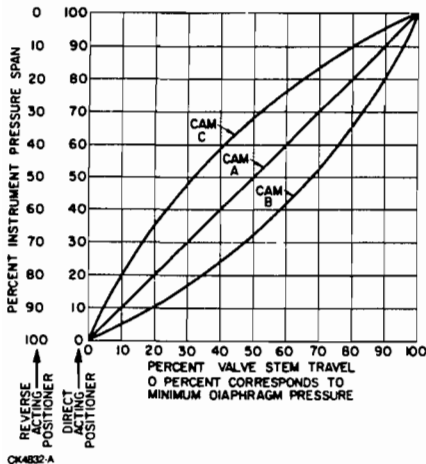


Figure 13. Cam Characteristic Curves

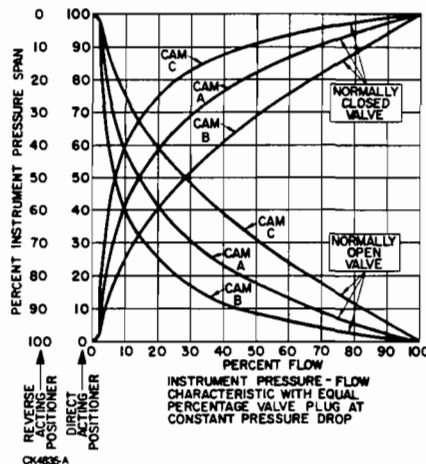


Figure 14. Flow Characteristics with Different Cams and Equal Percentage Valve Plug

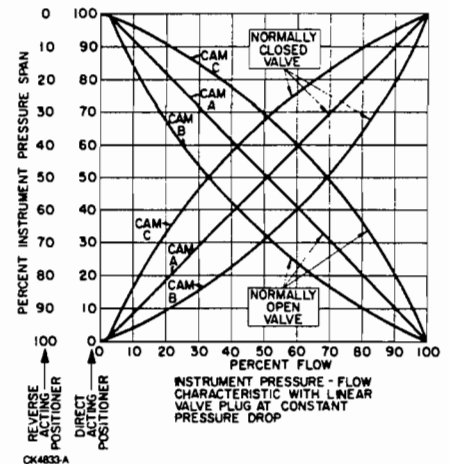


Figure 15. Flow Characteristics with Different Cams and Linear Valve Plug

When cam A is the operating cam, there is a linear relationship between an incremental instrument pressure change and the resultant valve stem travel. The flow characteristic is that of the control valve. Installing either cam B or C as the operating cam, changes the relationship between the incremental instrument pressure change and valve stem travel, thereby modifying the valve flow characteristic.

The linear cam is the only cam available for the 3583 Series valve stem position transmitter. There is always a linear relationship between stem travel and the stem position transmitter output.

### Valve Stem Position Transmitter Cam Information

**Note**

If the small arrow on the valve stem position transmitter cam points up toward the nozzle, output pressure increases with downward stem movement. If the arrow points down, output pressure decreases with downward stem movement. If the arrow is pointing in the wrong direction, remove, reverse, and re-install the cam.

Isolate the control valve and shut off pressure lines to the valve positioner. Refer to figure 20 for key number locations. Unhook the spring (key 38), and remove the cam bolt and locking nut (keys 6 and 45). Remove the cam (key 4) and spring retainer bracket (key 43). To install the cam, screw the locking nut all the way onto the cam bolt. Attach the cam and spring retainer bracket with the cam bolt. Tighten the bolt to secure the cam. Then, tighten the locking nut against the spring retainer bracket. Hook the spring into the spring retainer bracket.

### Valve Positioner Bypass Operation

Type 3582 and 3582D valve positioners are supplied with a bypass assembly. A handle on the bypass assembly permits selecting positioner or bypass operation. Refer to figure 23 for key number locations.

**CAUTION**

Do not use bypass when the valve positioner is reverse-acting or is in split-range operation. In these cases, bypassing the valve positioner sends the input signal directly to the actuator. Such a change will affect the desired operation and possibly upset the system. Use bypass only when the input signal range is the same as the valve positioner output range required for normal actuator operation.

Labels on the bypass block (key 34A) and a pointer on the bypass handle (key 34D) indicate if the input signal from the instrument goes to the positioner or directly to the control valve actuator. Push the bypass handle toward the back of the positioner to move the pointer over the word POSITIONER. With the bypass handle in this position, the input signal goes to the valve positioner bellows and the output pressure of the valve positioner goes to the actuator. Pull the bypass handle forward to move the pointer over the word BYPASS. In this position, the input signal goes directly to the actuator.

Table 4. Standard Instrument Input Signals and Range Springs

INSTRUMENT INPUT SIGNAL RANGE	STANDARD SPAN	ALLOWABLE INPUT SIGNAL <sup>(1)</sup>		RANGE SPRING COLOR	RANGE SPRING PART NUMBER
		Minimum	Maximum		
3-15 psig	12 psig	1 psig	21 psig	Silver	1V621727012
0.2-1.0 bar	0.8 bar	0.07 bar	1.4 bar		
4-20 mA <sup>(2)</sup>	16 mA	2 mA	22 mA		
5-25 psig	20 psig	1 psig	30 psig	Green	1V621827012
0.3-1.7 bar	1.4 bar	0.07 bar	2.0 bar		
6-30 psig	24 psig	1 psig	35 psig	Red	1V621927012
0.4-2.0 bar	1.6 bar	0.07 bar	2.4 bar		

1. Minimum and maximum allowable input signals ensure functional operation.  
2. For Type 3582i, only.

**Note**

A difference between the input signal pressure and the valve positioner output pressure could cause a transient bump in the controlled system when the bypass handle is moved to BYPASS.

With a reverse-acting or split-range valve positioner, the bypass handle may be locked in the POSITIONER position so that bypass cannot be used. To lock the bypass handle in the POSITIONER position, first shut off the instrument and supply pressure to the valve positioner. Then, remove the hex head shoulder screw from the center of the handle. Remove the handle and rotate it 180 degrees and re-install it with the handle between the two lugs cast on the bypass block. Replace the shoulder screw.

**Input Signal Ranges**

Standard input signal ranges for valve positioners and valve stem position transmitters are shown in table 4. Changing from one standard range to another requires changing the range spring. To change the range spring, refer to the instructions for changing the range spring in the maintenance section of this manual. Split-range operation of 3582 Series valve positioners or the Type 3582i valve positioner normally does not require changing the spring. Refer to the section below for split-range information.

**Valve Positioner Split-Range Operation**

The 3582 Series valve positioners and the Type 3582i valve positioner are suitable for split-range operations. In split-range operation, the input signal, either pneumatic or dc current, from a single control device is split between two or more control valves. No additional parts are required to use an existing valve positioner for split-range operation.

Table 5 shows some typical split-ranges for the valve positioners.

Table 5. Split-Range Capabilities

3582 SERIES POSITIONERS				
Split	3 to 15 Psig or 0.2 to 1.0 Bar Input Signal		6 to 30 Psig or 0.4 to 2.0 Bar Input Signal	
	Psig	Bar	Psig	Bar
Two-way	3 to 9 9 to 15	0.2 to 0.6 0.6 to 1.0	6 to 18 18 to 30	0.4 to 1.2 1.2 to 2.0
Three-way	3 to 7 7 to 11 11 to 15	0.2 to 0.5 0.5 to 0.7 0.7 to 1.0	6 to 14 14 to 22 22 to 30	0.4 to 0.9 0.9 to 1.5 1.5 to 2.0
TYPE 3582i POSITIONER				
Split	4 to 20 Milliampere Input Signal			
Two-way	4 to 12 12 to 20			
Three-way	4 to 9.3 9.3 to 14.7 14.7 to 20			

To change to split-range operation, perform the pre-calibration alignment procedures in the Calibration section then perform the following steps. See figure 16 for part locations.

1. Move the flapper assembly along the beam to increase travel. The flapper assembly can be positioned by hand or by using a screwdriver in the slot of the flapper setting adjustment.
2. Vary the input signal, observing the span required to stroke the valve completely.
3. Readjust the flapper assembly along the beam until the desired change in input signal results in full valve travel. For example, for a 3582 Series valve positioner with a 3 to 15 psig (0.2 to 1.0 bar) input signal range spring and a two-way split, a 6 psi (0.4 bar) change should stroke the valve completely.
4. Apply an input signal equal to the low value of the input signal range. For example, for a 3582 Series valve positioner with a 3 to 9 psig (0.2 to 0.6 bar) input signal range, set the input signal at 3 psig (0.2 bar).

5. Adjust the nozzle until the actuator is at the starting position (fully up or fully down depending on the action selected) corresponding to the low input signal.

**Note**

The flapper must approach the nozzle squarely at the midpoint value of the input signal range for proper operation.

On some applications where the input signal span is comparatively small (as found with split-range applications), the nozzle adjustment may not be enough to set the proper starting point. Also, some difficulty may be experienced in keeping a valve positioner from unloading when the input signal continues to increase above the split-range.

For example, for a 3 to 9 psig (0.2 to 0.6 bar) input signal range, the input signal could increase to 15 psig (1.0 bar). Continued bellows travel due to the increased input signal over the split-range would drive the flapper into the nozzle. The impact could possibly cause misalignment between the flapper and nozzle. Such a misalignment, in turn, could affect split-range calibration.

In these cases, adjust the follower assembly screw in addition to the nozzle adjustment to obtain satisfactory results.

**Note**

The 3582 Series valve positioners require a relatively small percentage of the instrument pressure span to obtain full valve travel. With the travel pin set to equal the valve travel, the input signal change required to fully stroke the valve can be reduced to 33 percent of normal input signal change. With the travel pin set to a value greater than the valve travel, the input signal change required to fully stroke the valve can be reduced to a minimum of 20 percent of normal input signal change.

**Changing Valve Positioner Action**

Converting a 3582 Series valve positioner or Type 3582i valve positioner from direct acting (an increasing input signal, either pneumatic or electrical, increases output pressure) to reverse acting (increasing input signal decreases output pressure) or vice versa requires no additional parts. The position of the flapper assembly on the beam determines the action. As shown in figure 16,

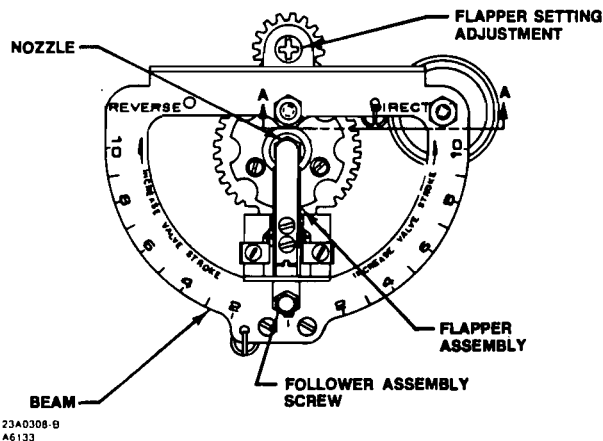
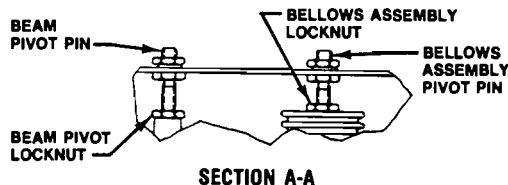


Figure 16. Partial View for Beam Leveling and Calibration

the beam is divided into quadrants. The direct-acting quadrant of the beam is labeled DIRECT and the reverse-acting quadrant is labeled REVERSE. To change the positioner action, simply move the flapper assembly to the opposite quadrant of the beam. Perform the calibration procedures in the valve positioner calibration section.

**Changing Valve Stem Position Transmitter Action**

Refer to figure 20 for key number locations unless otherwise indicated.

The flapper of the 3583 Series valve stem position transmitter is always positioned in the reverse-acting quadrant as shown in figure 19. To reverse the signal, reverse the cam as follows:

1. Unhook the spring (key 38), and remove the cam bolt (key 6), cam (key 4), and spring retainer bracket (key 43).
2. Screw the locking nut (key 45) all the way onto the cam bolt.

**Note**

If The arrow stamped on the cam points toward the nozzle, output pressure increases with downward stem movement. If the arrow points down away from the nozzle, output pressure decreases with downward stem movement.

3. Reverse the cam (key 4) from its original position. Attach the cam and spring retainer bracket with the cam bolt. Tighten the cam bolt to secure the cam. Then tighten the locking nut against the spring retainer bracket.

4. Hook the spring into the spring retainer bracket.

5. After reversing the cam, perform the calibration procedures in the calibration of valve positioners and transmitters section.

## Calibration Of Valve Positioner Or Valve Stem Position Transmitter

### Pre-Calibration Alignment

#### Note

The following procedures for pre-calibration alignment and calibration are applicable for both the 3582 Series and the Type 3582i valve positioners and 3583 Series valve stem position transmitters.

The purpose of alignment is to ensure the correct mechanical position of parts so the valve positioner can be calibrated. Provide the appropriate supply pressure. Also, provide an input signal to the positioner which can be manually set at the midpoint of the desired input signal range.

Refer to figure 16 for parts locations. Refer to figure 20 for key number locations unless otherwise indicated. Position The flapper assembly by hand to different settings on the beam assembly or by using a screwdriver in the slot of the flapper setting adjustment.

#### Note

The beam is leveled at the factory prior to shipment. Once the beam is leveled, no additional leveling should be required unless the beam pivot pin or the bellows assembly pivot pin are changed, the bellows assembly or range spring are replaced, or the valve positioner is changed to split range operation.

To level the beam, proceed as follows:

#### Note

In the following steps, if it is not possible to attain the required output pressure when

adjusting a pivot point, adjust one of the other pivot points slightly. Then, repeat the original pivot adjustment. Continue this process until the required output pressure can be attained.

1. Stroke the actuator to its mid-travel position with a handwheel or a manual loader. Refer to figures 4 and 7. Lift the rotary shaft arm (key 2) so that the 0-degree index marks on the rotary shaft arm align with the case index marks as shown in figure 7. Then, position the travel pin (key 60) so that it is perpendicular to the arm and aligns with the appropriate total actuator travel index mark on the rotary shaft arm. Tighten the locking nut (key 62).

#### Note

Valve stem travels less than 1-1/8 inches (29 mm) require that the travel pin be set at the 1-1/8 inches travel index mark on the rotary shaft arm.

2. Loosen the nozzle locknut and turn the nozzle clockwise to its lowest position. Then screw the nozzle out (counterclockwise) 2 turns and tighten the locknut.

3. Remove any loading pressure and/or disengage any handwheel used to position the actuator. Connect the necessary tubing from the valve positioner output to the actuator pressure connection.

4. Connect the input to the valve positioner and set the input signal value at midrange. For example, for a 3582 Series valve positioner with a 3 to 15 psig (0.2 to 1.0 bar) input signal range, set the input signal at 9 psig (0.6 bar). Then apply supply pressure to the valve positioner.

#### Note

For proper operation, the flapper must approach the nozzle squarely. Inspect the nozzle/flapper alignment. Be sure the flapper is not loose, bent, or twisted.

5. Move the flapper assembly to zero on the beam scale. The output pressure should be at the mid-point value of the output pressure range. If not, loosen the follower assembly screw locknut and adjust the follower assembly screw until the output pressure is equal to the mid-point value of the output pressure range. Tighten the locknut.

6. Move the flapper assembly to position 10 on the direct-acting side of the beam scale. The output pressure should be at the mid-point value of the output pressure range. If not, loosen the bellows assembly

Table 6. Minimum Travel with Given Pin Position

TRAVEL PIN POSITION ALONG ROTARY SHAFT ARM	MINIMUM TRAVEL AVAILABLE	
	Inch	mm
1-1/8	1/4	6
1-1/2	5/16	8
2	7/16	11
2-1/2	1/2	13
3	5/8	16
4	7/8	22

locknut and adjust the bellows pivot pin until the output pressure is equal to the mid-point value of the output pressure range. Tighten the locknut.

7. Move the flapper assembly to the left to position 10 on the reverse-acting side of the beam. The output pressure should be at the mid-point value of the output pressure range. If not, loosen the beam pivot pin locknut and adjust the beam pivot pin until the output pressure is equal to the mid-point value of the output pressure range. Tighten the locknut.

8. Repeat steps 5, 6, and 7 to optimize alignment. Recheck to make sure the flapper approaches the nozzle squarely. If it does not, adjust the nozzle and re-level the beam. After alignment, the valve positioner is ready for calibration.

## Calibration

1. Shut off the supply pressure to the valve positioner. Connect or reconnect the necessary tubing from the valve positioner output to the actuator supply connection. Connect the input to the valve positioner and set the input signal value at midrange.

2. Move the flapper assembly to approximately position 6 in the proper operating quadrant of the beam (direct or reverse acting), and apply supply pressure to the valve positioner. The actuator should move close to its mid-travel position. If it does not, first check for loose linkage or improper cam installation. If the beam is not properly leveled, a minor nozzle height adjustment might be necessary to make the desired input signal value correspond to the starting point of travel.

3. Apply an input signal equal to the low value of the input signal range. For example, for a 3582 Series valve positioner with a 3 to 15 psig (0.2 to 1.0 bar) input signal range, set the input signal at 3 psig (0.2 bar). Loosen the nozzle locknut and adjust the nozzle until the actuator moves to the proper end of its travel. Changing the nozzle position is intended only as a means of zero trim adjustment. Whenever nozzle position is changed, the zero reference point is changed.

4. Apply an input signal equal to the high value of the input signal range and observe the actuator stem travel. If the stem travel is short of its expected range, increase

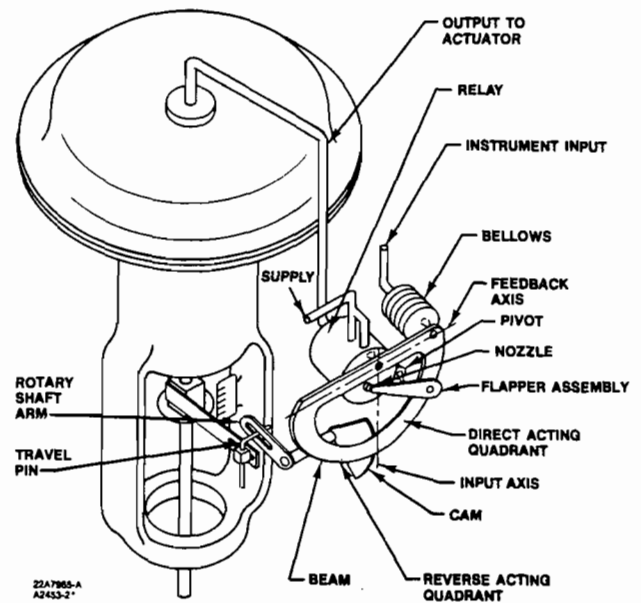


Figure 17. Schematic Illustration of 3582 Series Positioner

the travel by moving the flapper assembly to a higher number on the beam. If the desired stem travel occurs before the input signal reaches the high value of the input signal range, decrease the travel by moving the flapper assembly toward a lower number on the beam.

5. Repeat steps 3 and 4 until the correct travel is achieved. Each time the flapper position is changed in step 4, repeat step 3 to provide proper zero.

Moving the flapper assembly toward zero on the beam scale decreases stem travel. Table 6 lists the minimum stem travel available for different travel pin settings. For example, with a travel pin setting of 2 the minimum stem travel possible, for the full input signal range, would be 7/16-inch (11 mm).

## Principle of Operation

### 3582 Series Valve Positioners

The 3582 Series (the Type 3582 and Types 3582A, C, D, and G pneumatic valve positioners) accept a pneumatic input signal from a control device. Figure 17 is an operational schematic for a direct-acting pneumatic valve positioner.

As shown in figure 17, in a diaphragm-actuated, sliding stem control valve package with a 3582 Series valve positioner, supply pressure is connected to the Type 83L relay. A fixed restriction in the relay limits flow to the nozzle so that when the flapper is not restricting the nozzle, air can bleed out faster than it is being supplied.

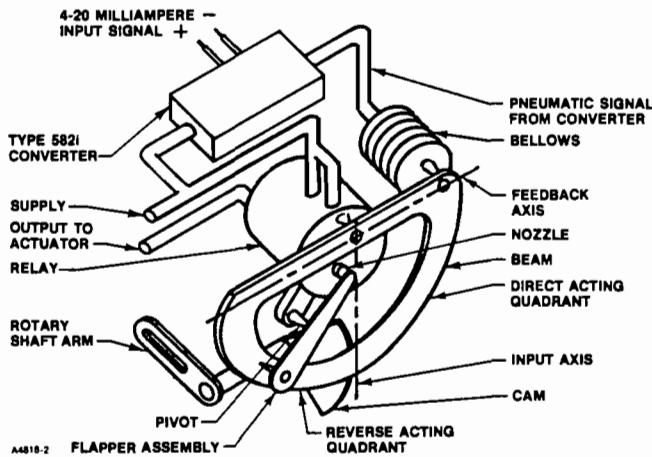


Figure 18. Schematic Illustration of Type 3582i Positioner

The input signal from the control device is connected to the bellows. When the input signal increases, the bellows expands and moves the beam. The beam pivots about the input axis moving the flapper closer to the nozzle. The nozzle pressure increases and, through relay action, increases the output pressure to the actuator. The increased output pressure to the actuator causes the actuator stem to move downward. Stem movement is fed back to the beam by means of a cam. As the cam rotates, the beam pivots about the feedback axis to move the flapper slightly away from the nozzle. The nozzle pressure decreases and reduces the output pressure to the actuator. Stem movement continues, backing the flapper away from the nozzle, until equilibrium is reached.

When the input signal decreases, the bellows contracts (aided by an internal range spring) and the beam pivots about the input axis to move the flapper away from the nozzle. Nozzle pressure decreases and the relay permits the release of diaphragm casing pressure to atmosphere. The actuator stem moves upward. Through the cam, stem movement is fed back to the beam to reposition the flapper closer to the nozzle. When equilibrium conditions are obtained, stem movement stops and the flapper is positioned to prevent any further decrease in diaphragm case pressure.

The principle of operation for reverse acting units is similar except that as the input signal increases, the diaphragm casing pressure is decreased. Conversely, a decreasing input signal causes an increase in the pressure to the diaphragm casing.

### Type 3582i Valve Positioner

As shown in figure 18, the Type 3582i electro-pneumatic valve positioner has a Type 582i electro-pneumatic converter attached to the valve positioner. The 582i contains an I/P module which provides a pneumatic output

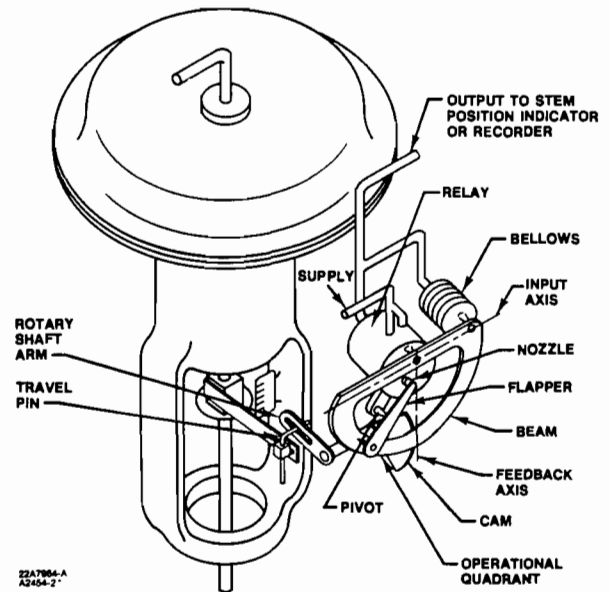


Figure 19. Schematic Illustration of 3583 Series Transmitter

proportional to a dc current input signal. The dc current input operates coils in a force balanced beam system which in turn, control bleed air through an integral nozzle/flapper arrangement. The nozzle pressure provides the pneumatic input signal used by the pneumatic valve positioner.

### 3583 Series Valve Stem Position Transmitters

3583 Series (Type 3583, 3583C) pneumatic valve stem position transmitters are mechanically linked to the valve stem in a diaphragm-actuated, sliding-stem control valve package. A change in the position of the valve stem changes the output pressure produced by the position transmitter. This signal is then piped to a reporting or recording device to indicate valve stem position.

The action of a valve stem position transmitter can be changed by reversing the internal cam. The valve stem position transmitter cam is supplied with an arrow stamped on one side. The cam can be positioned to obtain either increasing or decreasing output pressure with downward stem motion. If the cam arrow points toward the nozzle, the output pressure increases; if the cam points away, the output pressure decreases with downward stem motion.

Figure 19 depicts a diaphragm actuator which produces downward stem motion for increasing actuator pressure. For a stem position transmitter, the flapper assembly is always positioned in the reverse-acting quadrant



of the beam. Supply pressure is connected to the Type 83L relay. A fixed restriction in the relay limits flow to the nozzle so that when the flapper is not restricting the nozzle, air can bleed out faster than it is being supplied.

As the pressure to the diaphragm actuator increases, the valve stem moves downward, causing the internal cam to rotate. Cam rotation causes the beam to pivot about the input axis moving the flapper closer to the nozzle. The nozzle pressure increases which, through relay action, increases the output pressure.

The output pressure is also connected to the bellows. As the output pressure increases, the bellows expands, causing the beam to pivot about the feedback axis moving the flapper slightly away from the nozzle until equilibrium is reached. The position transmitter output pressure is now proportional to the valve stem position.

As the pressure to the diaphragm actuator decreases, the valve stem moves upward, causing the internal cam to rotate. Cam rotation causes the beam to pivot about the input axis moving the flapper away from the nozzle. The nozzle pressure decreases which, through relay action, decreases the output pressure. The bellows contracts, causing the beam to pivot about the feedback axis and moving the flapper closer to the nozzle until equilibrium is reached. The position transmitter output pressure is again proportional to the valve stem position.

## Maintenance

### WARNING

**Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:**

- **Disconnect any operating lines providing air pressure, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

**For explosion proof applications, disconnect power before removing the converter housing cap in an explosive atmosphere.**

Due to normal wear or damage from external sources (such as debris in the supply medium), periodic maintenance or repair of the valve positioner or valve stem position transmitter may be necessary. Maintenance of these units consists of troubleshooting, removal for inspection, and replacement of component parts.

### CAUTION

**When replacing components, use only components specified by Fisher Controls. Substitution with other components may result in the positioner or transmitter no longer meeting safety certification requirements. Also, always use proper component replacement techniques. Improper techniques and poor quality repairs can impair the safety features of the device.**

In case of operational difficulties, the valve positioner or valve stem position transmitter should first be checked to see that adjustments have been properly made. All pressure lines and connections should be checked for leaks.

The pneumatic relay and gaskets should also be inspected and replaced if necessary. If necessary, clean or replace the relay restriction. Remove the restriction assembly (key 9 in figure 25). Clean the restriction, install a new O-ring (key 14 in figure 25) if necessary, and replace the restriction assembly.

Instructions are given below for:

- changing the range spring;
- replacing gaskets, nozzle O-rings, and the relay;
- adjusting the flapper pivot;
- replacing the Type 582i converter primary O-ring and filter;
- replacing the Type 582i converter cover O-ring;
- removing the Type 582i converter; and
- reassembling the Type 582i converter.

## Changing the Range Spring

Unless otherwise noted, key number locations are shown in figure 20.

The range spring is inside the bellows assembly. Standard range spring data is given in table 4. When an input signal range is split to operate two or more control valves, normally changing the range spring is not necessary. The input signal range for the range spring is stamped on the nameplate.

Perform the following procedure to change the range spring in a valve positioner or valve stem position transmitter.

1. Unhook the extension springs (keys 27, 77) from the beam (key 29).
2. Loosen and remove the two screws (key 13), and lock washers (key 12) that hold the bellows assembly (key 7) in place.
3. Lift out the beam and bellows assembly. Be careful not to lose the small O-ring (key 11).
4. Loosen the machine screw (key 10), and remove the range spring (key 8).
5. Install a new range spring, making sure the small end of the spring is against the spring seat (key 9). Replace the spring seat and tighten the screw.
6. If the O-ring (key 11) is worn or damaged, replace it with a new one after applying lubricant (key 94). Make sure the O-ring is in place, then install the bellows assembly, securing it with two mounting screws and lock washers.
7. Install the beam over the pivots and hook the springs to the beam.
8. Make any minor adjustments that may be necessary to re-level the beam as outlined in the pre-calibration alignment procedures of the valve positioners or the valve stem position transmitters calibration section. After leveling the beam, calibrate the unit according to the appropriate calibration instructions.

### Replacing Gaskets

Unless otherwise noted, key numbers used in this procedure are shown in figures 23 and 24.

A gasket (key 34C) is located behind the bypass handle (key 34D) of the 3582 Series valve positioners or manifold (key 34D) of the 3583 Series valve stem position transmitters.

1. Remove the screw (key 34G), and lift out the bypass handle or manifold.
2. Remove the gasket.
3. Apply lubricant (key 94) to both sides of the replacement gasket when used with the bypass assembly of the 3582 Series valve positioners. Do not apply lubricant to the gasket when the bypass assembly is not used.
4. Set the new gasket in place on the four locating pins and replace the bypass handle or manifold.

The case gasket (key 104) is located between the case (key 1 in figure 20) and the bypass block (key 34A) in a 3582 Series valve positioner or a 3583 Series valve stem position transmitter or the housing of the Type 5821 converter (key 1 in figure 26).

5. Remove the two mounting screws (key 105 in figures 23 and 24; key 11 in figure 26) that hold the bypass block or converter housing to the case and remove the unit to expose the case gasket.
6. Install a new gasket and replace the bypass block or converter housing.

### Replacing the Nozzle O-Ring

Unless otherwise noted, key numbers are shown in figures 21 and 22.

1. Remove the two screws (key 19C) that hold the flapper and follower assembly (keys 19B and 19G) to the adjustment arm (key 19A).

#### CAUTION

**For proper operation, be careful not to bend or twist the flapper or nick the nozzle orifice during reassembly.**

2. Carefully remove the flapper and follower assembly for access to the nozzle (key 18 in figure 20).
3. Loosen the locking nut (key 71), and unscrew the nozzle (key 18).
4. Remove the locking sleeve (key 72) from the nozzle adaptor (key 3). The nozzle adaptor is bonded to the positioner case with adhesive (key 96) and should not be removed.
5. Inspect the O-ring (key 73) on the nozzle adaptor and replace the O-ring, if necessary. If replacing the O-ring, apply lubricant (key 93) to the O-ring before installing it on the nozzle adaptor.
6. Reinstall the nozzle onto the nozzle adaptor, leaving the locking nut loose.
7. Replace the flapper and follower assembly. Make sure the letter "T" on the flapper is visible from the front of the positioner or transmitter.
8. Perform the pre-calibration alignment and calibration procedures in the Calibration of Valve Positioner or Valve Stem Position Transmitter section.

## Removing and Replacing the Relay

Use the following procedure when removing or replacing a relay assembly that requires maintenance, or when installing a replacement relay assembly. Refer to figure 25 for key number locations.

1. For valve positioners using a bypass, direct action, and a full-range input signal, place the positioner in bypass operation by moving the bypass handle to BY-PASS. Then, shut off the supply pressure. For all other valve positioners and valve stem position transmitters, isolate the control valve from the system and shut off all pressure lines.

### Note

**A difference between input and valve positioner output pressure could cause a transient bump in the controlled system when the bypass handle is moved to BYPASS.**

2. Remove the Type 83L relay (key 32 in figure 20) from the back of the case by loosening the two mounting screws (key 10).

3. Reinstall the new relay assembly on the case, making sure the O-rings (keys 13 and 15) are in place. Secure with the two mounting screws (key 10).

4. Resume operation by moving the bypass handle to the POSITIONER position or by connecting the valve positioner or valve stem position transmitter and control valve to the system.

## Relay Maintenance

Use the procedure below to repair and replace the relay assembly. Refer to figure 25 for key number locations.

Obtain the relay repair kit listed in the parts kits. This kit provides the parts required to repair the relay assembly.

1. Remove the relay by performing steps 1 and 2 in the relay removal and replacement procedure.

2. Remove the four screws (key 16) and separate the relay base (key 1) from the exhaust block (key 2) by inserting a screwdriver between the external casting lugs and twisting.

3. Thread the mounting screws (key 10) out of the exhaust block (key 2), then separate the exhaust block from the output block assembly (key 4) and the output block assembly from the relay cap (key 3).

4. Remove the diaphragm (key 8), diaphragm assembly (key 7), spring (key 12), inner valve (key 6), gasket (key 5) and spring (key 11).

5. Remove the nozzle and adapter assembly (key 9) and remove the O-rings (keys 14 and 19). Clean the nozzle opening with solvent and blow dry with air. If the opening is plugged, use a wire to clear the opening. Be careful not to enlarge the hole. Then, clean with solvent and blow dry with air.

6. Apply lubricant (key 20) to the O-rings (keys 14 and 19) before re-installing the nozzle and adapter assembly into the relay base. Do not over tighten.

7. Fold the diaphragm assembly (key 7) over and push it through the exhaust block (key 2). Set the diaphragm assembly and exhaust block aside.

8. Invert the relay cap (key 3) and insert the mounting screws (key 10) through the holes in the relay cap. Hold the screws in place while assembling the remaining parts. The screws serve as studs to keep the parts aligned as they are assembled.

9. Install the spring (key 11). Align the holes in the gasket with the holes in the cap. Also, be sure the tab on the gasket aligns with the casting lug on the cap. Place the gasket (key 5) on the relay cap. Set the inner valve (key 6) on the spring.

10. Align the casting lugs and holes in the output block assembly (key 4) with the casting lug and holes in the relay cap (key 3). Place the output block assembly on the gasket. The inner valve will protrude through the valve seat insert of the output block assembly. Install the spring (key 12). Hold the assembled parts in place.

11. Ensure the tab on the diaphragm assembly (key 7) aligns with the casting lug on the exhaust block (key 2). With the casting lug on the exhaust block aligned with the casting lug on the output block assembly, place the diaphragm assembly and exhaust block over the output block assembly so that the inner valve fits into the hole in the diaphragm assembly. Screw the mounting screws through the exhaust block. Hold the assembled parts in place.

12. Ensure the holes in the diaphragm (key 8) align with the holes in the exhaust block (key 2) and that the tab on the diaphragm aligns with the casting lug on the exhaust block. Place the diaphragm on the exhaust block (key 2).

13. Align the casting lug on the relay base (key 1) with the casting lug on the exhaust block (key 2). Place the relay base on the diaphragm.

14. Insert the four screws (key 16) through the relay base (key 1), exhaust block, output block assembly and into the relay cap. Tighten evenly in an "X" pattern.

15. Install the relay assembly on the positioner case.

16. Apply supply pressure to the positioner case and check the relay assembly for leaks with soap solution.

## Adjusting the Flapper Pivot

Key numbers used in this procedure are shown in figure 22.

1. Loosen the two screws (key 19C).
2. Tighten the pivot pin (key 19L) by compressing the upturned ears of the arm support (key 19K). Tighten the screws (key 19C) and make sure the flapper (key 19B) does not rub on the supports.
3. The flapper should be snug, but not constricting to pivot action.

## Replacing the Type 582i Converter Primary O-Ring and Filter

Key numbers used in this procedure are shown in figure 26.

1. Locate and remove the nozzle restriction adaptor assembly (key 4).
2. Inspect and replace, if necessary, the O-rings (keys 5 and 6). Apply lubricant (key 15) to the O-ring before replacing.
3. Inspect and replace the filter cartridge (key 23).

## Replacing the Type 582i Converter Housing Cap O-Ring

Key numbers used in this procedure are shown in figure 26.

1. Unscrew and remove the converter housing cap (key 2). Inspect and replace the O-ring (key 8), if necessary. Apply lubricant (key 15) to the O-ring before replacing.

## Removing the Type 582i Converter

During the following converter removal procedures, refer to figure 26 for key number locations.

### CAUTION

The I/P module should never be disassembled because the magnetism in the coils will decrease permanently. If troubleshooting or alignment attempts indicate a faulty I/P module, replace the module or return the converter to your Fisher sales representative or sales office for repair.

### Note

To check the operation of the I/P module, remove the pipe plug (key 12), and connect a pressure gauge. Provide a 20 psig supply pressure to the converter. With a 4-milliamperere input signal the pressure output should read 2.3 to 3.5 psig (0.16 to 0.24 bar). With a 20-milliamperere input signal the pressure output should read 14.0 to 15.5 psig (0.96 to 1.07 bar).

1. Turn off the input signal to the converter. Release all supply pressure from the valve positioner.

2. Remove the housing cap (key 2).

3. Note the location of the wires, disconnect the field wiring from the terminal block. Disconnect the grounding wire from the external ground screw (key 10).

4. To remove the I/P module, remove the two screws (key 9), and pull the module out of the housing. Inspect the O-ring (key 6) and replace it, if necessary. Apply lubricant (key 15) to the O-ring before replacing.

- a. To remove the entire Type 582i converter from the Type 3582i valve positioner, continue with steps 4 through 6.

- b. To replace the I/P module only, obtain a replacement I/P module listed in the parts list and refer to the procedures for reassembling the Type 582i converter.

4. Disconnect the supply tubing, output tubing, and electrical conduit from the converter.

5. If necessary, remove the Type 67AFR regulator by removing the two screws (key 13). Then, remove the regulator from the converter assembly. Inspect the O-ring (key 3) and replace it if necessary. Apply lubricant (key 15) to the O-ring before replacing.

6. Remove the two screws (key 11) holding the Type 582i converter to the valve positioner case. Remove the converter from the valve positioner case (key 1 in figure 20). Inspect the gasket (key 20) and replace it if necessary.

## Reassembling the Type 582i Converter

During the following converter reassembly procedures, refer to figure 26 for key number locations.

1. If the Type 582i converter was removed from the valve positioner, install a new gasket (key 20) between the converter housing and the valve positioner case. Attach the converter housing to the valve positioner case with the screws (key 11) and tighten the screws.

2. If the I/P module was removed from the Type 582i converter, reinstall the I/P module in the converter housing. Secure the I/P module with the two screws (key 9).

3. If other valve positioner components are removed, refer to the appropriate reassembly procedures and assemble the valve positioner completely.

4. Reconnect the supply tubing, output tubing, and conduit to the valve positioner.

5. Reconnect the wiring to the terminal block. Do not overtighten the terminal screws. Maximum torque is 4 lbf-in. (0.45 N-m). Reconnect the grounding wire to the housing ground screw (key 10) and replace the cap (key 2).

**Note**

To check the operation of the I/P module, remove the pipe plug (key 12), and connect a pressure gauge. Provide a 20 psig supply pressure to the converter. With a 4-milliamperere input signal the pressure output should read 2.3 to 3.5 psig (0.16 to 0.24 bar). With a 20-milliamperere input signal the pressure output should read 14.0 to 15.5 psig (0.96 to 1.07 bar).

7. Plug the output connection and apply 35 psig (2.4 bar) to the supply pressure connection.

**CAUTION**

Do not apply a signal greater than 35 milliamperes to the I/P module. Higher signal values may damage the converter module.

8. Apply a 20 milliamperere dc current input signal to the converter.

9. Check for leaks using a soap solution. Check any components which were disassembled or disconnected.

**Parts Ordering**

A serial number is assigned to each valve positioner or valve stem position transmitter and is stamped on the nameplate. Always refer to this number when corresponding with your Fisher representative regarding spare parts or technical information. When ordering parts, also give the eleven-digit part number shown in the following parts list.

**Parts Kits**

Description	Part Number
Repair kit for positioner/transmitter Kit contains keys 11, 16, 17, 33B, 34C, 34H, and 73. This kit also contains keys 18C and 18E for 3580 and 3581 Series positioners For standard temperature applications	R3580X00022
For high temperature applications	R3580X00032
Repair kit for Type 582i electro-pneumatic converter Kit contains keys 3, 5, 6, 8, 20, and 23	R582X000012
Repair kit for Type 83L Relay Kit contains keys 5, 6, 7, 8, 11, 13, 14, 15, and 19 For Relays with std. const.	R83LX000012
For Relays with hi-temp. const.	R83LX000022
Replacement kit for Type 83L Relay Kit contains keys 10, 13, 15, 32 For 3582 Series, std. const.	R3580XRS012
For 3582 Series, hi-temp. const.	R3580XRH012
For 3583 Series, std. const.	R3580XRS022
For 3583 Series, hi-temp. const.	32B0255X0E2

**Parts List**

**Note**

Parts in the following list are common to both the 3582 Series valve positioners and the 3583 Series position transmitters, unless identified by specific type or series number.

When replacing either extension spring (key 27 or 77 in figure 20), check the springs being used in the valve positioner or valve stem position transmitter. If one of the springs has a red color code and the other has a yellow color code, either spring could be replaced independently. If the springs being used do not have color codes, both springs must be replaced.

**Diagnostic Connections (figure 9)**

FlowScanner™ valve diagnostics system hook-up.

Includes connector body and body protector. If ordered for units with gauges, a stem is also included. Also, part number provides correct quantities of each item.

Description	Part Number
<b>For 3582 Series pneumatic valve positioners</b>	
For units w/gauges	
SST fittings	12B8045 X012
brass fittings	12B8045 X022
For units w/o gauges	
SST fittings	12B8045 X032
brass fittings	12B8045 X042
<b>For 3582i electro-pneumatic valve positioners</b>	
For units w/gauges	
SST fittings	12B8046 X012
brass fittings	12B8046 X022
For units w/o gauges	
SST fittings	12B8046 X032
brass fittings	12B8046 X042

## Positioner/Transmitter Common Parts (figure 20)

Key	Description	Part Number	Key	Description	Part Number
1	Case Assembly	11B8556 X012			
2*	Shaft Assembly, SST/steel For travel up to 2-1/8 inch (54 mm) For travel up to 4-inch (102 mm)	15A9609 X012 15A9609 X022			
3	Nozzle Adaptor, SST	12A2613 X012			
4	Cam, SST Cam A (For all types) Cam B (For all except Types 3583, 3583C) Cam C (For all except Types 3583, 3583C)	45A9614 X012 45A9615 X012 45A9616 X012	35	Pipe Plug, pl steel Req'd when gauges are not used: 3 req'd for Type 3582, 3582A 1 req'd for Types 3583, 3583C	1D8293 28982
5	Machine Screw, pl steel (3582 Series only, not shown)	1A7690 28982	36*	Output Gauge, Dual Scale Types 3582, 3582G, 3583 0-30 psig/0-2 kg/cm <sup>2</sup> 0-60 psig/0-4 kg/cm <sup>2</sup>	11B4040 X042 11B4040 X052
6	Cam Bolt, 416 SST	12A2616 X012	36*	Output Gauge, Triple Scale Types 3582, 3582G, 3583 0-30 psig/0-0.2 MPa/0-2 bar 0-60 psig/0-0.4 MPa/0-4 bar	11B4040 X012 11B4040 X022
7*	Bellows Assembly, brass	12A7360 X012	37*	Supply Gauge, Dual Scale Types 3582, 3582G, 3583 0-30 psig/0-2 kg/cm <sup>2</sup> 0-60 psig/0-4 kg/cm <sup>2</sup>	11B4040 X042 11B4040 X052
8	Range Spring, pl steel (also see table 4) 3 to 15 PSI (0.2 to 1.0 bar) 5 to 25 PSI (0.3 to 1.7 bar) 6 to 30 PSI (0.4 to 2.0 bar)	1V6217 27012 1V6218 27012 1V6219 27012	37*	Supply Gauge, Triple Scale Types 3582, 3582G, 3583 0-30 psig/0-0.2 MPa/0-2 bar 0-60 psig/0-0.4 MPa/0-4 bar	11B4040 X012 11B4040 X022
9	Spring Seat, aluminum	12A7355 X012	38	Extension Spring, pl steel	12A2937 X012
10	Machine Screw, pl steel	1B2856 28982	39	Shipping Stop (not shown)	1V4517 06992
11*	O-Ring Nitrile (std. const.) Fluoroelastomer (hi-temp. const.)	1F4636 06992 1N5714 06382	42	Hex Nut, pl steel (2 req'd)	1A5735 28982
12	Lockwasher, pl steel (2 req'd)	1H3223 28982	43	Spring Retainer Bracket, SST	25A9611 X012
13	Machine Screw, pl steel (2 req'd)	1A3294 X0022	44	Gear Mounting Plate, aluminum	12A2611 X012
18	Nozzle, SST 3582 Series 3583 Series	12A9840 X012 12A9841 X012	45	Locking Nut, aluminum	12A2618 X012
19	Flapper Sub-Assembly	13A1451 X012			
	<b>Note</b>				
	Parts 19A through 19L are shown in figure 22.				
19A	Adjustment Arm, pl steel	2V6066 25182			
19B	Flapper, SST	13A1314 X012			
19C	Machine Screw, pl steel (2 req'd)	1V6056 28982			
19D	Flapper Arm, aluminum	23A1318 X012			
19E	Machine Screw, pl steel (2 req'd)	1A3450 28982	46*	Instrument Gauge, Dual Scale 0-30 psig/0-2 kg/cm <sup>2</sup> (3-15 psig/0.2-1.0 kg/cm <sup>2</sup> ranges) 0-60 psig/0-4 kg/cm <sup>2</sup> (5-25 psig/0.4-1.8 kg/cm <sup>2</sup> ranges) (6-30 psig/0.4-2.0 kg/cm <sup>2</sup> ranges)	11B4040 X042 11B4040 X052
19F	Flapper Spring, SST	13A1316 X012	46*	Instrument Gauge, Triple Scale 0-30 psig/0-0.2 MPa/0-2 bar (3-15 psig/20-100 kPa/0.2-1 bar ranges) 0-60 psig/0-0.4 MPa/0-4 bar (5-25 psig/35-170 kPa/0.3-1.7 bar ranges) (6-30 psig/40-200 kPa/0.4-2 bar ranges)	11B4040 X012 11B4040 X022 11B4040 X022
19G	Follower Assembly, 416 SST/nylon	1K3758 000A2	47	Test Connection (3 req'd for Types 3582C, 3582D) (2 req'd for Type 3583C)	1N9088 99012
19H	Hex Nut, pl steel	1A3303 28982	71	Locking Nut, aluminum	12A2615 X012
19J	Lockwasher, pl steel	1H2671 28982	72	Locking Sleeve, aluminum	12A2619 X012
19K	Arm Support, SST	13A1315 X012	73*	O-Ring (2 req'd) Nitrile (std. const.) Fluoroelastomer (hi-temp. const.)	10A0871 X012 14A0592 X012
19L	Pivot Pin, 440C SST	13A1317 X012	75	Machine Screw, pl steel	1H2675 28992
20	Setting Adjustment Gear, nylon	2U9052 06162	76	Beam Pivot Pin, SST	12A7358 X012
21	Flapper Assembly Retainer, SST	2U9053 36012	77	Extension Spring <sup>(2)</sup> , pl steel, red code color	14A8215 X012
23	Machine Screw, pl steel (2 req'd)	1A3450 28982			
25	Nameplate, aluminum	12B4376 X0A2			
26	Self Tapping Screw, steel (2 req'd)	1P4269 28982			
27	Extension Spring <sup>(2)</sup> , pl steel, yellow color code	14A8214 X012			
28	Machine Screw, pl steel (3 req'd)	1H7365 28982			
29	Beam Sub-Assembly	12A8869 X022			
30	Bellows Pivot Pin, SST	12A7357 X012			
32	Type 83L Relay—See "Type 83L Relay" section of this parts list				
33	Cover Assembly For all types, plastic	22B4905 X012			

\* Recommended spare part.  
2. Please read the note at the beginning of the Parts List section.

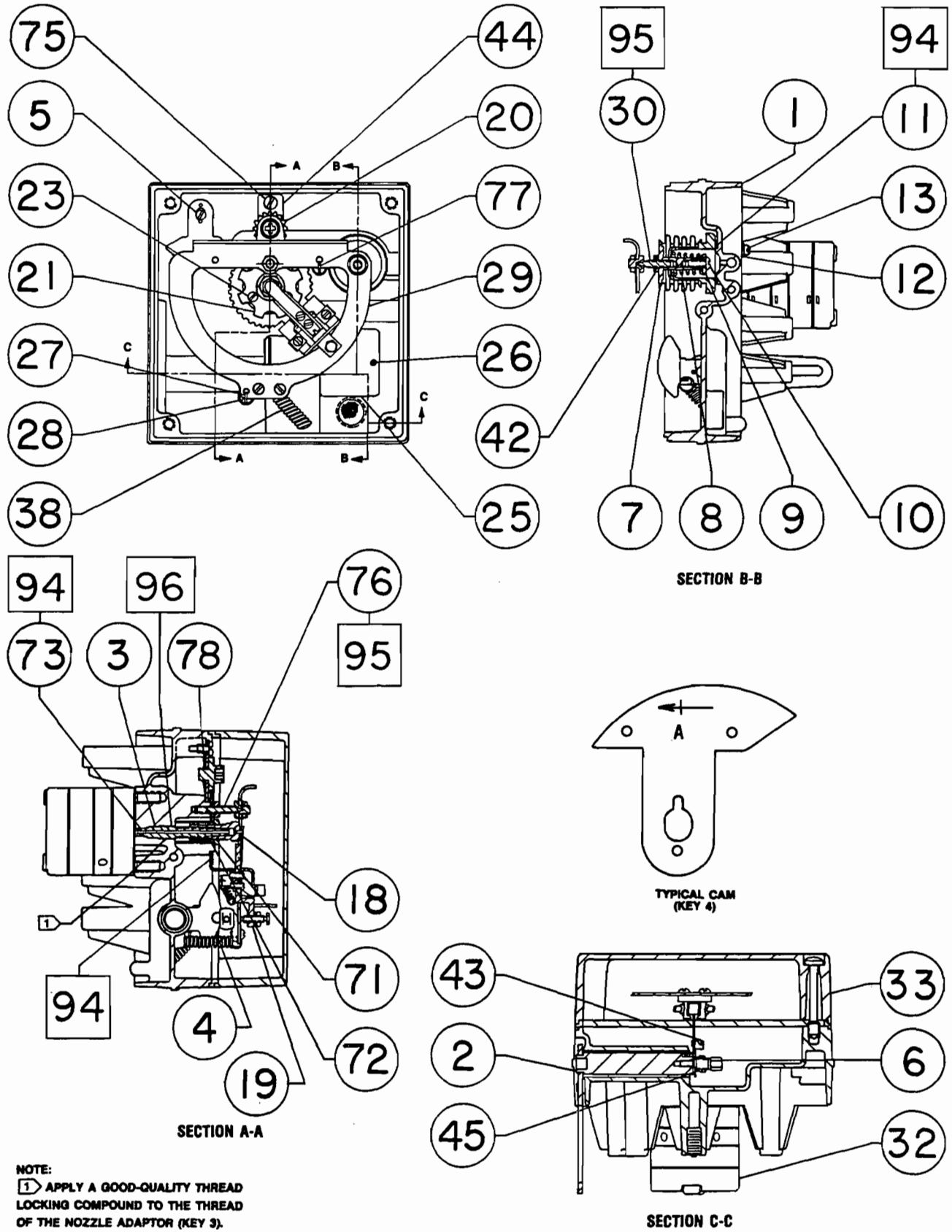


Figure 20. 3582 and 3583 Series Positioners and Transmitters Assembly Drawing

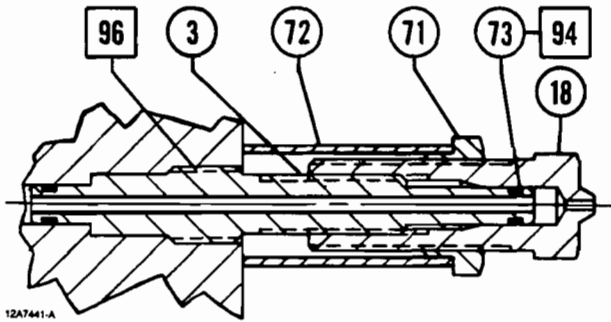


Figure 21. Nozzle Sub-Assembly

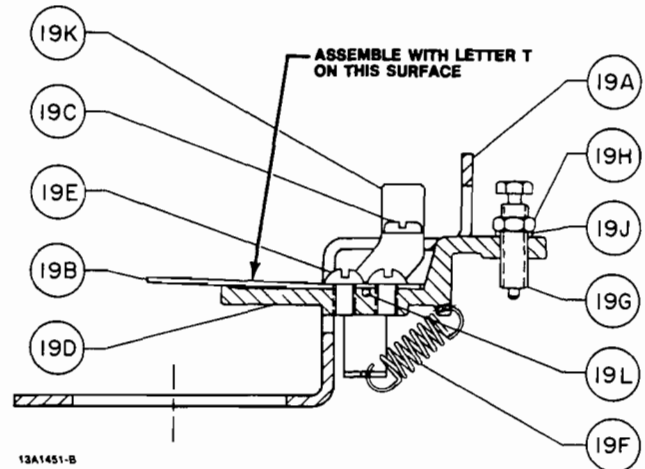


Figure 22. Flapper Sub-Assembly (Key 19)

Key	Description	Part Number
78	Speed Nut, SST	12A0801 X012
93	Anti-seize Compound, Zink Plate No. 770 <sup>(3)</sup> 1 pound (0.5 kg) can (not furnished with positioner)	1M5240 06992
94	Lubricant, Dow Corning 111 <sup>(4)</sup> 5.3 oz (0.1 kg) tube (not furnished with positioner)	1M5282 06992
95	Lubricant, Lubriplate MAG-1 <sup>(5)</sup> 1 lb (0.45 kg) can (not furnished with positioner)	1M1100 X0012
96	Adhesive, Loctite No. 680 <sup>(6)</sup> 50 cc bottle	1M3630 X0012

**Note**

Parts 104 and 105 shown in figures 23 and 24. Part 107 shown in figure 24.

103*	O-Ring, nitrile, (not shown) used with integrally mounted Type 67AFR filter regulator	1E5914 06992
104*	Case Gasket, Std. const.	1U9078 04132
	Hi-temp. const.	1U9078 X0012
105	Machine Screw, SST (2 req'd)	12B0909 X012
107	Pipe Plug, pl steel for Type 3583C	1A7675 24662
108	Shipping tag (not shown)	1N5864 06992

**For Units With Bypass (figure 23)**

**Note**

Bypass block assembly (key 34) and parts are listed below. Non-bypass block assembly (also key 34) and parts are listed following the bypass block assembly and parts.

34	Block Assembly Types 3582, 3582D	21B8557 X012
34A	Bypass Block, aluminum	41B5987 X012
34B	Groove-Pin, pl steel (not shown) (4 req'd)	1L9428 28992
34C*	Bypass Gasket, cork	1V6062 04132
34D	Bypass Handle, aluminum	2V6071 08012
34E	Spring, pl steel	1V6063 X0022
34F	Washer, polyethylene	1V6061 06992
34G	Screw, pl steel	1V6058 24642
34K	Spring Seat, SST	1V6060 35032
34L	Spring Retainer, pl steel Types 3582, 3582D	1V6059 25072

\* Recommended spare part.  
3. Trademark of Armit Laboratories.  
4. Trademark of Dow Corning Corp.  
5. Trademark of Flake Brothers Refining Co.  
6. Trademark of Loctite Corp.

Key	Description	Part Number
<b>For Units Without Bypass (figure 24)</b>		
34	Non-Bypass Block Assembly Std. const.	21B8555 X012
	Types 3582A, 3582C, 3582G	21B8554 X012
	Types 3583, 3582C	
	Hi-temp. const.	
	Types 3582A, 3582C	21B8555 X022
	Type 3583C	21B8554 X022
34A	Bypass Block, aluminum	41B5987 X012
34C*	Gasket Std. const.	1V6062 04132
	Hi-temp. const.	1V6062 X0012
34D	Manifold 3582 Series, std. and hi-temp. const.	1V9429 08012
	3583 Series, std. and hi-temp. const.	10A0746 X012
34G	Cap Screw, pl steel	1J5241 28982

**Type 83L Relay (figure 25)**

1	Relay Base, aluminum 3582 Series	42B0245 X012
	3583 Series	12B0246 X012
2	Exhaust Block, aluminum	23A0141 X012
3	Relay Cap, aluminum	3U9019 08012
4	Output Block Assembly aluminum/SST	1U9006 000A2
5*	Gasket Nitrile/nylon (std. const.)	1V5579 02032
	Polyacrylic/nylon (hi-temp. const.)	1V5579 X0042
6*	Inner, Valve, SST	1U9016 35032
7*	Diaphragm Assembly Std. const.	1U9018 000A2
	Hi-temp. const.	1U9018 X0072
8*	Diaphragm Nitrile/nylon (std. const.)	1V5578 02032
	Polyacrylic/nylon (hi-temp. const.)	1V5578 X0052
9	Nozzle & Adaptor Assembly 3582 Series	12B0247 X012
	3583 Series	12B0248 X012
10	Relay Mounting Screw, SST (2 req'd)	1U9012 38982
11	Spring, SST	1P4204 37022
12	Spring, pl steel	19A8907 X012



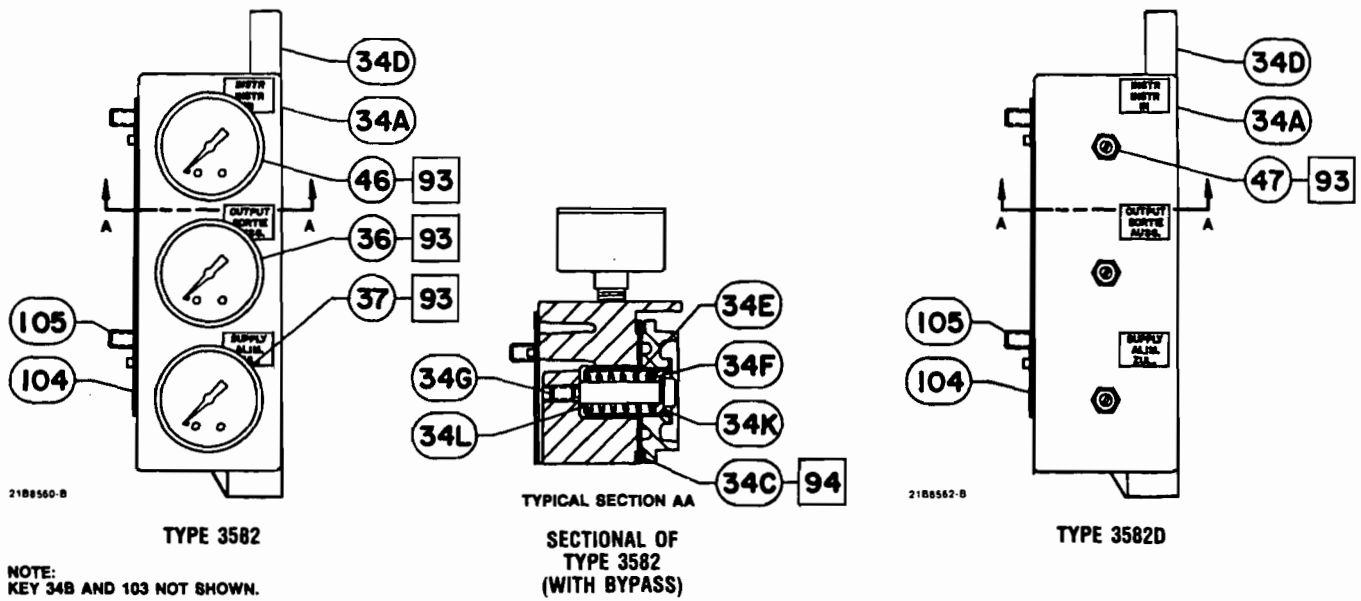


Figure 23. 3582 Series Block Assembly with Bypass

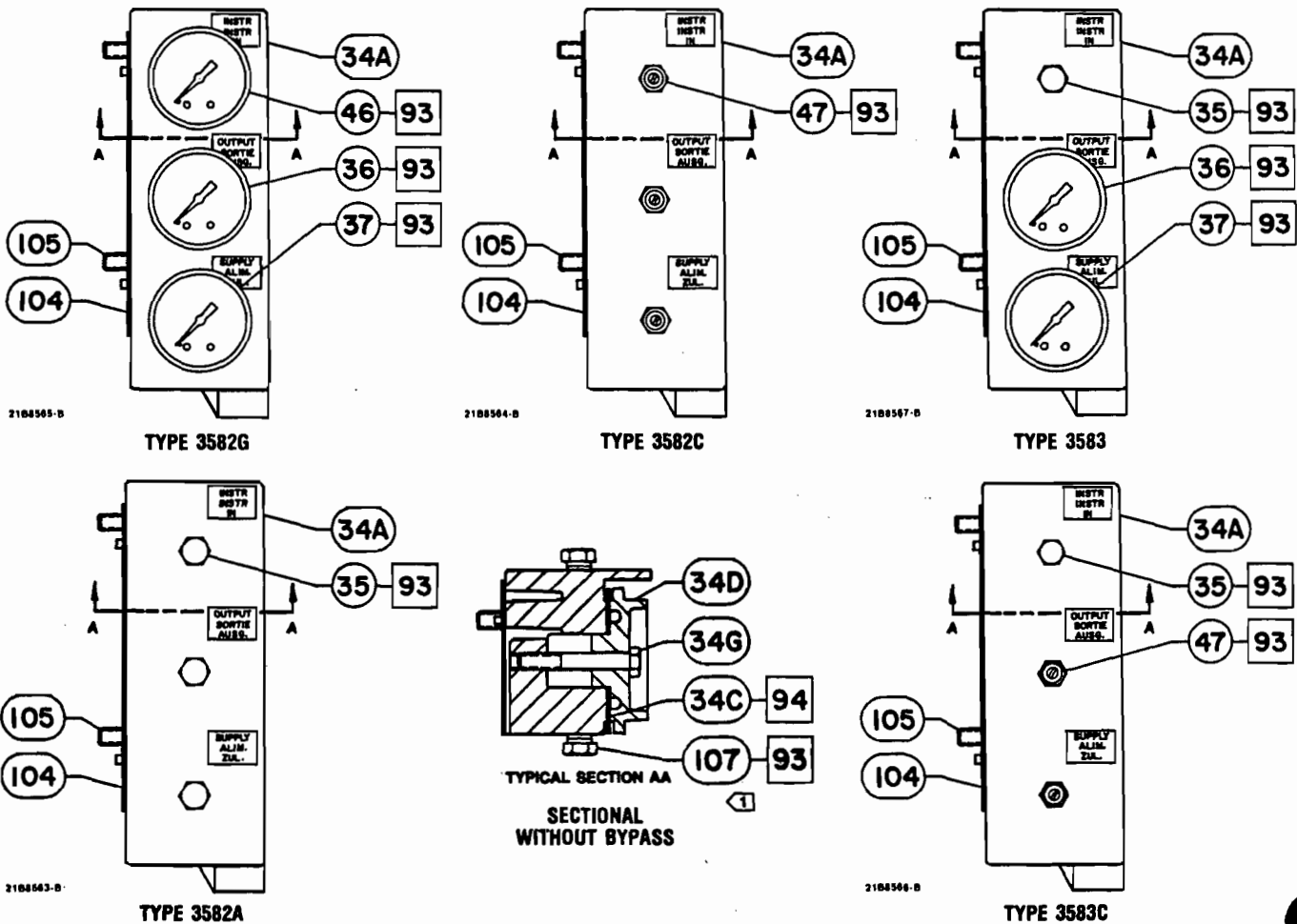
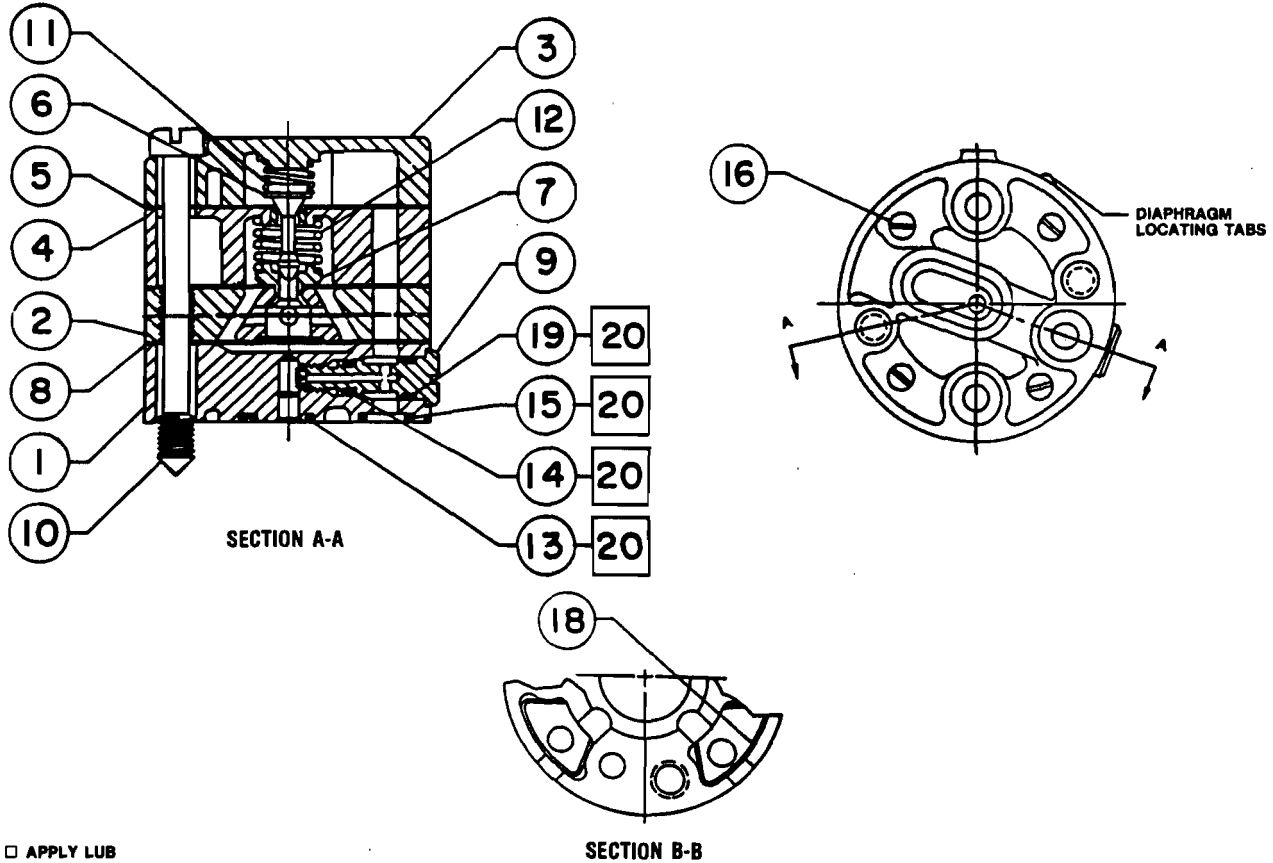


Figure 24. 3582 and 3583 Series Block Assemblies without Bypass



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Figure 25. Type 83L Relay Sub-Assembly (Key 32)

Key	Description	Part Number	Key	Description	Part Number
13*	O-Ring Nitrile (std. const.) Fluoroelastomer (hi-temp. const.)	17A6891 X012 17A6891 X022	5*	O-Ring, Nitrile	1P4207 06992
14*	O-Ring Nitrile (std. const.) Fluoroelastomer (hi-temp. const.)	1D1346 06992 1D2899 X0022	6*	O-Ring, Nitrile (2 req'd)	1C8538 X0022
15*	O-Ring (3 req'd) Nitrile (std. const.) fluoroelastomer (hi-temp. const.)	1D6875 06992 1N4304 06382	7	Tire Valve (not shown) (2 req'd w/tire valve option)	1N9088 99012
16	Machine Screw, SST (4 req'd)	1A8176 X0012	8*	O-Ring, Nitrile	1H8762 X0012
18	Screen Insert, MONEL <sup>(7)</sup> (2 req'd)	13A0103 X012	9	Machine Screw, 304 SST (2 req'd)	1A9021 X0012
19*	O-Ring Nitrile (std. const.) fluoroelastomer (hi-temp. const.)	1D1347 06992 1N4239 06382	10	Wire Retaining Screw (2 req'd)	16A2821 X012
20	Lubricant, Dow Corning 111 (not furnished with positioner) 5.3 oz (0.1 kg) tube	1M5282 06992	11	Machine Screw, SST (2 req'd)	12B0909 X012
			12	Pipe Plug, steel (2 req'd w/pipe plug option)	1E8231 28982
			13	Screw, pl steel, used with integrally-mounted Type 67AFR filter/regulator (2 req'd)	1C3988 24052
			14*	Supply Gauge, Dual Scale 0-30 psig/0-2 kg/cm <sup>2</sup> 0-60 psig/0-4 kg/cm <sup>2</sup>	11B4040 X042 11B4040 X052
			14*	Supply Gauge, Triple Scale 0-30 psig/0-0.2 MPa/0-2 bar 0-60 psig/0-0.4 MPa/0-4 bar	11B4040 X012 11B4040 X022
			15	Lubricant, Lubriplate MAG-1, 1 lb (0.45 kg) can (not furnished with positioner)	1M1100 X0012
			16	Anti-seize compound, Zink Plate No. 770 1 pound (0.5 kg) can (not furnished with positioner)	1M5240 06992
			18	Self-Tapping Screw, SST (2 req'd)	1P4269 28982
			19	Nameplate, SST, without 3rd party approvals	11B5625 X0A2
			20*	Case Gasket, cork	1U9078 04132

**Type 582i (figure 26)**

---	I/P Module	33B7073 X012
1	Housing 1/2-inch NPT conduit connection	21B5991 X012
2	Cap, aluminum	31B2305 X012
3*	O-Ring, nitrile, used with integrally-mounted Type 67AFR filter regulator	1E5914 06992
4	Nozzle Restriction Assembly, Aluminum/Brass/Sapphire	13B7116 X012

\* Recommended spare part.  
7. Trademark of International Nickel Co.

Key	Description	Part Number
21	Cable Gland, plastic, for use with M20 housing	11B3870 X012
22*	Output Gauge, Dual Scale 0-30 psig/0-2 kg/cm <sup>2</sup> 0-60 psig/0-4 kg/cm <sup>2</sup>	11B4040 X042 11B4040 X052
22*	Output Gauge, Triple Scale 0-30 psig/0-0.2 MPa/0-2 bar 0-60 psig/0-0.4 MPa/0-4 bar	11B4040 X012 11B4040 X022
23*	Filter	11B5996 X012
24	Vent Assembly	11B8279 X012

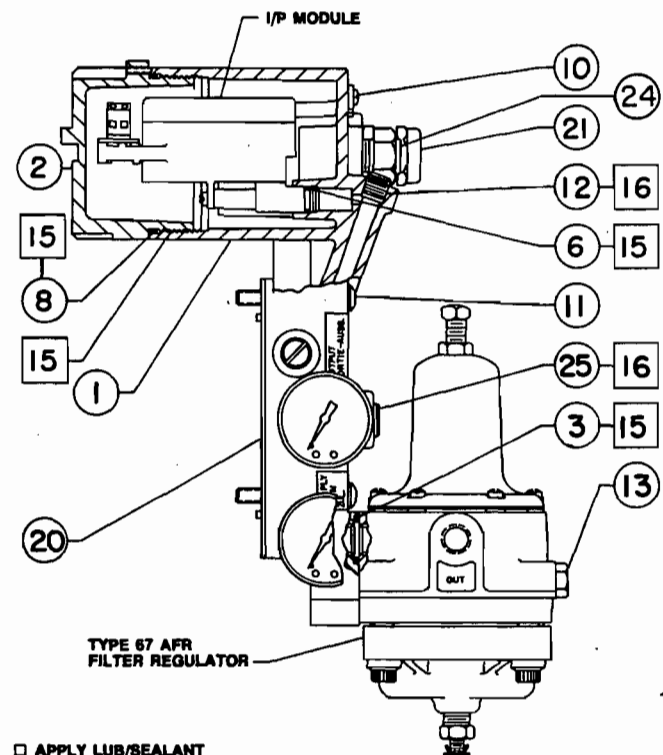
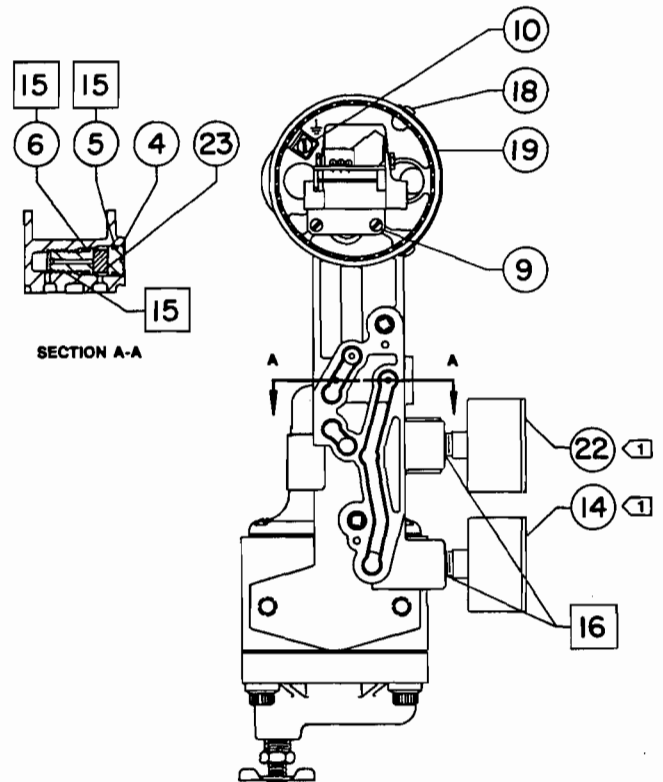
**Mounting Parts**

**For Mounting 3582, 3582i, or 3583 Only  
(figure 3)**

**Note**

Part 48 also shown in figure 27.

48	Connector Arm, pl steel Type 478 (Type 3583 only) Size 40 Sizes 46 & 60 Type 513 Size 20 Size 32 Type 650 Size 30 Size 40 Size 60 Type 656 Sizes 30, 40, & 60 Types 657, 667 W/o side-mtd. h'wheel Sizes 30 & 34 Sizes 40 thru 100 W/side-mtd. h'wheel Size 34 Sizes 40, 50, & 60 Size 45 & 46 Sizes 70 thru 100	30A4897 X012 3V4796 25212 2V6722 25212 2U9099 25212 20A5177 X012 10A4870 X012 10A4871 X012 2V1705 25212 1U9101 000A2 2U9099 25212 2V1889 25212 2U9095 25212 2V1705 25212 2U9099 25212
48	Connector Arm, pl steel (Cont'd) Type 657-4, 667-4 Type 657-8 Sizes 30 & 34 Sizes 40 thru 70 For Competitor's Actuators 3/8 to 3/4 stem	2U9099 25212 2V1889 25212 2V6724 25212 2U9095 25212
49	Washer, pl steel Type 513 Size 20 (1 req'd) 5/16 inch (7.9 mm) stem 3/8 inch (9.5 mm) stem Type 650, (2 req'd) Size 30 Size 40 Size 60 Type 656, 1/2 inch (12.7 mm) stem Sizes 30, 40, & 60 Type 657 (2 req'd.) W/o side-mtd. h'wheel Sizes 30 thru 70, & 100 Sizes 80 & 87 W/side-mtd. h'wheel Size 70 up to 3-inch (76 mm) travel 3-1/16 to 4-inch (78 to 102 mm) travel	1B8659 28982 1E7941 28992 1B8659 28982 1K8995 25072 1P5057 25072 1K8995 25072 1D7162 28982 1K8995 25072 1K8995 25072 1D7162 28982



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**NOTE:**

① GAUGES MAY BE REPLACED BY PIPE PLUGS (KEY 12) OR TIRE VALVES (KEY 7).

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Figure 26. Type 582i Converter

Key	Description	Part Number	Key	Description	Part Number
97	Spacer, steel (2 req'd) <b>Type 657 or 667</b> W/ side-mtd. h'wheel Sizes 70 & 87 up to 2-inch (51 mm) travel 2-1/16 to 3-inch (52 to 76 mm) travel W/ or W/o side-mtd. h'wheel Size 80 up to 2-inch (51mm) travel	1R4093 24092 1R4095 24092 1R4096 24092	<b>For Mounting 3582, 3582i, and 3583 on Type 657 or 667 Actuator without Side- Mounted Handwheel</b>		
98	Stud, continuous thread, steel (2 req'd) <b>Type 657 or 667</b> W/ side-mtd. h'wheel Sizes 70 & 87 up to 3-inch (76 mm) travel W/ or W/o side-mtd. h'wheel Size 80 up to 2-inch (51mm) travel	1R1661 31012 1R1661 31012	<b>Note</b>  The following parts (key numbers 48 through 87) are used when mounting both a 3582 Series positioner and a 3583 Series transmitter on a Type 657 or 667 Size 45 actuator without a side-mounted handwheel.		
99	Hex Nut, pl steel (2 req'd) <b>Type 657 or 667</b> W/ side-mtd. h'wheel Sizes 70 & 87 up to 3-inch (76 mm) travel W/ or W/o side-mtd. h'wheel Size 80	1A3412 24112 1A3412 24112	48	Connector Arm, pl steel (2 req'd) Sizes 30 & 34 Sizes 40 thru 100	1U9101 000A2 2U9099 25212
102	Spacer, steel <b>Type 657</b> Size 70 up to 2-inch (51 mm) travel (2 req'd) Size 87 up to 2-inch (51 mm) travel (2 req'd)	1U4371 24092 1R7623 24092	49	Washer, pl steel (4 req'd) Sizes 30 thru 70, & 100 Sizes 80 & 87	1D7162 28982 1K8995 25072
102	Spacer, steel (Cont'd) <b>Types 657 or 667</b> W/ side-mtd. h'wheel Size 70 3-1/16 to 4-inch (78 to 102 mm) travel (4 req'd) Sizes 70 and 87 up to 3-inch (76mm) travel (2 req'd) Size 87 3-1/16 to 4-inch (78 to 102 mm) travel, (2 req'd) W/ or W/o side-mtd. h'wheel Size 80 (2 req'd) Size 100 up to 2-1/2 inch (63.5 mm) travel (4 req'd) 2-9/16 to 4-inch (65 mm to 102 mm)travel (2 req'd) <b>Types 657-4 or 667-4</b> W/ side-mtd. h'wheel Size 70 (4 req'd) Size 87 (2 req'd)	1R7370 24092 1V6833 24092 1R4096 24092 1V6833 24092 10A2567 X012 10A5252 X012 1R7370 24092 1R4096 24092	50	Spacer, steel (4 req'd) Size 100 up to 2-1/2 inch (64 mm) travel	1J8307 24092
			59	Pin Lock, SST, all sizes (2 req'd)	1U9098 35032
			60	Travel Pin, SST, all sizes (2 req'd)	1U9096 46332
			61	Pin Holder, SST, all sizes (2 req'd)	1U9097 35032
			62	Cap Nut, SST, all sizes (2 req'd)	1U9102 35032
			63	Mounting Plate, steel, all sizes (2 req'd)	31B5993 X012
			64	Cap Screw, pl steel, all sizes (8 req'd)	1A3816 24052
			65	Cap Screw, pl steel (2 req'd) Size 100 up to 2-1/2 inch (64 mm) travel	1C3979 24052
			70	Cap Screw, pl steel (4 req'd) Sizes 30 thru 60 Size 70 Up to 3-inch (76 mm) travel Size 80 Size 100 up to 2-1/2 inch (64 mm) travel	1A3816 24052 1A3816 24052 1A3816 24052 1A3816 24052 1A3525 24052
			71	Stud, continuous thread, steel (not shown) (2 req'd) <b>Type 657 or 667</b> Sizes 30, 34, & 40 Sizes 45 thru 60 Size 80 <b>Type 657</b> Size 70 up to 3-inch (76 mm) travel	12A1491 X012 12A1493 X012 1U4216 31012 12A1492 X012
			72	Hex Nut, pl steel (not shown) (4 req'd) <b>Type 657 or 667</b> Sizes 30, 34, & 40 Sizes 45 thru 60 Size 80 <b>Type 657</b> Size 70 up to 3-inch (76 mm) travel	1E9440 24112 1A3753 24122 1A3412 24122 1A3753 24122
			102	Spacer <b>Type 657 or 667</b> Size 80 (4 req'd) Size 100 up to 2-1/2 inch (64 mm) travel (8 req'd)	1V6833 24092 10A2567 X012

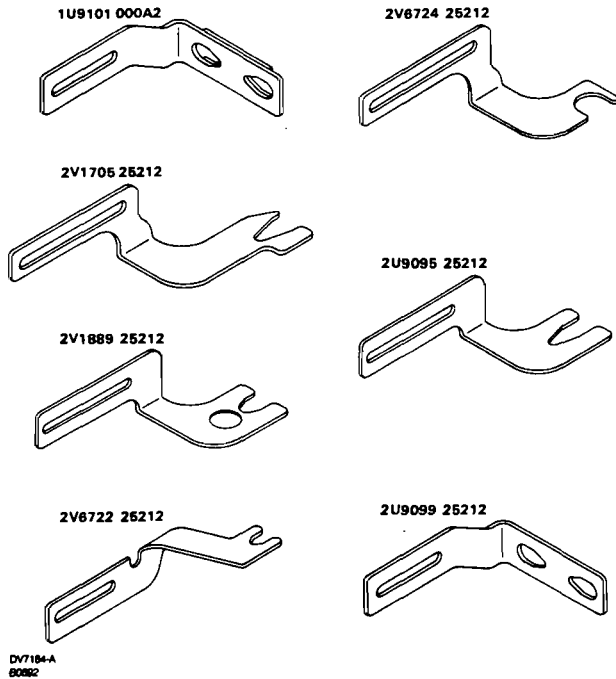


Figure 27. Connector Arm (Key 48)

Key	Description	Part Number
50	Spacer, steel (Cont'd)	
	<b>Type 657</b>	
	W/o side-mtd. h'wheel	
	Sizes 70 & 87	
	3-1/16 to 4-inch (78 to 102 mm) travel	1C5590 24092
	Size 80	
	2-1/16 to 3-inch (52 to 76 mm) travel	1J8307 24092
	Size 100	
	up to 2-1/2 inch (64 mm) travel	1J8307 24092
	2-9/16 to 4-inch (65 to 102 mm) travel	1C5590 24092
	W/side-mtd. h'wheel	
	Sizes 34, 50, & 60	1J8307 24092
	Size 45 & 46	1V1026 24092
	Sizes 70 & 87	1R8019 24092
	Size 80	
	2-1/16 to 3-inch (52 to 76 mm) travel	1J8307 24092
	Size 100	
	up to 2-1/2 inch (64 mm) travel	1J8307 24092
	2-9/16 to 4-inch (65 to 102 mm) travel	1C5590 24092
	<b>Type 657-4</b>	
	W/o side-mtd. h'wheel	
	Size 70	1C5590 24092
	W/side-mtd. h'wheel	
	Size 70 & 87	1R8019 24092
	<b>Type 657-8</b>	
	Sizes 30, 34, 47, & 70	1C5590 24092
	Size 40	1N9524 24092
	Sizes 46 & 60	1R8019 24092
	<b>Type 667</b>	
	W/o side-mtd. h'wheel	
	Sizes 70 & 87	
	2-1/16 to 3-inch (52 to 76 mm) travel	1J8307 24092
	3-1/16 to 4-inch (78 to 102 mm) travel	1R8019 24092
	Size 80	
	2-1/16 to 3-inch (52 to 76 mm) travel	1J8307 24092
	Size 100	
	up to 2-1/2 inch (64 mm) travel	1J8307 24092
	2-9/16 to 4-inch (65 to 102 mm) travel	1C5590 24092
	W/side-mtd. h'wheel	
	Size 34	1J8307 24092
	Size 45 & 46	1V1026 24092
	Sizes 70 & 87	1R8019 24092
	Size 80	
	2-1/16 to 3-inch (52 to 76 mm) travel	1J8307 24092
	Size 100	
	up to 2-1/2 inch (64 mm) travel	1J8307 24092
	2-9/16 to 4-inch (65 to 102 mm) travel	1C5590 24092
	<b>Type 667-4</b>	
	Sizes 70 & 87	1R8019 24092
52	Pipe Plug	1A6495 28992
54	Elbow, 3/8 inch, brass (specify quantity)	15A6002 X162
55	Connector, 3/8 inch brass (not shown) (specify quantity)	15A6002 X202
56	Cap Screw, pl steel (2 req'd)	1C3988 24052
57	Hex Nut (2 req'd)	1A3527 24122
58	Lockwasher (2 req'd)	1C2257 28982
59	Pin Lock, SST	
	<b>Type 650</b> , all sizes (none req'd)	
	For all other types	1U9098 35032
60	Travel Pin, SST	
	<b>Type 650</b> , Sizes 30, 40, & 60 (none req'd)	
	<b>Type 657-8</b>	
	Sizes 30 & 34	1U9096 46332
	Sizes 40 thru 70	10A2167 X012
	For all other types	1U9096 46332
61	Pin Holder, SST	
	<b>Type 650</b> , all sizes (none req'd)	
	For all other types	1U9097 35032
49	Washer, pl steel (Cont'd)	
	Sizes 80 & 87	1K8995 25072
	Size 100	1D7162 28982
	<b>Type 657-4</b> (2 req'd)	
	W/o side-mtd. h'wheel	
	Size 70	1D7162 28982
	W/side-mtd. h'wheel	
	Size 70	1D7162 28982
	Size 87	1K8995 25072
	<b>Type 657-8</b> (2 req'd)	
	Sizes 30 & 34	1K8995 25072
	<b>Type 667</b> (2 req'd)	
	W/o side-mtd. h'wheel	
	Sizes 30 thru 70, & 100	1D7162 28982
	Size 80	1K8995 25072
	Size 87	
	up to 2-inch (51 mm) travel	1K8995 25072
	2-1/16 to 3-inch (52 to 76 mm) travel	1D7162 28982
	3-1/16 to 4-inch (78 to 102 mm) travel	1K8995 25072
	W/side-mtd. h'wheel	
	Size 70	
	up to 3 inch (76 mm) travel	1K8995 25072
	3-1/16 to 4-inch (78 to 102 mm) travel	1D7162 28982
	Size 80 & 87	1K8995 25072
	Size 100	1D7162 28982
	<b>Type 667-4</b> (2 req'd)	
	Size 70	1D7162 28982
	Size 87	1K8995 25072
50	Spacer, steel (2 req'd)	
	<b>Type 513</b> , Size 32	1J8307 24092
	<b>Type 650</b>	
	Sizes 30 & 60	1J8307 24092
	Size 40	1C5590 24092
	<b>Type 656</b>	1L2006 24092

Key	Description	Part Number	Key	Description	Part Number
62	Cap Nut, SST Type 650, Sizes 30, 40, & 60 (none req'd) For all other types	1U9102 35032	70	Cap Screw, pl steel (2 req'd) Type 478 (Type 3583 only) Type 513 Type 650 Type 656 Type 657	1A3816 24052 1A3816 24052 1A3525 24052 1P7937 X0012
63	Mounting Plate, steel Type 650, Sizes 30, 40, & 60 For all other types	31B8553 X012 31B5993 X012		W/o side-mtd. h'wheel Sizes 30 thru 60 Size 70 Up to 3-inch (76 mm) travel 3-1/16 to 4-inch (78 to 102 mm) travel	1A3816 24052 1A3816 24052 1A5534 24052
64	Cap Screw, pl steel (3 req'd for Types 1250 and 1250R) (5 req'd for all other types)	1A3816 24052		Size 80 up to 2-inch (51 mm) travel 2-1/16 to 3-inch (52 to 76 mm) travel	1A3816 24052 1A3525 24052
65	Cap Screw, pl steel (2 req'd) Type 513, Size 32 Type 657 W/o side-mtd. h'wheel Sizes 30, 34, & 40 Size 70 up to 2-inch (51 mm) travel 2-1/16 to 4-inch (52 to 102 mm) travel Size 80 2-1/16 to 3-inch (52 to 76 mm) travel Size 87, up to 2-inch (51 mm) travel Size 100 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel W/side-mtd. h'wheel Size 70 3/16 to 4-inch (78 to 102 mm) travel Size 87 3-1/16 to 4-inch (78 to 102 mm) travel Size 80 2-1/16 to 3-inches (52 to 76 mm) travel Size 100 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel Type 657-4 W/o side-mtd. h'wheel Sizes 70 & 87 W/ side-mtd. h'wheel Size 70 Size 87 Type 667 W/o side-mtd. h'wheel Sizes 30, 34, & 40 Size 80 2-1/16 to 3-inch (52 to 76 mm) travel Size 100 Up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel W/side-mtd. h'wheel 3-1/16 to 4-inch (78 to 102 mm) Size 70 Size 87 Size 80 2-1/16 to 3-inch (52 to 76 mm) travel Size 100 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel	1B7624 24052 1A3525 24052 1A3751 24052 1A9145 24052 1U6256 31192 1A9503 24052 1C3979 24052 1A6430 24052 1B3664 24052 1A9503 24052 1U6256 31192 1C3979 24052 1A6430 24052 1A9145 24052 1B3664 24052 1A9503 24052 1A3525 24052 1U6256 31192 1C3979 24052 1A6430 24052 1B3664 24052 1A9503 24052 1U6256 31192 1C3979 24052 1A6430 24052			
66	Actuator Rod, pl steel (not shown) Type 650 Size 30 Size 40 Size 60	10A5176 X012 10A4872 X012 10A4873 X012		Size 87 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel W/side-mtd. h'wheel Size 34 Sizes 40, 50, 60 Size 45 & 46 Size 70 & 87 Size 80 up to 2-inch (51 mm) travel 2-1/16 to 3-inch (52 to 76 mm) travel Size 100 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel Type 667-4 Sizes 70 & 87 For Competitor's Actuators 3/8 to 3/4 stem	1A3816 24052 1A3525 24052 1A3816 24052 1A5534 24052 1B9896 24052 1A5534 24052 1C3988 24052 1B9896 24052 1A3816 24052 1A3816 24052 1B9896 24052 1A3816 24052 1A5534 24052 1A3816 24052 1B9896 24052 1A3816 24052 1A3525 24052 1B7624 24052 1A3816 24052 1A3525 24052 1A3525 24052 1A3816 24052 1A5534 24052 1B7624 24052 1A3816 24052 1A3525 24052 1B7624 24052 1A3816 24052 1A3525 24052 1B7624 24052 1A3816 24052 1A3525 24052 1A3816 24052
67	Hex Nut, pl steel (not shown) Type 650, Size 30 (2 req'd)	1A9463 24122		W/side-mtd. h'wheel Size 70 Size 87 Size 80 up to 2-1/2 inch (64 mm) travel 2-9/16 to 4-inch (65 to 102 mm) travel	1A3525 24052 1A3816 24052 1A3525 24052 1B7624 24052
68	Anti-Torque Rod, steel (not shown) Type 478 (Type 3583 only)	1V4738 24092			
69	Damper Control Swivel (not shown) Type 650 (2 req'd)	10A4874 X012			

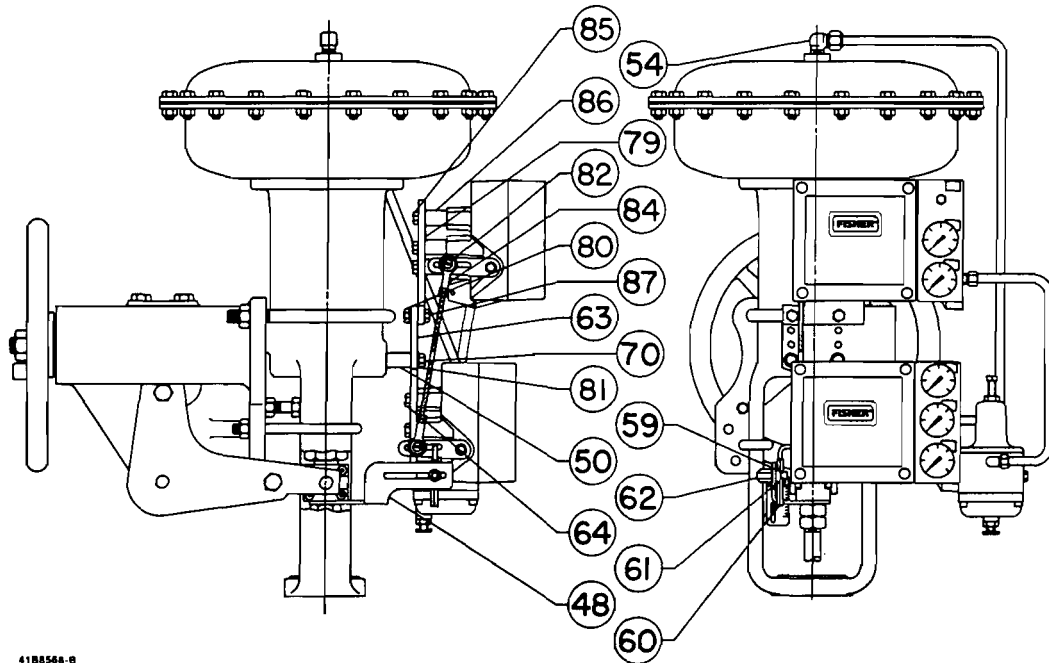


Figure 28. Typical Application of Transmitter and Positioner

**Key Description Part Number**  
**For Mounting 3582, 3582i, and 3583 on Type 657 or 667 Actuator with Side-Mounted Handwheel (figure 28)**

**Note**

The following parts (key numbers 48 through 87) are used when mounting both a 3582 Series positioner and a 3583 Series transmitter on a Type 657 or 667 Size 45 actuator with side-mounted handwheel.

48	Connector Arm, pl steel	2V1705 25212
50	Spacer, steel (2 req'd)	1V1026 24092
54	Elbow, 3/8 inch, brass	15A6002 X162
55	Connector, 3/8 inch brass (not shown)	15A6002 X202
59	Pin Lock, SST	1U9098 35032

<b>Key</b>	<b>Description</b>	<b>Part Number</b>
60	Travel Pin, SST	10A2167 X012
61	Pin Holder, SST	1U9097 35032
62	Cap Nut, SST	1U9102 35032
63	Mounting Plate, steel	31B5993 X012
64	Cap Screw, pl steel (5 req'd)	1A3816 24052
70	Cap Screw, pl steel (2 req'd)	1C8702 24052
79	Mounting Plate, steel	22A6848 X012
80	Hex Nut, pl steel, for Type 667 only (2 req'd)	1A3527 24122
81	Lockwasher, pl steel	
	Type 657 (2 req'd)	1C2257 28982
	Type 667 (4 req'd)	1C2257 28982
82	Machine Screw, pl steel (2 req'd)	1V4058 28982
83	Elastic Stop Nut, pl steel (not shown)	
	(2 req'd)	1J7192 28982
84	Connecting Linkage, pl steel	1R6839 99012
85	Cap Screw, pl steel, for Type 667 only (5 req'd)	1A5534 24052
86	Spacer, pl steel for Type 667 only (5 req'd)	1C5590 24092
87	Cap Screw, pl steel for Type 667 only (2 req'd)	1A3526 24052

While this information is presented in good faith and believed to be accurate, Fisher Controls does not guarantee satisfactory results from reliance upon such information. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding the performance, merchantability, fitness

or any other matter with respect to the products, nor as a recommendation to use any product or process in conflict with any patent. Fisher Controls reserves the right, without notice, to alter or improve the designs or specifications of the products described herein.

**Design CE Valve with  
Separable Flanges****FISHER®**

May 1992

Form 5192

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**Introduction****Scope of Manual**

This instruction manual includes installation, maintenance, and parts information for the Design CE control valve. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Only persons qualified through training or experience should install, operate, and maintain these valves. If you have any questions about these instructions, contact

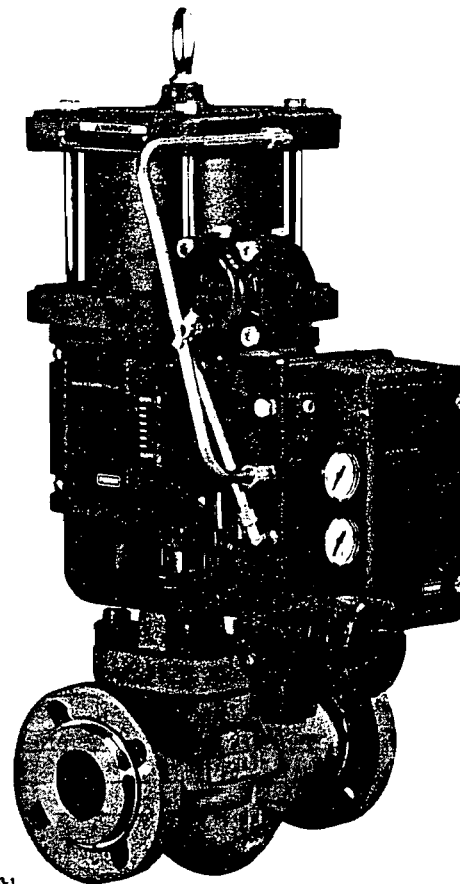


Figure 1. Design CE Separable-Flange Valve with  
Type 585 Actuator and Type 3621JP I/P Valve Positioner

your Fisher Controls sales office or sales representative before proceeding.

**Description**

The Design CE valve (figure 1) is a globe-style valve with stem guiding and quick-change trim. The valve has separable steel or stainless steel flanges and is ideal for control of corrosive fluids encountered in chemical processing and other industries.



Table 1. Specifications

<p><b>End Connections</b></p> <p>Separable flanges to mate with ANSI Class 150, 300, or 600 raised-face flanges. Patented<sup>(1)</sup> lock-in-place flange retention prevents accidental rotation of the valve</p> <p><b>Maximum Inlet Pressures<sup>(2)</sup></b></p> <p><b>WCB Steel, CF3M (316L Stainless Steel), CF3 (304L Stainless Steel), and CN7M (Alloy 20) Bodies:</b> Consistent with applicable Class ■ 150, ■ 300, or ■ 600 pressure-temperature ratings per ASME/ANSI B16.34-1988, but do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. See also the Installation section for additional information.</p> <p><b>M35-1 (Monel)<sup>(3)</sup> and CW2M (Hastelloy C)<sup>(4)</sup> Bodies:</b> These materials are not listed in ASME/ANSI B16.34-1988. Maximum inlet pressure and temperatures are shown in table 2, but do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. See also the Installation section for additional information.</p> <p><b>Shutoff Classification</b></p> <p>See table 3</p>	<p><b>Flow Characteristics/Valve Plug Styles</b></p> <p><b>Full-Capacity Trim:</b> ■ Linear or ■ equal percentage  <b>Restricted-Capacity Trim with Standard Valve Plugs:</b> ■ Linear or ■ equal percentage  <b>Micro-Flow Valve Plugs:</b> Linear</p> <p><b>Flow Direction</b></p> <p><b>With Type 585 and 585R Actuators</b>  <i>Fail Open:</i> Always flow up  <i>Fail Closed:</i> Flow up if port diameter is less than or equal to the valve stem diameter; flow down if port diameter is greater than the valve stem diameter  <b>With all Other Actuators:</b> Flow up</p> <p><b>Approximate Weights</b></p> <table border="1"> <thead> <tr> <th rowspan="3">VALVE SIZE, INCHES</th> <th colspan="4">WEIGHT</th> </tr> <tr> <th colspan="2">With Class 150 Flanges</th> <th colspan="2">With Class 300 or 600 Flanges</th> </tr> <tr> <th>Pounds</th> <th>kg</th> <th>Pounds</th> <th>kg</th> </tr> </thead> <tbody> <tr> <td>1/2</td> <td>23</td> <td>10</td> <td>23</td> <td>10</td> </tr> <tr> <td>3/4</td> <td>23</td> <td>10</td> <td>26</td> <td>12</td> </tr> <tr> <td>1</td> <td>25</td> <td>11</td> <td>29</td> <td>13</td> </tr> <tr> <td>1-1/2</td> <td>33</td> <td>15</td> <td>39</td> <td>18</td> </tr> <tr> <td>2</td> <td>44</td> <td>20</td> <td>49</td> <td>22</td> </tr> <tr> <td>3</td> <td>68</td> <td>31</td> <td>77</td> <td>35</td> </tr> <tr> <td>4</td> <td>131</td> <td>59</td> <td>156</td> <td>71</td> </tr> </tbody> </table>	VALVE SIZE, INCHES	WEIGHT				With Class 150 Flanges		With Class 300 or 600 Flanges		Pounds	kg	Pounds	kg	1/2	23	10	23	10	3/4	23	10	26	12	1	25	11	29	13	1-1/2	33	15	39	18	2	44	20	49	22	3	68	31	77	35	4	131	59	156	71
VALVE SIZE, INCHES	WEIGHT																																																
	With Class 150 Flanges		With Class 300 or 600 Flanges																																														
	Pounds	kg	Pounds	kg																																													
1/2	23	10	23	10																																													
3/4	23	10	26	12																																													
1	25	11	29	13																																													
1-1/2	33	15	39	18																																													
2	44	20	49	22																																													
3	68	31	77	35																																													
4	131	59	156	71																																													

1. Covered by U.S. Patent 4,991,881.  
 2. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.  
 3. Trademark of Inco International.  
 4. Trademark of Haynes International.

Table 2. Maximum Allowable Inlet Pressures for M35-1 and CW2M Bodies

TEMPERATURE	M35-1 <sup>(1)</sup> (MONEL)			CW2M <sup>(1)</sup> (HASTELLOY C)		
	150 <sup>(2)</sup>	300 <sup>(2)</sup>	600 <sup>(2)</sup>	150 <sup>(2)</sup>	300 <sup>(2)</sup>	600 <sup>(2)</sup>
<b>°F</b>	<b>Psig</b>					
- 50 to 100	230	600	1200	290	750	1500
200	200	530	1050	260	735	1465
300	190	495	990	230	695	1390
400	185	480	955	200	695	1390
500	170	475	950	170	650	1300
600	140	475	950	140	605	1210
<b>°C</b>	<b>Bar</b>					
- 46 to 38	15.9	41.4	82.7	20.0	51.7	103.4
93	13.8	36.5	72.4	17.9	50.3	101.0
149	13.1	34.1	68.3	15.9	47.9	95.8
204	12.8	33.1	65.8	13.8	47.9	95.8
260	11.7	32.8	65.5	11.7	43.1	89.6
316	9.7	32.8	65.5	9.6	41.7	83.4

1. These are not ASME/ANSI B16.34-1988 code-approved materials. Also see the installation section.  
 2. The designations 150, 300, and 600 are used only to indicate relative pressure-retaining capabilities and are not ANSI pressure-temperature rating class designations.

**Specifications**

Specifications for the Design CE valves are shown in table 1. Some of the specifications for a given valve assembly appear on the actuator nameplate if the valve is part of a control valve assembly.

**Installation**

**WARNING**

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by accepted industry or local, state, and Federal codes and good engineering practices.

Table 3. Available Shutoff Classifications  
per ANSI/FCI 70-2-1976 (R1982)

Seating	Shutoff Class
Metal (standard)	IV (standard)
	V (optional)
Composition	VI

### CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting the Fisher Controls sales office or sales representative.

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of foreign material. Clean out all pipelines to remove scale, welding slag, and other foreign materials.

2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the body. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult the Fisher Controls sales office or sales representative.

Flow through the body must be in the direction indicated by the arrow on the valve body.

### WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however some readjustment will be required to meet specific service conditions. Refer to the Packing Maintenance Section for recommended packing flange nut torque values.

3. Use accepted piping practices when installing the valve in the pipeline. Use a suitable gasket between the body and pipeline flanges.

4. With a leak-off bonnet construction, remove the pipe plug to hook up the leak-off piping.

5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.

6. If the actuator and valve are shipped separately, refer to the appropriate actuator instruction manual for the actuator mounting procedure.

## Maintenance

### WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before performing any maintenance operations:

- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.

Due to the care Fisher Controls takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured or furnished by Fisher Controls.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, and lapping seating surfaces. All these maintenance operations may be performed with the valve in the line. Instructions are also given for changing flanges and maintaining the optional bellows seal.

#### Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

#### Note

If the valve has Enviro-Seal™ or High-Seal™ live-loaded packing installed, contact your Fisher Controls representative or sales office for packing instructions.

## Packing Lubrication

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE-composition or other packings that require lubrication, it will be installed in a 1/4-inch NPT tapping in the optional bonnet. Use a silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 500°F (260°C) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

## Packing Maintenance

Key numbers refer to figure 6.

### WARNING

**Personal injury or equipment damage caused by sudden release of pressure may result if the pressure is not relieved from the bonnet assembly. To avoid such injury or damage, remove the valve plug stem assembly (key 6), by following the "Replacing Packing" procedure, before removing the packing flange (key 19) or packing flange hex nuts (key 21).**

To limit undesirable packing leakage, for all packing except spring-loaded packings, establish a stem seal by tightening the packing flange nuts (key 21) to at least the minimum recommended torque in table 4. However, do not exceed the maximum recommended torque in table 4, or excessive friction may result. If the packing (key 15) is relatively new and tight on the stem, and tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is 4 micro-inches (0.1µm) rms. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing per the numbered steps below, or when performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

## Replacing Packing

1. Exhaust actuator pressure completely, and disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, and then remove the actuator from the valve by unscrewing the yoke locknut (key 22).

2. Loosen, but do not remove, the packing flange nuts (key 21) so that the packing is not tight on the valve

Table 4. Recommended Packing Flange Nut Torque

VALVE BODY SIZE, INCHES	VALVE STEM SIZE		Maximum		Minimum	
	Inch	mm	Lbf-in.	N-m	Lbf-in.	N-m
1/2 through 1-1/2	1/2	12.7	48	5.4	24	2.7
2	3/4	19.1	28	3.2	20	2.3
3	1	25.4	84	9.5	60	6.8
4	1-1/4	31.8	60	6.8	36	4.1

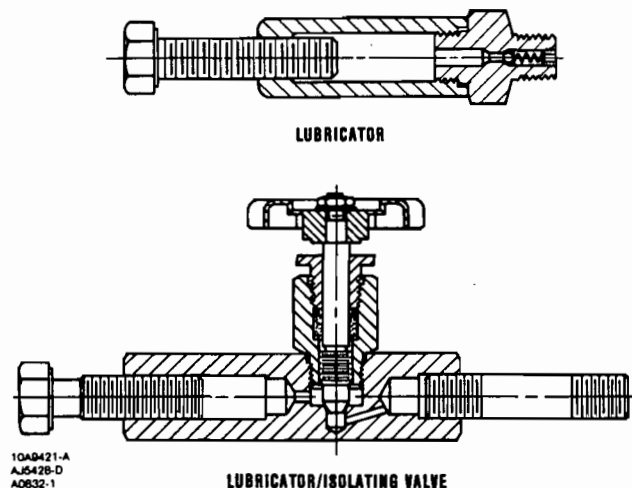


Figure 2. Lubricator and Lubricator/Isolating Valve

stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

3. Unscrew the hex nuts (key 10) that secure the bonnet to the body and carefully lift off the bonnet and valve plug stem assembly. If the valve plug stem assembly does not come out of the valve with the bonnet, pull it out of the valve body. Set the bonnet and valve plug assembly on a protective surface, to prevent damage to the bonnet gasket surface.

4. Remove the valve plug and stem from the bonnet, and carefully set it on a protective surface.

5. Remove the bonnet gasket (key 8), and cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the body cavity.

6. Remove the packing flange nuts, packing flange, wiper, and bushing (keys 21, 19, 18, and 14). The packing box bushings may be one-piece or three-piece bushings. Carefully push out all the remaining packing box parts from the bonnet using a rounded rod or other tool that will not scratch the packing box wall or lower guide bushing. Clean the packing box and the metal packing box parts.

7. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition

Table 5. Body-to-Bonnet Bolt Torque Guidelines

BODY SIZE, INCHES	STUD BOLT MATERIAL			
	SA-193-B7		SA-193-B8M	
	Bolt Torque Range		Bolt Torque Range	
	Lbf-ft	N·m	Lbf-ft	N·m
1/2, 3/4, 1	95-105	129-142	47-52	64-71
1-1/2	125-138	169-187	65-72	88-98
2	200-220	271-298	115-127	156-172
3	405-445	549-603	270-297	244-268
4	550-605	746-820	390-427	366-403

cannot be improved by light sanding, replace the damaged parts.

8. Remove the covering protecting the body cavity, and install a new bonnet gasket (key 8), making sure the gasket seating surfaces are clean and smooth.

9. Lubricate the stud bolts, nuts, and the surface between nuts and bonnet with a suitable lubricant. Carefully slide the valve plug into the bonnet, slide the bonnet onto the bolts, and secure with the stud bolt nuts (key 10). Do not tighten or torque the stud bolt nuts until step 12.

**Note**

If graphite ribbon/filament packing is used, avoid trapping air between the packing rings by starting only one ring at a time without forcing the top of the packing ring below the bottom of the entrance chamfer of the packing box (figure 3). Thus, when a ring is added, the stack should not be pushed into the cavity more than the thickness of the added ring (figure 3).

10. Install new packing and the metal packing box parts according to the appropriate arrangement in figures 4, 6, or 7. Place a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.

11. Slide the bushing, wiper, and packing flange (keys 14, 18, and 19) into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Replace the packing flange nuts, but do not tighten.

**Note**

When the valve plug has been removed from the valve body, it will be necessary to center the seat ring with respect to the valve plug before the body-to-bonnet bolting can be tightened.

The bolting procedures in step 12 include—but are not limited to—ensuring that bolting

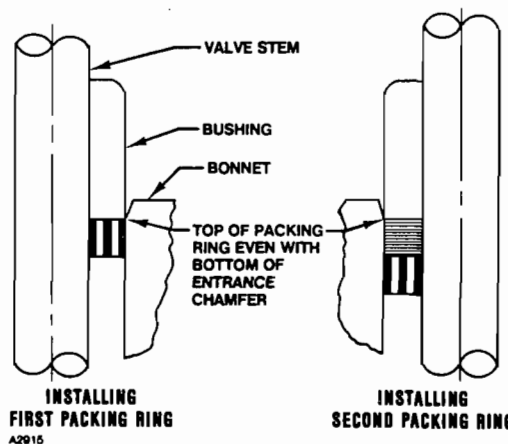


Figure 3. Method of Installing Graphite Ribbon/Filament Packing

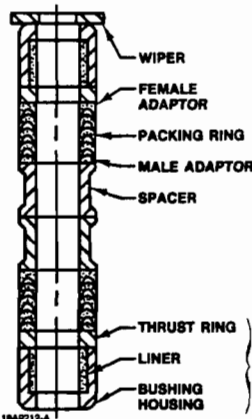
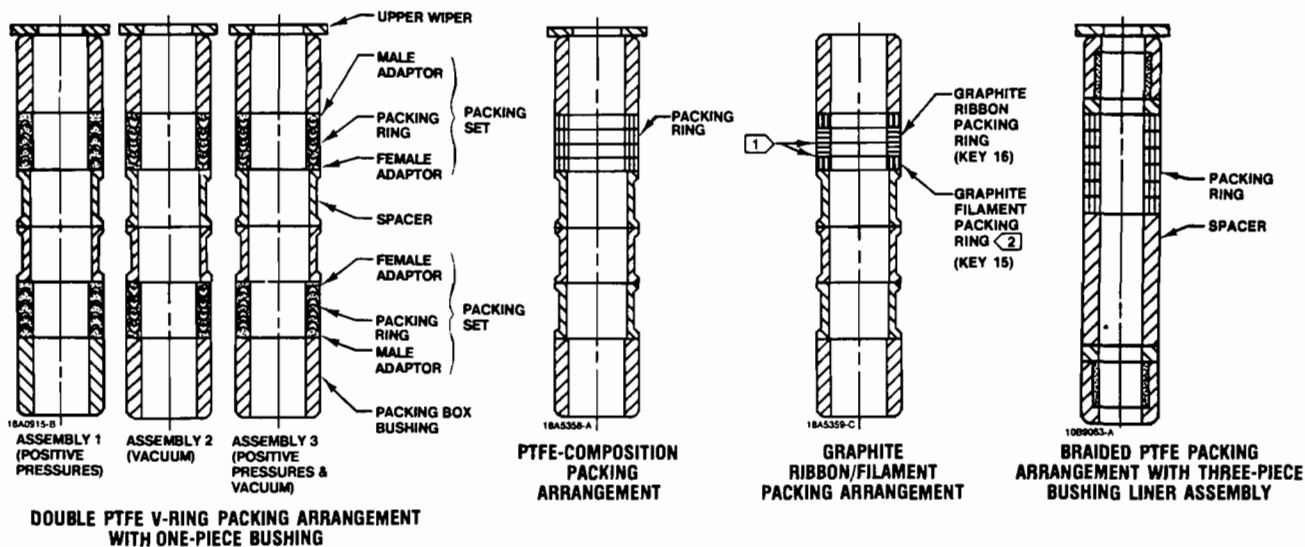
threads are clean, and the hex nuts are evenly tightened onto the studs in a criss-cross pattern. Tightening one nut may loosen an adjacent nut. Repeat the crisscross tightening pattern several times until each nut is tight and the body-to-bonnet seal is made. When the operating temperature has been reached, perform the torquing procedure once again.

12. Center the seat ring by lowering the valve plug to the closed position (valve plug on seat ring) and tapping the end of the valve stem with a brass or lead hammer.

Now that the seat ring has been centered, raise the plug off the seat ring prior to the bolt tightening procedure.

Using accepted bolting procedures, tighten the body-to-bonnet joint to withstand test pressures and application service conditions. The bolt torques in table 5 may be used as guidelines unless accepted bolting procedures dictate otherwise.

The recommended procedure for obtaining proper shutoff is to coin the valve seat. This procedure will provide a slight impression on the seating surface, thus ensuring shutoff. To coin the seat, lower the valve plug to the closed position and solidly tap on the end of the valve stem with a brass or lead hammer. Do not rotate the valve stem after coining has been completed.



NOTES:  
 ① 0.004 INCH (0.102 mm) THICK SACRIFICIAL ZINC WASHERS  
 ② HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

NUMBER OF PACKING BOX SPACERS REQUIRED			
Valve Body Size, Inch	Double PTFE V-Ring Packing	Single PTFE/Composition or Graphite Ribbon/Filament Packing	Braided PTFE
1/2, 3/4, 1, 1-1/2, & 2	2	3	1
3	3	4	
4	4	5	

Figure 4. Packing Arrangements for Standard Bonnet

13. For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For Enviro-Seal or High-Seal live-loaded packing, refer to the note at the beginning of the Maintenance section.

14. Mount the actuator on the valve assembly, and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required.

**Trim Maintenance**

Key numbers in this section refer to figure 6.

**Removal**

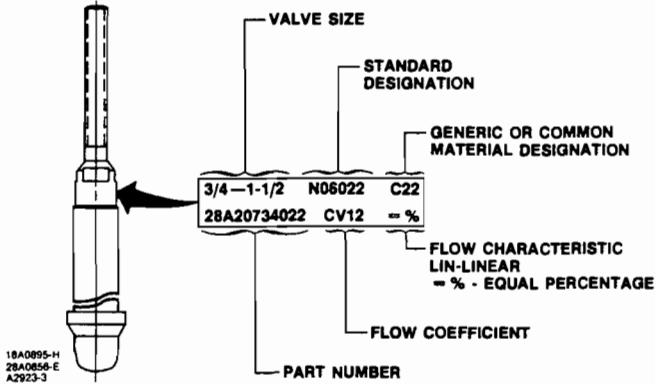
1. Remove the actuator and the bonnet as described in steps 1 through 3 of the Replacing Packing section.

2. Packing parts can be removed if desired. Replace these parts as described in the Packing Maintenance section.

3. Lift out the seat ring retainer (key 5), seat ring (key 4), and seat ring gasket (key 7) or the disk retainer, disk and disk seat (keys 27, 28, and 29) if used.

4. Inspect parts for wear or damage that would prevent proper operation of the valve. The valve plug and stem assembly are marked to show valve size, flow characteristic, material identification, flow coefficient, and part number. The other trim parts are marked to show valve size, material identification, and part number. Refer to figure 5 for an example of trim marking.

5. Replace or repair trim parts according to the following lapping metal seats (for eroded valve seats) or assembly procedures as appropriate.



The following table provides material identification information that is marked on trim parts. Some trim parts were previously marked with a material set up number instead of the actual material identification, and, for these parts, a cross reference is required to determine material. The previous marking information is listed in the right column.

Trim parts are now marked with both the standard designation and a generic or common material designation. The standard designation is listed in the left column, and the generic or common material designation is listed in the middle column.

MATERIAL IDENTIFICATION PLACED ON PART		PREVIOUS MARKING INFORMATION	MATERIAL IDENTIFICATION PLACED ON PART		PREVIOUS MARKING INFORMATION
Standard Designation	Generic or Common Material Designation		Standard Designation	Generic or Common Material Designation	
A-696-C	STL	242B	N05500-CRCT	K500	402S
CF8	304	3307	N10276-721	C276	402Z
CF8M	316	3309	N04400-COL6	MON	403G
CF8C	347	3311	R60702	ZIRC	403L
CF3	304L	3316	N02200-ENC	NI	403T
CF3M	316L	3318	N07750	INC	4025
CN7M 19C6	20	3322	R50700	TI	4035
S31603-CRCT	316L	35AK	N06985	G3	4038
S31600-PTFE	316	35BN	N06022	C22	405C
S30403-PTFE	304L	35BQ	N05500	K500	4052
S31603-PTFE	316L	35BR	6B	---	4118
S31600-PTFE	316	35CE	N04400-CARB	MON	N04400/CARBON
S31603	316L	35DR	N04400	MON	N04400/MON
S17400-6	17-4	35EB	N04400-PTFEC	MON	N04400,PTFE/CARB
S31603-CRCT	316L	35GL	N04400-PTFEG	MON	N04400,PTFE/GLAS
S30403	304L	3505	N05500-6B	MON	N05500/ALLOY 6B
S17400	17-4	3536	N06022-6B	C22	N06022/ALLOY 6B
S30400	304	3556	N06022-721	C22	N06022/ALLOY 721
S31600	316	3557	N06022-6	C22	N06022/R30006
S31603	316L	3560	N06625	625	N06625/625
S34700	347	3562	N08020-PTFEC	20	N08020,PTFE/CARB
S31600-CRCT	316	3577	N08020-PTFEG	20	N08020,PTFE/GLAS
S41600	416	3584	N10276	C276	N10276/C276
S31603-COCRA	316L	3589	N10276-PTFEC	C276	N10276,PTFE/CARB
M35-1 19C3	MON	3901	N10276-PTFEG	C276	N10276,PTFE/GLAS
CZ100	NI	3904	N10665-PTFEC	B2	N10665,PTFE/CARB
N7M	H-B	3906	N10665-PTFEG	B2	N10665,PTFE/GLAS
CW2M 19C5	H-C	3907	R50700-PTFEC	TI	R50700,PTFE/CARB
R30006	6	3910	R50700-PTFEG	TI	R50700,PTFE/GLAS
R50550	TI	3920	S30403-PTFEC	304L	S30403,PTFE/CARB
N04400	MON	4001	S30403-PTFEG	304L	S30403,PTFE/GLAS
N06600	INC	4004	S31603-6B	316L	S31603/ALLOY 6B
N02200	NI	4005	S31603-6	316L	S31603/R30006
N08020	20	4009	S31603-COCRA	316L	S31603/COCRA
N08020-CRCT	20	401C	S31603/N05500	---	S31603/N05500
N10276-CRCT	C276	401E	S31603/S31600	316	S31603/S31600
N08020-PTFE	20	401X	S31603	316L	S31603
N10276	C276	4015	S30403/COL6	304L	S304/NICR-C
N04400-PTFE	MON	402J	S34700-PTFEG	347	S34700,PTFE/GLAS
N10665	B2	402R			

Figure 5. Trim Identification

### Lapping Metal Seats

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring (keys 6 and 4) can be improved by lapping. Coining (see step 12 of the Replacing Packing section) the seat ring to provide proper shutoff should be tried before the lapping procedure is started. Deep nicks should be machined out rather than lapped out. Using a 400 grit commercial lapping compound, apply the compound to the valve plug and seat ring seating surfaces.

The valve must be assembled to the extent that the seat ring retainer is in place, the seat ring centered, and the bonnet (with guide bushings installed) bolted to the body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction with light downward pressure to lap the seats. If there is any indication of insufficient lubrication (e.g., squeaking, vibration, etc.), stop the procedure, and apply more lapping compound before continuing. After lapping, remove the bonnet, and clean the seating surfaces. Completely assemble as described in the assembly portion of this section, and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

### Assembly

1. Clean all gasketed surfaces, and use new gaskets for assembly.
2. Install the seat ring gasket (key 7) and the seat ring (key 4) or the disk retainer, disk and disk seat (keys 27, 28 and 29) if used.
3. Place the seat ring retainer (key 5) in the valve body and lower it, making sure that the retainer sits flat on top of the seat ring. Any rotational orientation of the seat ring retainer with respect to the body is acceptable.

#### CAUTION

**If the packing is to be reused and was not removed from the bonnet, install the valve plug carefully to avoid damaging the packing with the valve stem threads.**

4. Install the bonnet gasket, mount the bonnet on the valve, and complete the assembly according to steps 9 through 14 of the Replacing Packing section, omitting steps 10 and 11 if new packing is not being installed. Be sure to observe the note prior to step 12.

### Enviro-Seal Bellows Seal and Bonnet

#### Replacing a Standard or Extension Bonnet with an Enviro-Seal Bellows Seal (Stem/Bellows Assembly) and Bonnet

Refer to figure 8 except where indicated.

1. Exhaust actuator pressure completely, if any was applied, and disconnect the actuator supply and any leakoff piping. Remove the cap screws in the stem connector and separate the two halves of the stem connector.
2. Loosen the stem locknuts, remove the cap screws in the stem connector, and separate the two halves of the stem connector.
3. Remove the actuator yoke locknut (key 22) and remove the actuator from the existing valve bonnet (key 13). Remove any travel indicator parts and stem locknuts from the valve stem threads.
4. Loosen, but do not remove, the packing flange nuts (key 21) so that the packing (key 15) is not tight on the valve stem (key 6, figure 6).
5. Unscrew the hex nuts (key 10, figure 6 or figure 7) that secure the bonnet to the body and carefully lift off the bonnet and valve plug stem assembly (key 6, figure 6). If the valve plug stem assembly does not come out of the valve with the bonnet, pull it out of the valve body. Set the bonnet and valve plug assembly on a protective surface, to prevent damage to the bonnet gasket surface.
6. Remove and discard the existing bonnet gasket (key 8, figure 6).

#### Note

**The Enviro-Seal stem/bellows assembly (key 36) is available in two different configurations:**

- Pinned plug construction, shipped without the valve plug attached to the stem.
- Seal welded plug construction, where the plug is welded to the stem.

**Complete the following steps to attach the new valve plug (key 6) to the standard Enviro-Seal stem/bellows assembly (key 36) with a pinned plug/stem connection. Skip step 7 if installing a stem/bellows assembly with a seal welded plug/stem connection.**

**CAUTION**

When installing a valve plug on the Enviro-Seal stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

7. To attach the valve plug (key 6) to the stem of the new Enviro-Seal stem/bellows assembly (key 36), place the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the stem extending out of the bellows shroud. Thread the stem into the valve plug. Tighten by gripping the flats of the stem extending out of the top of the bellows shroud with a wrench. Do not grip the bellows shroud or other areas of the stem/bellows assembly. Turn the stem/bellows assembly until the hole in the plug aligns with the hole in the stem. Secure the valve plug to the stem with a new pin (key 40).

8. Inspect the valve seat ring (key 4, figure 6) and seat ring retainer (key 5, figure 6). Replace, if necessary.

9. Place a new bellows gasket (key 39) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly by placing it into the body on top of the bellows gasket.

10. Place a new bonnet gasket (key 8) over the stem/bellows assembly. Place the new Enviro-Seal bellows seal bonnet (key 13) over the stem/bellows assembly.

11. Properly lubricate the bonnet stud bolts (key 9). Install and tighten the hex nuts (key 10) to the torque values shown in table 5.

12. Install the various parts of the packing system in the following order:

- Thrust ring (key 41). Place the thrust ring in the packing box. The thrust ring should fall to the bottom of the packing box. If necessary, use the packing box bushing (key 14) to press the thrust ring into the packing box. In the following steps, carefully press the other packing parts on top of the thrust ring to move all parts into the packing box.

- Packing set or packing ring (key 15). Press the packing set or packing ring into the packing box. Again, use the packing box bushing to exert pressure to move

Table 6. Recommended Torque for Enviro-Seal Bellows Seal Packing Flange Nuts

VALVE SIZE, INCHES	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		Lbf-in	N-m	Lbf-in	N-m
1/2 - 2	1/2	24	3	48	5
3 - 4	1	60	7	84	10

the packing set or packing ring and the thrust ring into the packing box.

- Spacer or spring (key 17). Press the spacer or spring into the packing box. Use equal pressure to move all the packing parts into the packing box.

- Additional packing set or packing ring. Use equal pressure to move all the packing parts into the packing box.

- Packing box bushing (key 14). Place the packing box bushing into the packing box on top of all the other parts installed above. Apply appropriate pressure to the packing box bushing to properly seat the packing parts in the packing box.

- Wiper (key 18). Place the wiper on top of the packing box bushing.

- Packing flange (key 19). Place the packing flange on top of the wiper.

13. Properly lubricate the packing flange stud bolts (key 20) and the faces of the packing flange nuts (key 21).

**For graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

**For other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

14. Mount the actuator according to the procedure in the appropriate actuator instruction manual.

**Replacement of an Installed Enviro-Seal Bellows Seal (Stem/Bellows Assembly)**

Refer to figure 8 except where indicated.

1. Exhaust actuator pressure completely, if any was applied, and disconnect the actuator supply and any leakoff piping.



2. Loosen the stem locknuts, remove the cap screws in the stem connector, and separate the two halves of the stem connector.

3. Unscrew the actuator yoke locknut (key 22) and remove the actuator from the existing Enviro-Seal bellows seal bonnet (key 13). Then, remove any travel indicator parts and stem locknuts from the valve stem threads.

4. Loosen, but do not remove, the packing flange nuts (key 21) on the existing valve bonnet (key 13) so the packing is not tight on the valve stem.

5. Remove the existing valve bonnet hex nuts (key 10) and lift off the existing valve bonnet (key 13) and valve plug stem assembly (key 6). Then, remove the existing Enviro-Seal stem/bellows assembly (key 36).

6. Remove and discard the existing bonnet gasket (key 8) and bellows gasket (key 39).

#### Note

The Enviro-Seal stem/bellows assembly (key 36) is available in two different configurations:

- Pinned plug construction, shipped without the valve plug attached to the stem.
- Seal welded plug construction, where the plug is welded to the stem.

Complete the following steps to attach the new valve plug (key 6) to the standard Enviro-Seal stem/bellows assembly (key 36) with a pinned plug/stem connection. Skip steps 7, 8, and 9 if installing a stem/bellows assembly with a seal welded plug/stem connection.

7. Inspect the existing valve plug (key 6). If the plug is in good condition, it can be reused with the new stem/bellows assembly.

#### CAUTION

When removing/installing a valve plug on the Enviro-Seal stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

8. To remove the existing valve plug from the stem, first, place the existing stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is **not** a seating surface. Drive out the pin (key 40).

9. Reverse the stem/bellows assembly in the soft-jaw chuck or vise. Grip the flats of the stem extending out of the top of the bellows shroud. Do not grip the bellows shroud or other areas of the stem/bellows assembly. Now, unscrew the valve plug.

10. To attach either the existing valve plug or a new valve plug to the stem of the new stem/bellows assembly, place the new stem/bellows assembly in the chuck or vise so that the jaws grip the flats of the stem extending out of the top of the stem/bellows assembly and screw the valve plug onto the valve stem extending from the bottom of the assembly. Secure the valve plug to the stem with a new pin.

11. Inspect the valve seat ring and seat ring retainer. Replace, if necessary.

12. Place a new bellows gasket (key 39) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly by placing it into the body on top of the bellows gasket.

13. Place a new bonnet gasket (key 8) over the stem/bellows assembly. Place either the existing Enviro-Seal bellows seal bonnet (key 13) or a new one over the stem/bellows assembly.

14. Properly lubricate the bonnet stud bolts. Install and tighten the valve bonnet hex nuts to the proper torque value.

15. Install the various parts of the packing system, following the description given in step 12 of the previous Enviro-Seal bellows seal and bonnet installation instructions.

16. Properly lubricate the packing flange stud bolts (key 20) and the faces of the packing flange nuts (key 21).

**For graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

**For other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

17. Mount the actuator according to the procedure in the appropriate actuator instruction manual.

## Changing Flanges

Operating conditions sometimes require that the flanges be replaced with those of a different class or material. When changing flanges, the valve must be removed from the pipeline, but the actuator may be left on the valve. Refer to figure 6.

### Flange Removal

1. Unscrew the capscrews and washers (Keys 33 and 34). Remove the clips (Key 32).
2. Rotate and then push the flange (key 2) toward the center of the valve.
3. Lift the two split ring halves (key 3) out of their groove in the valve.
4. Slide the flange off the valve.

### Flange Replacement

1. Slide the flange onto the valve far enough to expose the split ring groove.
2. Replace the two split ring halves in their groove.
3. Slide the flange into place on the valve, moving it over the split ring.
4. Rotate the flange until its boss aligns with the boss on the valve.
5. Replace the clips, washers, and capscrews (Keys 32, 33, and 34).

## Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your Fisher Controls sales office or sales representative for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number from the following parts list.

## Parts Kits

### Note

Stem and packing box constructions not supplied by Fisher Controls and that do not meet Fisher Controls stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the following repair kits and retrofit kits. Contact your Fisher Controls representative or sales office for Enviro-Seal™ packing instructions.

Repair kits for the Design CE valve (non live-loaded) include FGM bonnet gasket, PTFE seat ring gasket, and double PTFE packing set with packing box parts, including bushings and spacers as required by size. Kits do not apply to special alloy constructions.

Repair Kits (Contains keys 7, 8, 14, 15, 17, 18)

Valve Size, Inches	Stem Diameter, Inch (mm)	Kits
1/2, 3/4, & 1	1/2 (12.7)	RCEX0000012
1-1/2	1/2 (12.7)	RCEX0000022
2	3/4 (19.1)	RCEX0000032
3	1 (25.4)	RCEX0000042
4	1-1/4 (31.8)	RCEX0000052

Repair kits for the Design CE packing box parts (Enviro-Seal packing) include a double PTFE packing set and anti-extrusion washers.

Repair Kits (Contains keys 214 and 215)

Valve Size, Inches	Stem Diameter, Inch (mm)	Kits
1/2, 3/4, 1, & 1-1/2	1/2 (12.7)	RCEXPACK012
2	1/2 (12.7)	RCEXPACK012
2	3/4 (19.1)	RCEXPACK022
3	1 (25.4)	RCEXPACK032
4	1 (25.4)	RCEXPACK032
4	1-1/4 (31.8)	RCEXPACK042

Retrofit kits for the Design CE packing box parts (Enviro-Seal packing) include parts to convert existing Design CE valves with standard bonnets to the Enviro-Seal packing box construction. Retrofit kits include double PTFE packing set, S31600/PTFE one piece bushing, and 316 stainless steel/Inconel spring pack assembly.

Retrofit Kits (Contains keys 14, 200, 212, 214, 215, 216, 217)

Valve Size, Inches	Stem Diameter, Inch (mm)	Kits
1/2, 3/4, 1, & 1-1/2	1/2 (12.7)	RCEXPKAT012
2	3/4 (19.1)	RCEXPKAT022
3	1 (25.4)	RCEXPKAT032
4	1-1/4 (31.8)	RCEXPKAT042

# Parts List

**Note**

Except where indicated, sizes shown are valve body sizes.

Key	Description	Part Number
1	Valve Body	See Key 1 table
2	Flange	See Key 2 table
3	Split Ring (2 req'd; each part number has two halves) K07001 (zn pl steel)	
	1/2 inch	18A2097 X022
	3/4 inch	18A2098 X022
	1 inch	18A0802 X022
	1-1/2 inch	18A0803 X022
	2 inch	18A0804 X022
	3 inch	18A0805 X022
	4 inch	18A0806 X022
	S31600 (316 stainless steel)	
	1/2 inch	18A2097 X012
	3/4 inch	18A2098 X012
	1 inch	18A0802 X012
	1-1/2 inch	18A0803 X012
	2 inch	18A0804 X012
	3 inch	18A0805 X012
	4 inch	18A0806 X012
4*	Seat Ring	See Key 4 table
5*	Seat Ring Retainer	See Key 5 table
6*	Valve Plug Stem Assembly	See Key 6 table
7*	Seat Ring Gasket	See Key 7 table
8*	Bonnet Gasket	See Key 8 table
9	Bonnet Stud Bolt	See Key 9 table
10	Hex Nut	See Key 10 table
11	Flow Arrow, stainless steel	1V1060 38982
12	Drive Screw, stainless steel (6 req'd; 10 req'd for Nickel bodies; 2 additional req'd for Enviro-Seal Bellows Seal Bonnet)	1A3682 28982
13	Bonnet	See Key 13 table
14*	Packing Box Bushing (2 req'd for standard bonnet; 1 req'd for extension bonnet)	
	One-piece bushing	
	S31600 (316 stainless steel)/PTFE	
	1/2, 3/4, 1, & 1-1/2 inch	18A0820 X012
	2 inch	18A0822 X012
	3 inch	18A0824 X012
	4 inch	18A0826 X012
	R30006 (alloy 6)	
	1/2, 3/4, 1, & 1-1/2 inch	18A0819 X012
	2 inch	18A0821 X012
	3 inch	18A0823 X012
	4 inch	18A0825 X012
	S31600 (316 stainless steel) chrome coated	
	1/2, 3/4, 1 & 1-1/2 inch	11B1155 X012
	2 inch	11B1156 X012
	3 inch	11B1157 X012
	4 inch	11B1158 X012
	Three-piece bushing (1 req'd)	See Key 14 table

Key	Description	Part Number
14*	Packing Box Bushing for Enviro-Seal Bellows Seal Bonnet (1 req'd)	
	One-piece bushing	
	S31600 (316 stainless steel)/PTFE	
	1/2, 3/4, 1, 1-1/2, 2 inch	18A0820 X012
	3, 4 inch	18A0824 X012
	R30006 (alloy 6)	
	1/2, 3/4, 1, 1-1/2, 2 inch	18A0819 X012
	3, 4 inch	18A0823 X012
	S31600 (316 stainless steel, chrome-coated)	
	1/2, 3/4, 1, 1-1/2, 2 inch	11B1155 X012
	3, 4 inch	11B1157 X012
	Three-piece bushing (1 req'd)	See Key 14 table
15*	Packing Set, PTFE V-Ring (for double packing only) (2 req'd)	
	1/2, 3/4, 1, & 1-1/2 inch	12A9016 X012
	2 inch	12A8995 X012
	3 inch	12A8832 X012
	4 inch	12A8951 X012
15*	Packing Set, PTFE V-Ring for Enviro-Seal Bellows Seal Bonnet (single packing 1 req'd)	
	1/2, 3/4, 1, 1-1/2, 2 inch	12A9016 X012
	3, 4 inch (double packing only)	12A8832 X012
	(double packing 2 req'd)	
	1/2, 3/4, 1, 1-1/2, 2 inch	12A9016 X012
	3, 4 inch (double packing only)	12A8832 X012
15*	Packing Ring	
	Graphite filament (for graphite ribbon/filament packing) (2 req'd)	
	1/2, 3/4, 1, & 1-1/2 inch	1P3905 X0172
	2 inch	14A1937 X042
	3 inch	14A0915 X042
	4 inch	14A0916 X072
	Enviro-Seal Bellows Seal Bonnet (double packing) (4 req'd)	
	1/2, 3/4, 1, 1-1/2, 2 inch	1P3905 X0172
	3, 4 inch	14A0915 X042
	PTFE/Composition (4 req'd)	
	1/2, 3/4, 1, & 1-1/2 inch	1P3905 01042
	2 inch	14A1937 X012
	3 inch	14A0915 X012
	4 inch	14A0916 X012
	Braided PTFE (may be used for chlorine service) (6 req'd)	
	1/2, 3/4, 1 & 1-1/2 inch	1P3905 X0202
	2 inch	14A1937 X072
	3 inch	14A0915 X092
	4 inch	14A0916 X112
16*	Packing Ring, graphite ribbon/zinc (for graphite ribbon/filament packing) (2 req'd)	
	1/2, 3/4, 1, & 1-1/2 inch	18A0908 X012
	2 inch	18A0914 X012
	3 inch	18A0918 X012
	4 inch	18A0913 X012
	Enviro-Seal Bellows Seal Bonnet (double packing) (4 req'd)	
	1/2, 3/4, 1, 1-1/2, 2 inch	18A0908 X012
	3, 4 inch	18A0918 X012
17	Packing Box Spacer (see Key 17 table for quantity req'd)	
	S31600 (316 stainless steel)	
	1/2, 3/4, 1 & 1-1/2 inch	18A0872 X012
	2 inch	18A0873 X012
	3 inch	18A0874 X012
	4 inch	18A0875 X012
	N10276 (Hastelloy C276)	
	1/2, 3/4, 1, & 1-1/2 inch	18A0872 X032
	2 inch	18A0873 X032
	3 inch	18A0874 X032
	4 inch	18A0875 X032
	N04400 (Monel 400)	
	1/2, 3/4, 1, & 1-1/2 inch	18A0872 X042
	2 inch	18A0873 X042
	3 inch	18A0874 X042
	4 inch	18A0875 X042

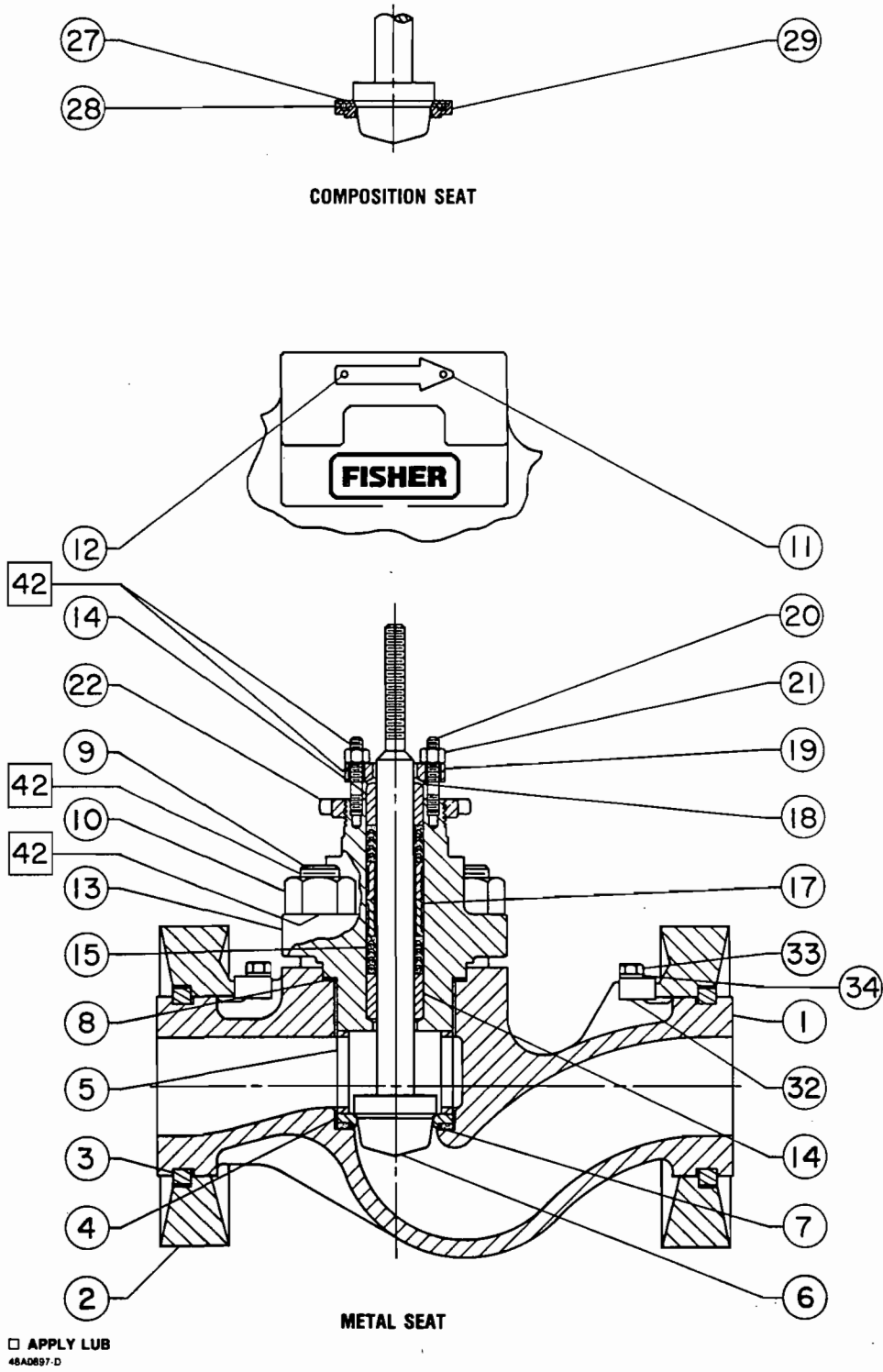


Figure 6. Design CE Separable Flange Valve

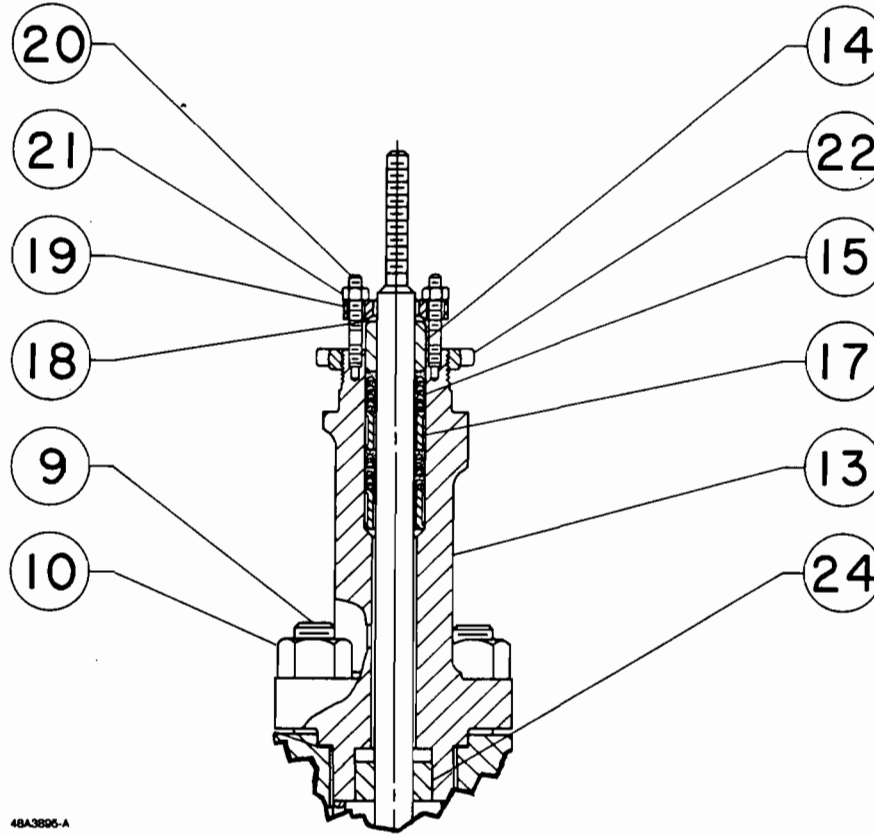
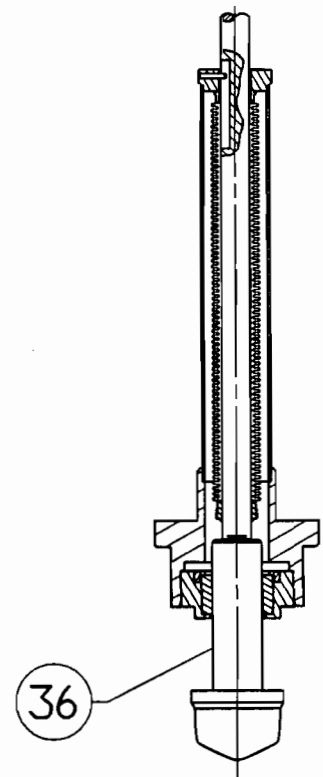
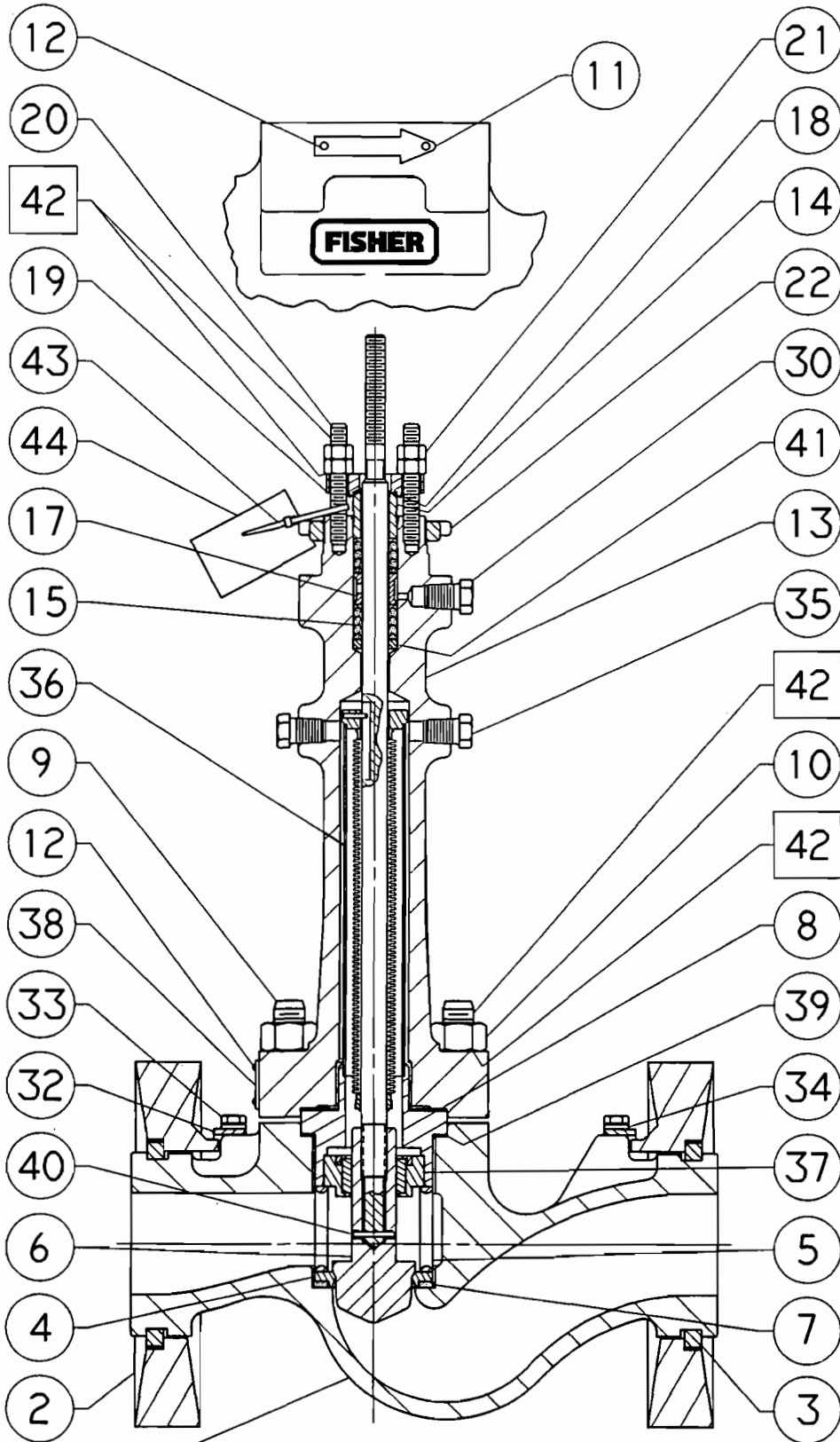


Figure 7. Extension Bonnet

Key	Description	Part Number	Key	Description	Part Number
17	Packing Box Spacer (Continued)		18*	Wiper, felt (not for use with graphite ribbon filament packing)	
	N08020 (Alloy 20)			1/2, 3/4, 1, & 1-1/2 inch	18A0868 X012
	1/2, 3/4, 1, & 1-1/2 inch	18A0872 X022		2 inch	18A0869 X012
	2 inch	18A0873 X022		3 inch	18A0870 X012
	3 inch	18A0874 X022		4 inch	18A0871 X012
	4 inch	18A0875 X022	18*	Wiper, felt for Enviro-Seal Bellows Seal Bonnet (for double and single packing)	
	S30403 (304L stainless steel)			(not for use with graphite ribbon/filament packing)	
	1/2, 3/4, 1, & 1-1/2 inch	18A0872 X092		1/2, 3/4, 1, 1-1/2, 2 inch	18A0868 X012
	2 inch	18A0873 X102		3, 4 inch	18A0870 X012
	3 inch	18A0874 X062	19	Packing Flange	
	4 inch	18A0875 X092		CFBM (316 stainless steel) (standard)	
	PTFE/Glass (may be used for chlorine service)			1/2, 3/4, 1, & 1-1/2 inch	28A0827 X012
	1/2, 3/4, 1, & 1-1/2 inch	19A4526 X012		2 inch	28A0828 X012
	2 inch	19A4844 X012		3 inch	28A0829 X012
	3 inch	19A4851 X012		4 inch	28A0830 X012
	4 inch	19A4852 X012		N04400 (Monel 400)	
17	Packing Box Spacer or Spring for Enviro-Seal Bellows Seal Bonnet			1/2, 3/4, 1, & 1-1/2 inch	28A0827 X032
	for single packing (PTFE)			2 inch	28A0828 X032
	Spring, S31600 (316 stainless steel)			3 inch	28A0829 X032
	1/2, 3/4, 1, 1-1/2, 2 inch only (1 req'd)	1F1254 37012		4 inch	28A0830 X032
	Spacer, N10276 (Hastelloy C276)			N10276 (Hastelloy C276)	
	1/2, 3/4, 1, 1-1/2, 2 inch only (1 req'd)	1H9815 40152		1/2, 3/4, 1, & 1-1/2 inch	28A0827 X112
	for double packing (PTFE, graphite ribbon/filament)			2 inch	28A0828 X112
	Spacer, S31600 (316 stainless steel)			3 inch	28A0829 X112
	1/2, 3/4, 1, 1-1/2, 2 inch (1 req'd)	18A0872 X012		4 inch	28A0830 X112
	3, 4 inch (2 req'd)	18A0874 X012		S30400 (304 stainless steel)	
	Spacer, N10276 (Hastelloy C276)			1/2, 3/4, 1, & 1-1/2 inch	28A0827 X062
	1/2, 3/4, 1, 1-1/2, 2 inch (1 req'd)	18A0872 X032		2 inch	28A0828 X042
	3, 4 inch (2 req'd)	18A0874 X032		3 inch	28A0829 X052
				4 inch	28A0830 X062



SEAL WELD OPTION

□ APPLY LUB  
42B3945 B

Figure 8. Design CE Valve with Enviro-Seal Stem/Bellows Assembly and Bonnet

Key	Description	Part Number	Key	Description	Part Number
19	Packing Flange for Enviro-Seal Bellows Seal Bonnet CF8M (316 stainless steel) (standard) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch N10276 (Hastelloy C276) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch	28A0827 X012 28A0829 X012 28A0827 X112 28A0829 X112	21	Packing Flange Hex Nut (Continued) SA-194-8 (304 stainless steel) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch	1E9440 35442 1A3915 X0052 1A3753 K0022 1E9440 35442
20	Packing Flange Stud Bolt (2 req'd for 1/2, 3/4, 1, 1-1/2, & 3 inch; 3 req'd for 2 & 4 inch) (see Key 20 table for stud bolt length) SA-193-B8M (316 stainless steel) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch SA-193-B7M/ENC (steel) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch N04400 (Monel 400) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch N10276 (Hastelloy C276) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch	11B6951 X032 11B6952 X032 16A1061 X052 11B3814 X022 11B6951 X112 11B6952 X102 16A1061 X122 11B3814 X112 11B6951 X042 11B6952 X042 16A1061 X062 11B3814 X042 11B6951 X052 11B6952 X052 16A1061 X072 11B3814 X052	21*	Packing Flange Hex Nut for Enviro-Seal Bellows Seal Bonnet (4 req'd) SA-194-8M (316 stainless steel) (standard) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch N10276 (Hastelloy C276) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch	1E9440 35252 1A3753 35252 1E9440 40152 1A3753 X0062
	SA-193-B8 (304 stainless steel) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch	11B6951 X012 11B6952 X012 16A1061 X032 11B3814 X062	22	Yoke Locknut Steel 1/2, 3/4, 1, 1-1/2 & 2 inch 3 & 4 inch 304L stainless steel 1/2, 3/4, 1, 1-1/2, & 2 inch 3 & 4 inch	1E7930 X0032 1E8074 X0042 1N7195 X0062 1N7396 X0042
20	Packing Flange Stud Bolt for Enviro-Seal Bellows Seal Bonnet (2 req'd) (see Key 20 table for stud bolt length) SA-193-B8M (316 stainless steel) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch N10276 (Hastelloy C276) 1/2, 3/4, 1, 1-1/2, 2 inch 3, 4 inch	11B6951 X032 16A1061 X052 11B6951 X052 16A1061 X072	24*	Extension Bonnet Bushing <sup>(1)</sup> for WCB Bodies, R30006 (Alloy 6) 1/2, 3/4, & 1 inch 1-1/2 inch 2 inch 3 inch 4 inch	18A3890 X012 18A3891 X012 18A3892 X012 18A3893 X012 18A3894 X012
21	Packing Flange Hex Nut (4 req'd for 1/2, 3/4, 1, 1-1/2, & 3 inch; 6 req'd for 2 & 4 inch) SA-194-8M (316 stainless steel) (standard) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch SA-194-2HM/ENC (steel) (sour service) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch N04400 (Monel 400) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch N10276 (Hastelloy C276) 1/2, 3/4, 1, & 1-1/2 inch 2 inch 3 inch 4 inch	1E9440 35252 1A3915 35252 1A3753 35252 1E9440 35252 1E9440 X0232 1A3915 X0262 1A3753 X0292 1E9440 X0232 1E9440 40012 1A3915 40012 1A3753 X0092 1E9440 40012 1E9440 40152 1A3915 40152 1A3753 X0062 1E9440 40152	25	Nameplate, stainless steel (not shown)	18A5087 X0A2
			26	Lead Seal & Wire (not shown)	1D8847 99012
			27*	Disk Retainer	See Key 27 table
			28*	Disk	See Key 28 table
			29*	Disk Seat	See Key 29 table
			30	Pipe Plug for 1/4 inch NPT Tapping in Packing Box, steel	See Key 30 table
			30	Lubricator, Steel/440 stainless steel	0V0873 000A2
			30	Lubricator/Isolating Valve, Cd pl steel	AJ5428 000A2
			31	Warning Label (use only with Nickel bodies) (2 req'd) (not shown)	11B9636 X0A2
			32	Clip, stainless steel (2 req'd)	12B0890 X012
			33	Cap screw, stainless steel (2 req'd)	1L7325 X0012
			34	Washer, S30200 (302 stainless steel) (2 req'd)	1F1280 35022
				<b>Note</b>	
				Always match Key 35 pipe plug material with the Enviro-Seal Bellows Seal Bonnet material. See the Key 13 table for Enviro-Seal Bellows Seal Bonnet part numbers. See the Key 35 table for pipe plug part numbers.	
			35	Pipe Plug, for Enviro-Seal Bellows Seal Bonnet, any size (2 req'd)	See Key 35 table

**Note**  
Keys 25 and 26 are used only when actuator is not furnished with the valve body.

Key	Description	Part Number	Key	Description	Part Number
	<b>Note</b>		36*	Stem/Bellows Ass'y	See Key 36/37 table
			37*	Bushing Ass'y	See Key 36/37 table
			38	Warning Nameplate	1E5174 X00A2
			39*	Bellows Gasket	See Key 39 table
			40*	Pin	
				N06022 (Hastelloy C22)	
				1/2, 3/4, 1, 1-1/2	12B3950 X012
				2 inch	12B3951 X012
				3 inch	12B3952 X012
				4 inch	12B3953 X012
			41	Thrust Ring	
				for single packing (PTFE)	
				S31600 (316 stainless steel)(3 req'd)	
				1/2, 3/4, 1, 1-1/2, 2 inch only	19A9208 X112
				N10276 (Hastelloy C276)(1 req'd)	
				1/2, 3/4, 1, 1-1/2, 2 inch only	19A9208 X022
				for double packing (PTFE, graphite ribbon/filament)	
				S31600 (316 stainless steel)(1 req'd)	
				1/2, 3/4, 1, 1-1/2, 2 inch only	19A9208 X112
				N10276 (Hastelloy C276)(1 req'd)	
				1/2, 3/4, 1, 1-1/2, 2 inch only	19A9208 X022
			42	Lubricant, Never-Seez Nickel Special <sup>(1)</sup>	
				8 lb. (3.6 kg) can	1M5539 X0012
			43	Cable tie	18A9401 X012
			44	Warning tag	22B3975 X012

**Key 36, the Enviro-Seal Bellows Seal stem/bellows assembly, is available in 1- or 2-ply bellows and with threaded and pinned or welded plug/stem connections.**

**See Key 36/Key 37 table for part numbers for the stem/bellows assembly with 1 ply construction and threaded and pinned plug/stem connection.**

**A stem/bellows assembly with a threaded and pinned plug/stem connection is provided without a valve plug (key 6) and pin (key 40). When ordering key 36 with the threaded and pinned plug/stem connection, also order the valve plug and pin.**

**A stem/bellows assembly with a seal welded plug/stem connection is provided with a valve plug welded to the stem. The bushing assembly (key 37) cannot be removed or replaced.**

**To order a stem/bellows assembly with a seal welded plug/stem connection, contact your Fisher sales office or representative for assistance.**

Key 1 Valve Body

VALVE SIZE, INCHES	VALVE BODY MATERIAL					
	WCB Steel	CN7M (Alloy 20)	M35-1 (Monel)	CW2M (Hastelloy)	CF3M (316L SST)	CF3 (304L SST)
1/2	42B0857 X012	42B0857 X032	42B0857 X042	42B0857 X052	42B0857 X072	42B0857 X082
3/4	42B0858 X012	42B0858 X032	42B0858 X042	42B0858 X052	42B0858 X072	42B0858 X082
1	42B0859 X012	42B0859 X032	42B0859 X042	42B0859 X052	42B0859 X102	42B0859 X112
1-1/2	42B0860 X012	42B0860 X032	42B0860 X042	42B0860 X052	42B0860 X072	42B0860 X082
2	42B0861 X012	42B0861 X032	42B0861 X042	42B0861 X052	42B0861 X122	42B0861 X092
3	42B0862 X012	42B0862 X032	42B0862 X042	42B0862 X052	42B0862 X092	42B0862 X062
4	42B0863 X012	42B0863 X032	42B0863 X042	42B0863 X052	42B0863 X082	42B0863 X092

Key 2 Flange (2 req'd)

CLASS	VALVE SIZE, INCHES	FLANGE MATERIAL	
		WCB Steel	CF8M (316 SST)
150	1/2	42B0835 X012	42B0835 X022
	3/4	42B0837 X012	42B0837 X022
	1	42B0839 X012	42B0839 X022
	1-1/2	42B0841 X012	42B0841 X022
	2	42B0843 X012	42B0843 X022
	3	42B0845 X012	42B0845 X022
300/600	4	42B0847 X012	42B0847 X022
	1/2	42B0836 X012	42B0836 X022
	3/4	42B0838 X012	42B0838 X022
	1	42B0840 X012	42B0840 X022
	1-1/2	42B0842 X012	42B0842 X022
300	2	42B0844 X012	42B0844 X022
	3	42B0846 X012	42B0846 X022
	4	42B0848 X012	42B0848 X022
600	4	42B0849 X012	42B0849 X022

1. Trademark of Never-Seez Corp.  
\*Recommended spare part.



Key 4\* Seat Ring

VALVE SIZE, INCHES	PORT DIAMETER		SEAT RING MATERIAL					
	Inches	mm	S31600 (316 SST)	R30006 (Alloy 6)	N10276 (Hastelloy C276)	N08020 (Alloy 20)	N05500 (K-Monel)	S30403 (304L SST)
1/2, 3/4, & 1	3/16	4.8	28A0841 X012	28A0841 X032	28A0841 X042	28A0841 X052	28A0841 X062	28A0841 X102
	1/4	6.4	28A0842 X012	28A0842 X032	28A0842 X042	28A0842 X052	28A0842 X062	28A0842 X082
	3/8	9.5	28A0843 X012	28A0843 X032	28A0843 X042	28A0843 X052	28A0843 X062	28A0843 X072
	1/2	12.7	28A0844 X012	28A0844 X032	28A0844 X042	28A0844 X052	28A0844 X062	28A0844 X082
	3/4	19.1	28A0845 X012	28A0845 X032	28A0845 X042	28A0845 X052	28A0845 X062	28A0845 X102
1-1/2	3/16	4.8	28A5340 X012	28A5340 X022	28A5340 X032	28A5340 X042	28A5340 X052	28A5340 X062
	1/4	6.4	28A5341 X012	28A5341 X022	28A5341 X032	28A5341 X042	28A5341 X052	28A5341 X062
	3/8	9.5	28A5342 X012	28A5342 X022	28A5342 X032	28A5342 X042	28A5342 X052	28A5342 X062
	1/2	12.7	28A0846 X012	28A0846 X032	28A0846 X042	28A0846 X052	28A0846 X062	28A0846 X072
	3/4	19.1	28A0847 X012	28A0847 X032	28A0847 X042	28A0847 X052	28A0847 X062	28A0847 X072
	1-1/8	29	28A0848 X012	28A0848 X032	28A0848 X042	28A0848 X052	28A0848 X062	28A0848 X092
2	3/4	19.1	28A0849 X012	28A0849 X032	28A0849 X042	28A0849 X052	28A0849 X062	28A0849 X072
	1-1/8	29	28A0850 X012	28A0850 X032	28A0850 X042	28A0850 X052	28A0850 X062	28A0850 X082
	1-1/2	38.1	28A0851 X012	28A0851 X032	28A0851 X042	28A0851 X052	28A0851 X062	28A0851 X102
3	1-1/2	38.1	28A0852 X012	28A0852 X032	28A0852 X042	28A0852 X052	28A0852 X062	28A0852 X072
	2-1/2	63.5	28A0853 X012	28A0853 X032	28A0853 X042	28A0853 X052	28A0853 X062	28A0853 X082
4	2-1/2	63.5	28A0854 X012	28A0854 X032	28A0854 X042	28A0854 X052	28A0854 X062	28A0854 X072
	3-1/4	83	28A0855 X012	28A0855 X032	28A0855 X042	28A0855 X052	28A0855 X062	28A0855 X092

Key 5\* Seat Ring Retainer

VALVE SIZE, INCHES	SEAT RING RETAINER MATERIAL				
	CF8M (316 SST)	CN7M (Alloy 20)	M35-1 (Monel)	CW2M (Hastelloy C)	CF3 (304L SST)
1/2, 3/4, & 1	18A0808 X012	18A0808 X022	18A0808 X032	18A0808 X042	18A0808 X082
1-1/2	18A0810 X012	18A0810 X022	18A0810 X032	18A0810 X042	18A0810 X062
2	18A0812 X012	18A0812 X022	18A0812 X032	18A0812 X042	18A0812 X102
3	18A0814 X012	18A0814 X022	18A0814 X032	18A0814 X042	18A0814 X062
4	18A0816 X012	18A0816 X022	18A0816 X032	18A0816 X042	18A0816 X102

Key 6\* Valve Plug & Stem Assembly (Linear)

VALVE SIZE, INCHES	PORT DIAMETER		MAX FLOW UP COEFFICIENT (C <sub>v</sub> ) BY VALVE SIZE	VALVE PLUG & STEM MATERIAL					
	Inches	mm		S31603 (316L SST)	N06022 (Hastelloy C22)	N08020 (Alloy 20)	N05500 (K-Monel)	S31603 (316L SST) w/ Alloy 6B Seat & Contour	S30403 (304L SST)
<b>Standard Bonnet</b>									
1/2, 3/4, 1, & 1-1/2	1/2	12.7	4.65, 5.63, 5.79, 6.08 (1), 10.3, 12.2, 15.1	28A2071 X012	28A2071 X022	28A2071 X032	28A2071 X042	28A2071 X072 <sup>(2)</sup>	28A2071 X062
	3/4	19.1		28A2074 X012	28A2074 X022	28A2074 X032	28A2074 X042	28A2074 X082 <sup>(2)</sup>	28A2074 X072
1-1/2	1-1/8	28.6	27.8	28A2089 X012	28A2089 X022	28A2089 X032	28A2089 X042	28A2094 X012	28A2089 X052
2	3/4	19.1	12.3	28A5395 X012	28A5395 X022	28A5395 X032	28A5395 X042	28A5395 X052 <sup>(2)</sup>	28A5395 X062
	1-1/8	28.6	31.7	28A0858 X012	28A0858 X022	28A0858 X032	28A0858 X042	28A0860 X012	28A0858 X052
	1-1/2	38.1	48.7	28A0894 X012	28A0894 X022	28A0894 X032	28A0894 X042	28A0862 X012	28A0894 X062
3	1-1/2	38.1	52.4	28A3402 X012	28A3402 X022	28A3402 X032	28A3402 X042	28A3406 X012	28A3402 X052
	2-1/2	63.5	114	28A3404 X012	28A3404 X022	28A3404 X032	28A3404 X042	28A3408 X012	28A3404 X052
4	2-1/2	63.5	132	28A3414 X012	28A3414 X022	28A3414 X032	28A3414 X042	28A3418 X012	28A3414 X052
	3-1/4	82.6	195	28A3416 X012	28A3416 X022	28A3416 X032	28A3416 X042	28A3420 X012	28A3416 X062
<b>Extension Bonnet</b>									
1/2, 3/4, 1, & 1-1/2	1/2	12.7	4.65, 5.63, 5.79, 6.08 (1), 10.3, 12.2, 15.1	28A3846 X012	28A3846 X022	28A3846 X032	28A3846 X042	28A3846 X062 <sup>(2)</sup>	28A3846 X052
	3/4	19.1		28A3847 X012	28A3847 X022	28A3847 X032	28A3847 X042	28A3847 X082 <sup>(2)</sup>	28A3847 X052
1-1/2	1-1/8	28.6	27.8	28A3857 X012	28A3857 X022	28A3857 X032	28A3857 X042	28A3859 X012	28A3857 X052
2	3/4	19.1	12.3	28A5396 X012	28A5396 X022	28A5396 X032	28A5396 X042	28A5396 X052 <sup>(2)</sup>	28A5396 X062
	1-1/8	28.6	31.7	28A3866 X012	28A3866 X022	28A3866 X032	28A3866 X042	28A3868 X012	28A3866 X052
	1-1/2	38.1	48.7	28A3867 X012	28A3867 X022	28A3867 X032	28A3867 X042	28A3869 X012	28A3867 X052
3	1-1/2	38.1	52.4	28A3874 X012	28A3874 X022	28A3874 X032	28A3874 X042	28A3876 X012	28A3874 X052
	2-1/2	63.5	114	28A3875 X012	28A3875 X022	28A3875 X032	28A3875 X042	28A3877 X012	28A3875 X052
4	2-1/2	63.5	132	28A3882 X012	28A3882 X022	28A3882 X032	28A3882 X042	28A3884 X012	28A3882 X052
	3-1/4	82.6	195	28A3883 X062	28A3883 X072	28A3883 X082	28A3883 X092	28A3885 X022	28A3883 X102

1. 1/2-inch body not available with 3/4-inch port diameter.  
 2. Valve plug is either R30006 (Alloy 6) or Alloy 6B material.

Key 6\* Valve Plug & Stem Assembly (Equal Percentage)

VALVE SIZE, INCHES	PORT DIAMETER		MAX COEFFICIENT (C <sub>v</sub> ) BY VALVE SIZE	VALVE PLUG & STEM MATERIAL					
	Inches	mm		S31603 (316L SST)	N06022 (Hastelloy C22)	N08020 (Alloy 20)	N05500 (K-Monel)	S31603 (316L SST) w/ R30006 (Alloy 6) Seat & Contour	S30403 (304L SST)
<b>Standard Bonnet</b>									
1/2, 3/4, 1, & 1-1/2	3/16	4.8	0.667	28A2067 X012	28A2067 X022	28A2067 X032	28A2067 X042	28A2076 X012 <sup>(2)</sup>	28A2067 X062
	1/4	6.4	1.59	28A2068 X012	28A2068 X022	28A2068 X032	28A2068 X042	28A2077 X012 <sup>(2)</sup>	28A2068 X062
	3/8	9.5	3.10, 3.34, 3.50, 3.50	28A2069 X012	28A2069 X022	28A2069 X032	28A2069 X042	28A2069 X062 <sup>(2)</sup>	28A2069 X052
	1/2	12.7	4.69, 5.37, 5.63, 5.91	28A2070 X012	28A2070 X022	28A2070 X032	28A2070 X042	28A2070 X072 <sup>(2)</sup>	29A2070 X062
	3/4	19.1	<sup>(1)</sup> , 10.5, 12.0, 15.3	28A2073 X012	28A2073 X022	28A2073 X032	28A2073 X042	28A2073 X082 <sup>(2)</sup>	28A2073 X062
1-1/2	1-1/8	28.6	25.2	28A2088 X012	28A2088 X022	28A2088 X032	28A2088 X042	28A2093 X012	28A2088 X062
2	3/4	19.1	12.0	28A0856 X012	28A0856 X022	28A0856 X032	28A0856 X042	28A0856 X052 <sup>(2)</sup>	28A0856 X062
	1-1/8	28.6	28.0	28A0857 X012	28A0857 X022	28A0857 X032	28A0857 X042	28A0859 X012	28A0857 X062
	1-1/2	28.1	46.5	28A0892 X012	28A0892 X022	28A0892 X032	28A0892 X042	28A0861 X012	28A0892 X082
3	1-1/2	38.1	51.8	28A3401 X012	28A3401 X022	28A3401 X032	28A3401 X042	28A3405 X012	28A3401 X052
	2-1/2	63.5	109	28A3403 X012	28A3403 X022	28A3403 X032	28A3403 X042	28A3407 X012	28A3403 X062
4	2-1/2	63.5	118	28A3413 X012	28A3413 X022	28A3413 X032	28A3413 X042	28A3417 X012	28A3413 X052
	3-1/4	82.6	179	28A3415 X012	28A3415 X022	28A3415 X032	28A3415 X042	28A3419 X012	28A3415 X072
<b>Extension Bonnet</b>									
1/2, 3/4, 1, & 1-1/2	3/16	4.8	0.667	28A3836 X012	28A3836 X022	28A3836 X032	28A3836 X042	28A3841 X012 <sup>(2)</sup>	28A3836 X052
	1/4	6.4	1.59	28A3837 X012	28A3837 X022	28A3837 X032	28A3837 X042	28A3842 X012 <sup>(2)</sup>	28A3837 X052
	3/8	9.5	3.10, 3.34, 3.50, 3.50	28A3838 X012	28A3838 X022	28A3838 X032	28A3838 X042	28A3838 X062 <sup>(2)</sup>	28A3838 X052
	1/2	12.7	4.69, 5.37, 5.63, 5.91	28A3839 X012	28A3839 X022	28A3839 X032	28A3839 X042	28A3839 X062 <sup>(2)</sup>	28A3839 X052
	3/4	19.1	<sup>(1)</sup> , 10.5, 12.0, 15.3	28A3840 X012	28A3840 X022	28A3840 X032	28A3840 X042	28A3840 X062 <sup>(2)</sup>	28A3840 X052
1-1/2	1-1/8	28.6	25.2	28A3852 X012	28A3852 X022	28A3852 X032	28A3852 X042	28A3855 X012	28A3852 X052
2	3/4	19.1	12.0	28A3860 X012	28A3860 X022	28A3860 X032	28A3860 X042	28A3860 X052 <sup>(2)</sup>	28A3860 X062
	1-1/8	28.6	28.0	28A3861 X012	28A3861 X022	28A3861 X032	28A3861 X042	28A3863 X012	28A3861 X052
	1-1/2	38.1	46.5	28A3864 X012	28A3864 X022	28A3864 X032	28A3864 X042	28A3865 X012	28A3864 X052
3	1-1/2	38.1	51.8	28A3870 X012	28A3870 X022	28A3870 X032	28A3870 X042	28A3872 X012	28A3870 X052
	2-1/2	63.5	109	28A3871 X012	28A3871 X022	28A3871 X032	28A3871 X042	28A3873 X012	28A3871 X052
4	2-1/2	63.5	118	28A3878 X012	28A3878 X022	28A3878 X032	28A3878 X042	28A3880 X012	28A3878 X052
	3-1/4	82.6	179	28A3879 X062	28A3879 X072	28A3879 X082	28A3879 X092	28A3881 X022	28A3879 X102

1. 1/2-inch body not available with 3/4-inch port diameter.  
 2. Valve plug is either R30006 (Alloy 6) or Alloy 6B material.

Key 6\* Valve Plug, Stem, & Seat Ring Assembly (Micro-Flow)

VALVE SIZE, INCHES	PORT DIAMETER		COEFFICIENT (C <sub>v</sub> )	VALVE PLUG, STEM & SEAT RING MATERIAL					
	Inches	mm		Plug & Stem: S31603 (316L SST) w/R30006 (Alloy 6) Seat & Tip Seat Ring: S31600 (316 SST)	Plug & Stem: N06022 (Hastelloy C22) Seat Ring: N10276 (Hastelloy C276)	All Parts: N08020 (Alloy 20)	All Parts: N05500 (K-Monel)	Plug & Stem: S31603 (316L SST) w/R30006 (Alloy 6) Seat & Tip Seat Ring: R30006 (Alloy 6)	All Parts: S30403 (304L SST)
<b>Standard Bonnet</b>									
1/2, 3/4, 1	3/16	4.8	0.022	28A2065 X012	28A2065 X022	28A2065 X032	28A2065 X042	28A2065 X052	28A2065 X212
			0.036	28A2066 X012	28A2066 X022	28A2066 X032	28A2066 X042	28A2066 X052	28A2066 X212
1-1/2	3/16	4.8	0.022	28A2065 X112	28A2065 X122	28A2065 X132	28A2065 X142	28A2065 X152	28A2065 X232
			0.036	28A2066 X112	28A2066 X122	28A2066 X132	28A2066 X142	28A2066 X152	28A2066 X232
<b>Extension Bonnet</b>									
1/2, 3/4, 1	3/16	4.8	0.022	28A2065 X062	28A2065 X072	28A2065 X082	28A2065 X092	28A2065 X102	28A2065 X222
			0.036	28A2066 X062	28A2066 X072	28A2066 X082	28A2066 X092	28A2066 X102	28A2066 X222
1-1/2	3/16	4.8	0.022	28A2065 X162	28A2065 X172	28A2065 X182	28A2065 X192	28A2065 X202	28A2065 X242
			0.036	28A2066 X162	28A2066 X172	28A2066 X182	28A2066 X192	28A2066 X202	28A2066 X242

Key 6" Valve Plug & Stem Assembly<sup>(1)</sup> (Micro-Flow)

VALVE SIZE, INCHES	PORT DIAMETER		COEFFICIENT (C <sub>v</sub> )	VALVE PLUG & STEM <sup>(1)</sup> MATERIAL				
	Inches	mm		S31603 (316L SST) w/R30006 (Alloy 6) Seat and Tip	N06022 (Hastelloy C22)	N08020 (Alloy 20)	N05500 (K-Monel)	S30403 (304L SST)
<b>Standard Bonnet</b>								
1/2, 3/4, 1, & 1-1/2	3/16	4.8	0.089 0.250	28A2062 X012 28A2063 X012	28A2055 X022 28A2056 X022	28A2055 X032 28A2056 X032	28A2055 X042 28A2056 X042	28A2055 X052 28A2056 X052
<b>Extension Bonnet</b>								
1/2, 3/4, 1, & 1-1/2	3/16	4.8	0.089 0.250	28A3834 X012 28A3835 X012	28A3829 X022 28A3830 X022	28A3829 X032 28A3830 X032	28A3829 X042 28A3830 X042	28A3829 X052 28A3830 X052

1. Seat rings must be ordered separately. Refer to Seat Ring table (key 4) for individual seat ring.

Key 6" Equal Percentage Valve Plug<sup>(1)(2)</sup> for Enviro-Seal Stem/Bellows Assembly with Threaded and Pinned Plug/Stem Connection

VALVE SIZE, INCHES	PORT DIAMETER		MAX FLOW COEFFICIENT (C <sub>v</sub> ) BY VALVE SIZE	TRAVEL, INCHES	VALVE PLUG MATERIAL	
	Inches	mm			S36103 (316L SST)	N10276 (Hastelloy C276)
1/2 <sup>(3)</sup> , 3/4, 1	3/8	9.5	2.70 2.70 2.70	0.56	22B6105 X012	22B6105 X022
	1/2	12.7	4.82 4.82 4.82	0.56	22B6106 X012	22B6106 X022
	3/4 <sup>(3)</sup>	19.1	-- <sup>(3)</sup> 11.1 11.1	0.56 0.75	22B4056 X012 22B4046 X012	22B4056 X022 22B4046 X022
1-1/2	3/4	19.1	11.1	0.56	22B6107 X012	22B6107 X022
	1-1/8	28.6	27.0	0.56 0.75	22B4057 X012 22B4047 X012	22B4057 X022 22B4047 X022
2	3/4	19.1	11.1	0.56	22B6109 X012	22B6109 X022
	1-1/8	28.6	27.0	0.56	22B6111 X012	22B6111 X022
	1-1/2	38.1	47.3	0.84 1.12	22B4058 X012 22B4048 X012	22B4058 X022 22B4048 X022
3	1-1/2	38.1	47.3	0.84	22B6113 X012	22B6113 X022
	2-1/2	63.5	108	1.13 1.50	22B2059 X012 22B4049 X012	22B4059 X022 22B4049 X022
4	2-1/2	63.5	108	1.13	22B6115 X012	22B6115 X022
	3-1/4	82.6	179	1.50 2.00	22B4060 X012 22B4050 X012	22B4060 X022 22B4050 X022

1. The Enviro-Seal stem/bellows assembly with threaded and pinned plug/stem connection is shipped without a valve plug. Order the valve plug using these part numbers. A separate valve plug is not required when ordering the Enviro-Seal stem/bellows assembly with seal welded plug/stem connection. See key 36 and key 36 table.  
 2. A pin (key 40) is also required for each valve plug.  
 3. The 3/4-inch port diameter is not available in a 1/2-inch body.

Key 6\* Linear Valve Plug<sup>(1)(2)</sup> for Enviro-Seal Stem/Bellows Assembly with Threaded and Pinned Plug/Stem Connection

VALVE SIZE, INCHES	PORT DIAMETER		MAX FLOW COEFFICIENT (C <sub>v</sub> ) BY VALVE SIZE	TRAVEL, INCHES	VALVE PLUG MATERIAL	
	Inches	mm			S36103 (316L SST)	N10276 (Hastelloy C276)
1/2 <sup>(3)</sup> , 3/4, 1	3/8	9.5	2.63 2.63 2.63	0.56	22B6100 X012	22B6100 X022
	1/2	12.7	4.79 4.79 4.79	0.56	22B6101 X012	22B6101 X022
	3/4 <sup>(3)</sup>	19.1	--- <sup>(3)</sup> 11.4 11.4	0.56 0.75	22B4061 X012 22B4051 X012	22B4061 X022 22B4051 X022
1-1/2	3/4	19.1	11.4	0.56	22B6108 X012	22B6108 X022
	1-1/8	28.6	27.5	0.56 0.75	22B4062 X012 22B4052 X012	22B4062 X022 22B4052 X022
2	3/4	19.1	11.4	0.56	22B6110 X012	22B6110 X022
	1-1/8	28.6	27.5	0.56	22B6112 X012	22B6112 X022
	1-1/2	38.1	47.3	0.84 1.13	22B4063 X012 22B4053 X012	22B4063 X022 22B4053 X022
3	1-1/2	38.1	48.1	0.84	22B6114 X012	22B6114 X022
	2-1/2	63.5	117	1.13 1.50	22B4064 X012 22B4054 X012	22B4064 X022 22B4054 X022
4	2-1/2	63.5	117	1.13	22B6116 X012	22B6116 X022
	3-1/4	82.6	193	1.50 2.00	22B4065 X012 22B4055 X012	22B4065 X022 22B4055 X022

1. The Enviro-Seal stem/bellows assembly with threaded and pinned plug/stem connection is shipped without a valve plug. Order the valve plug using these part numbers. A separate valve plug is not required when ordering the Enviro-Seal stem/bellows assembly with seal welded plug/stem connection. See key 36 and key 36 table.  
 2. A pin (key 40) is also required for each valve plug.  
 3. The 3/4-inch port diameter is not available in a 1/2-inch body.

Key 7\* Seat Ring Gasket for Use with Metal Seats  
 Key 8\* Bonnet Gasket for Use with Metal Seats

VALVE SIZE, INCHES	SEAT RING GASKET MATERIAL	BONNET GASKET MATERIAL					
		Glass-Filled PTFE <sup>(1)</sup>	PTFE Coated N04400 (Monel 400)	Graphite Laminated/ S31600 (316 SST)	PTFE Coated S31603 (316L SST)	PTFE Coated N10276 (Hastelloy C276)	PTFE Coated N08020 (Alloy 20)
Use with Glass-Filled PTFE Seat Ring Gasket							
1/2, 3/4 & 1	18A0881 X012	18A5344 X012	18A0898 X022	18A5344 X022	18A5344 X032	18A5344 X042	18A5344 X072
1-1/2	18A0882 X012	18A5345 X012	18A0899 X022	18A5345 X022	18A5345 X032	18A5345 X042	18A5345 X062
2	18A0883 X012	18A5346 X012	18A0900 X022	18A5346 X022	18A5346 X032	18A5346 X042	18A5346 X072
3	18A0884 X012	18A5347 X012	18A0901 X022	18A5347 X032	18A5347 X042	18A5347 X052	18A5347 X082
4	18A0885 X012	18A5348 X012	18A0902 X022	18A5348 X022	18A5348 X032	18A5348 X042	18A5348 X072
Use with Carbon-Filled PTFE Seat Ring Gasket							
1/2, 3/4 & 1	18A0881 X042	18A5344 X012	18A0898 X022	18A5344 X022	18A5344 X032	18A5344 X042	18A5344 X072
1-1/2	18A0882 X042	18A5345 X012	18A0899 X022	18A5345 X022	18A5345 X032	18A5345 X042	18A5345 X062
2	18A0883 X042	18A5346 X012	18A0900 X022	18A5346 X022	18A5346 X032	18A5346 X042	18A5346 X072
3	18A0884 X042	18A5347 X012	18A0901 X022	18A5347 X032	18A5347 X042	18A5347 X052	18A5347 X082
4	18A0885 X042	18A5348 X012	18A0902 X022	18A5348 X022	18A5348 X032	18A5348 X042	18A5348 X072

1. May be used with Enviro-Seal Stem/Bellows Assembly option.

Key 7\* Seat Ring Gasket for Use with Metal Seats  
Key 8\* Bonnet Gasket for Use with Metal Seats

VALVE SIZE, INCHES	SEAT RING GASKET MATERIAL	BONNET GASKET MATERIAL
	N06600 (Inconel <sup>(1)</sup> 600/ Graphite) <sup>(2)</sup>	Graphite Laminated/ S31600 (316 SST)
1/2, 3/4 & 1 1-1/2 2 3 4	18A0886 X012 18A0887 X012 18A0888 X012 18A0889 X012 18A0890 X012	18A0898 X022 18A0899 X022 18A0900 X022 18A0901 X022 18A0902 X022
1/2, 3/4 & 1 1-1/2 2 3 4	Calcium Fluoride Filled PTFE	PTFE Coated N04400 (Monel 400)
	18A0881 X032 18A0882 X022 18A0883 X032 18A0884 X022 18A0885 X022	18A5344 X012 18A5345 X012 18A5346 X012 18A5347 X012 18A5348 X012

1. Trademark of INCO International.  
2. May be used with Enviro-Seal Stem/Bellows Assembly option.

Key 7\* Seat Ring Gasket for Use with Composition Seats  
Key 8\* Bonnet Gasket for Use with Composition Seats

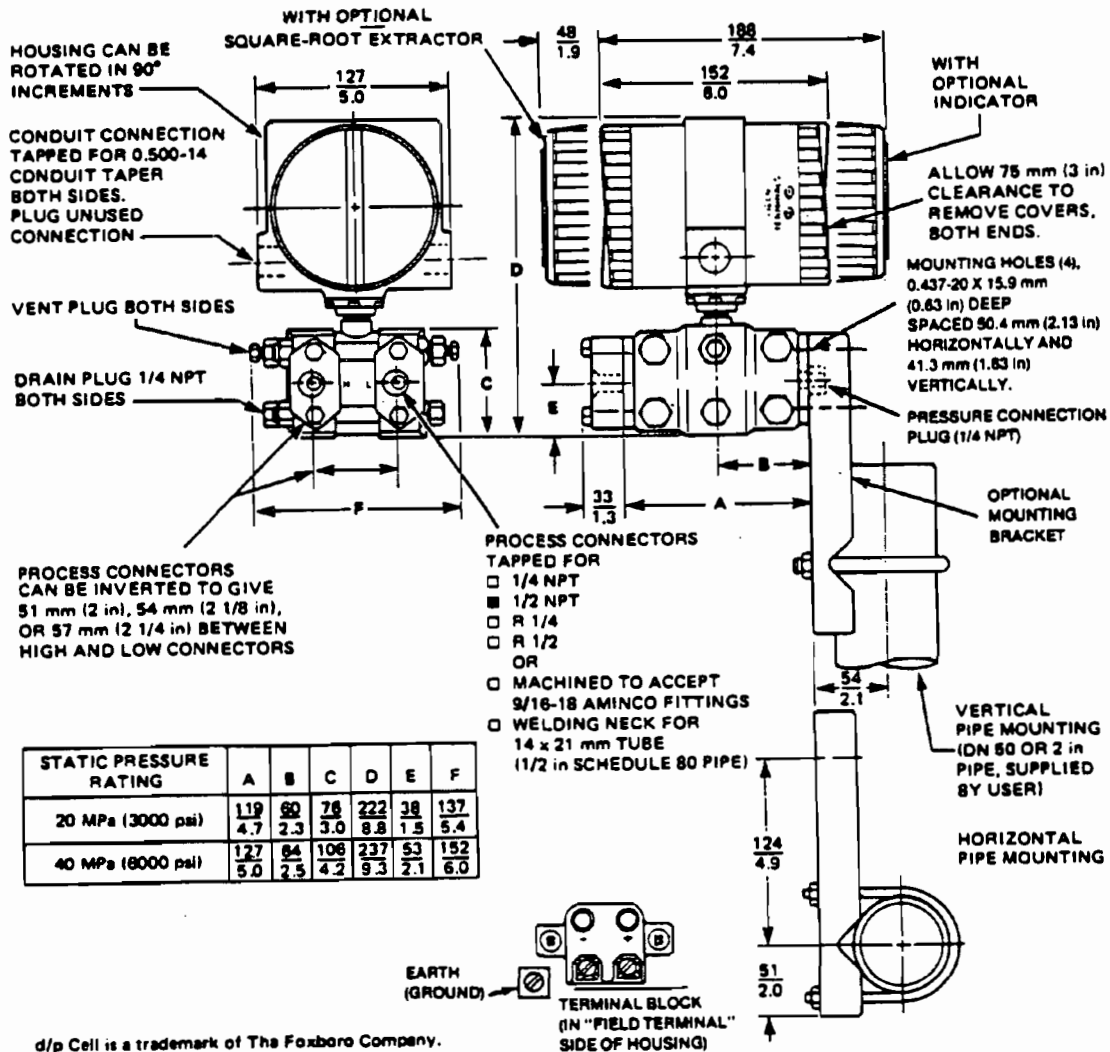
VALVE SIZE, INCHES	SEAT RING GASKET MATERIAL	BONNET GASKET MATERIAL	
	Glass Filled PTFE <sup>(1)</sup>	PTFE Coated N04400 (Monel 400)	Graphite Laminated/ S31600 (316 SST)
		Use with Glass-Filled PTFE Seat Ring Gasket	
1/2, 3/4 & 1 1-1/2 2 3 4	18A5349 X012 18A5350 X012 18A5351 X012 18A5352 X012 18A5353 X012	18A5344 X012 18A5345 X012 18A5346 X012 18A5347 X012 18A5348 X012	18A0898 X022 18A0899 X022 18A0900 X022 18A0901 X022 18A0902 X022
1/2, 3/4 & 1 1-1/2 2 3 4	Carbon Filled PTFE <sup>(1)</sup>	Use with Carbon-Filled PTFE Seat Ring Gasket	
	18A5349 X032 18A5350 X032 18A5351 X042 18A5352 X032 18A5353 X032	18A5344 X012 18A5345 X012 18A5346 X012 18A5347 X012 18A5348 X012	18A0898 X022 18A0899 X022 18A0900 X022 18A0901 X022 18A0902 X022

1. May be used with Enviro-Seal Stem/Bellows Assembly option.

Key 8\* Bonnet Gasket for Enviro-Seal Bellows Seal Bonnet

VALVE SIZE, INCHES	BONNET GASKET MATERIAL			
	PTFE Coated S31603	PTFE Coated N10276	Graphite Laminate S31600	
	For Use with Metal or Composition Seat <sup>(1)</sup>	For Use with Metal or Composition Seat <sup>(1)</sup>	For Use with Metal Seat <sup>(2)(3)</sup>	For Use with Composition Seat <sup>(3)</sup>
1/2, 3/4, 1	12B4209 X012	12B4209 X022	12B4202 X022	12B4202 X012
1-1/2	12B4210 X012	12B4210 X022	12B4203 X022	12B4203 X022
2	12B4211 X012	12B4211 X022	12B4204 X022	12B4204 X022
3	12B4212 X012	12B4212 X022	12B4205 X022	12B4205 X022
4	12B4213 X012	12B4213 X022	12B4206 X012	12B4206 X022

1. Use with seat ring gasket (key 7), PTFE/glass or PTFE/carbon ribbon.  
2. Use with seat ring gasket (key 7), N06600 nickel alloy (spiral wound) w/graphite  
3. Use with seat ring gasket (key 7) PTFE/glass.



STATIC PRESSURE RATING	A	B	C	D	E	F
20 MPa (3000 psi)	119 4.7	60 2.3	78 3.0	222 8.8	38 1.5	137 5.4
40 MPa (6000 psi)	127 5.0	64 2.5	106 4.2	237 9.3	53 2.1	152 6.0

d/p Cell is a trademark of The Foxboro Company.

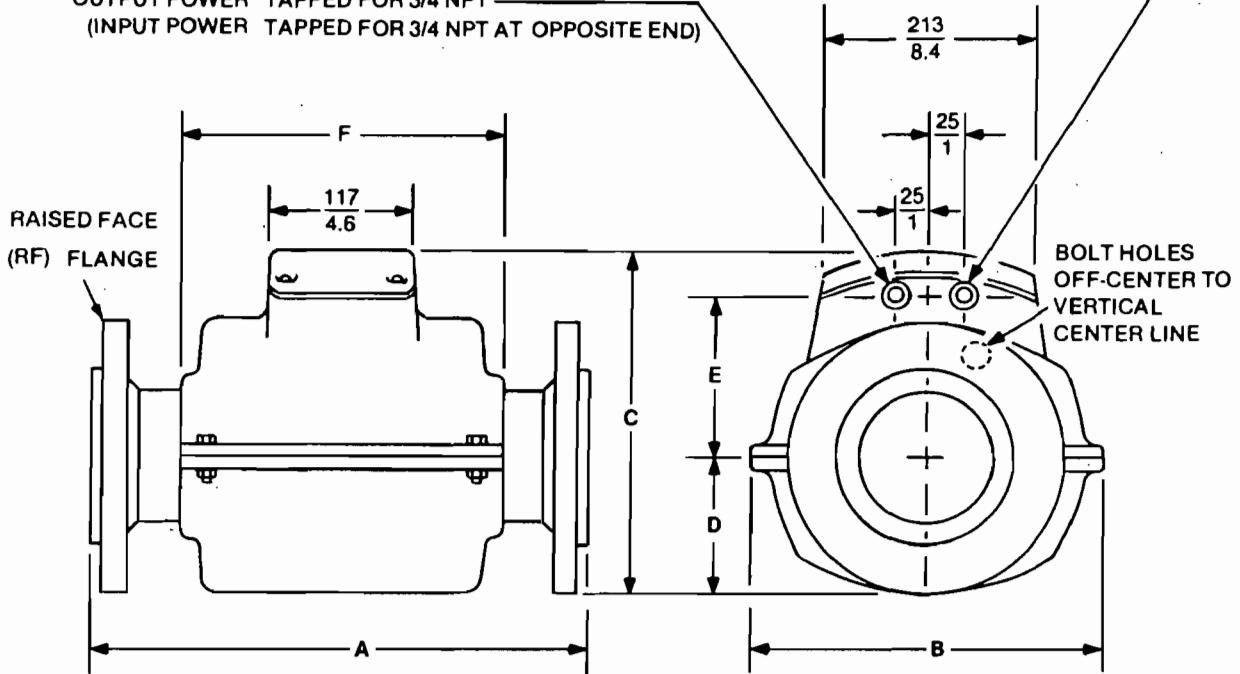
AMINCO: HIGH PRESSURE CONNECTION OF AMERICAN INSTRUMENT COMPANY

Foxboro Model 823DP-I3S1SM2-M  
 Aux Spec: CS-E/FD-A, FM certified explosionproof for Class I, Groups B, C and D, Division 1. Dust-ignitionproof for Class II, Groups E and G, Division 1. Nonincendive-resistive for Class I, Groups A, B, C and D, Division 2 and for Class II, Group G, Division 2. Temperature range T6.

Tag Number: 1CCF-FT-1006      Calibrated Range: 0 to 41.153" WC  
 1CCF-FT-2006  
 1CCF-FT-3006  
 1CCF-LT-102      Calibrated Range: -43.68" to 0" WC  
 1CCF-PDT-103      Calibrated Range: 0 to 32" WC

The Truesdell Company P O Box 77 Skillman, NJ 08558 908 526-2900 Approved by: DPT	Drawing Number 93089	Customer Glitsch Package Plants
	Sheet 1 of 1	Purchase Order Number 19381
March 30, 1993	Revision 0	Requisition Number

SIGNAL CONNECTION 1/2 NPT FITTING (INTERNAL THREAD) WITH ADAPTER TAPPED FOR 3/4 NPT  
 OUTPUT POWER TAPPED FOR 3/4 NPT  
 (INPUT POWER TAPPED FOR 3/4 NPT AT OPPOSITE END)



FLANGE RATING  
 CLASS 150 ANSI  
FLANGE MATERIAL  
 316 ss

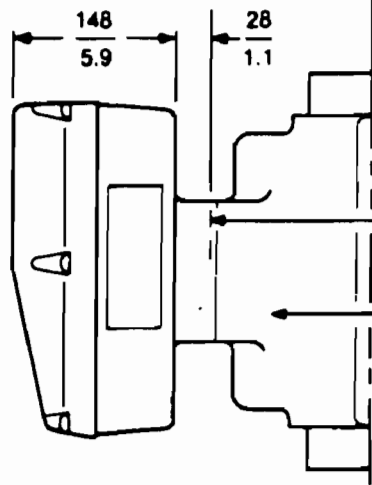
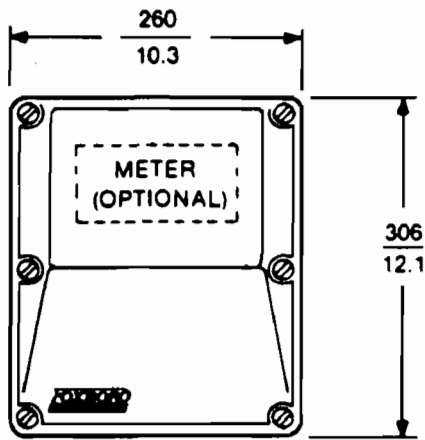
NOMINAL LINE SIZE		□ A*	□ A**	B	C	D	E	F	INSIDE DIAMETER	
mm	in								ID*	ID**
15	1/2	365 14.4	—	273 10.8	294 11.6	114 4.5	141 5.6	221 8.7	12.70 0.500	—
25	1	365 14.4	—	273 10.8	294 11.6	114 4.5	141 5.6	221 8.7	24.71 0.973	—

NOTE: "A" length increase by approximately 25 mm (1 in) when flowtube has optional lining protection (AS Reference TLP).

Foxboro Model 2801-SABB-TSF magnetic flowtube.  
 Aux Spec: CS-E/FN-A, FM certified nonincendive for Class I, Groups A, B, C and D, Division 2 and Class II, Group G, Division 2. Also suitable for use in ordinary locations. Temperature Class T6.  
 Coil Construction: Series

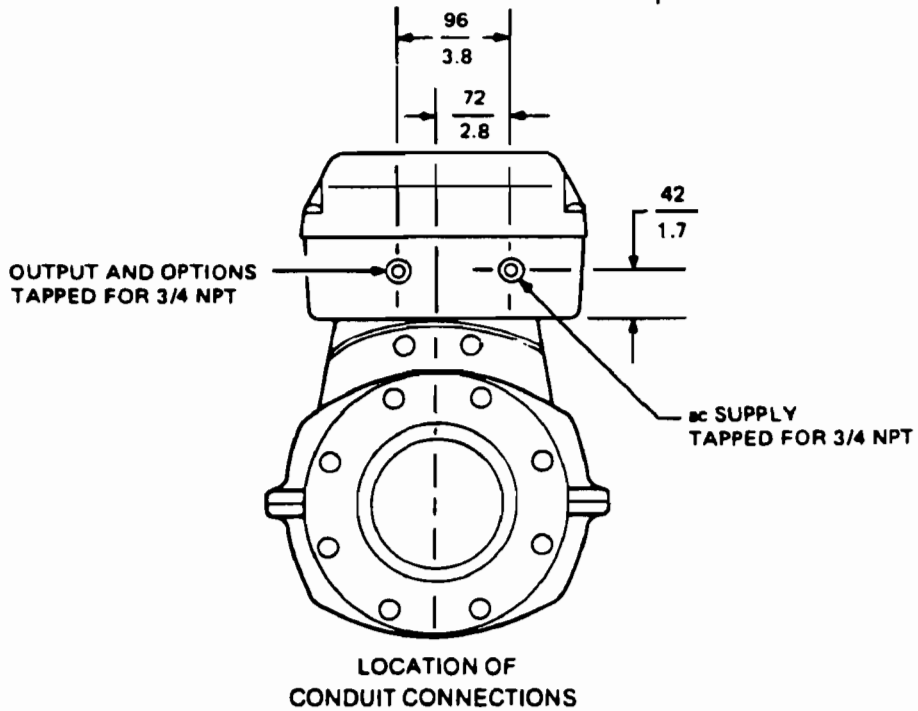
Tag Number: 1CCF-FE-101

The Truesdell Company P O Box 77 Skillman, NJ 08558 908 526-2900 Approved by: DPT	Drawing Number 93089-1	Customer Glitsch
	Sheet 1 of 1	Purchase Order Number 19381
March 27, 1993	Revision 0	Requisition Number



TOP OF FLOWTUBE HOUSING

NOTE:  
FOR FLOWTUBE  
DIMENSIONS REFER TO  
FLOWTUBE DIMENSIONAL  
PRINTS



Foxboro Model 896-TA-A magnetic flow transmitter.  
Aux Spec: CS-E/FN-A, FM certified nonincendive for Class I, Groups A, B, C and D, Division 2 and Class II, Group G, Division 2. Also suitable for use in ordinary locations. Temperature Class T6.

Flow Range: 0 to 14 GPM

Tag Number: 1CCF-FT-101

The Truesdell Company P O Box 77 Skillman, NJ 08558 908 526-2900 Approved by: DPT	Drawing Number 93089-2	Customer Glitsch
	Sheet 1 of 1	Purchase Order Number 19381
March 27, 1993	Revision 0	Requisition Number



HOUSING CAN BE  
ROTATED 270° IN  
90° INCREMENTS

CONDUIT CONNECTION  
TAPPED FOR  
0.500-14 CONDUIT TAPER  
BOTH SIDES. PLUG  
UNUSED CONNECTION

MOUNTING HOLES (2),  
0.375-24 x 10 mm (0.4 in) DEEP  
SPACED 33 mm (1.5 in)

VERTICAL OR  
HORIZONTAL DN 50  
OR 2 in PIPE  
(SUPPLIED BY USER)

OPTIONAL  
MOUNTING  
BRACKET

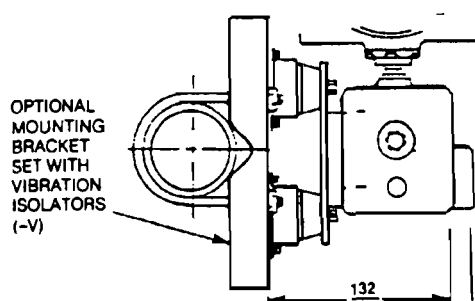
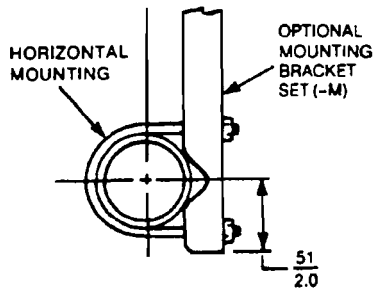
ALLOW 75 mm (3 in)  
CLEARANCE FOR  
COVER REMOVAL.  
BOTH ENDS.

VERTICAL  
CONDUIT  
(SEE NOTE)

PROCESS CONNECTION  
TAPPED FOR  
1/2 NPT  
R 1/2  
OR  
MACHINED FOR 9/16-18 AMINCO FITTING

EARTH (GROUND)

TERMINAL BLOCK  
LOCATED IN  
FIELD TERMINAL  
SIDE OF HOUSING



Foxboro Model 821GM-IS1SM2-M electronic gauge pressure transmitter  
Aux Spec: CS-E/FD-A, FM certified explosionproof for Class I, Groups B, C and D, Division 1. Dust-ignitionproof for Class II, Groups E and G, Division 1. Nonincendive-resistive for Class I, Groups A, B, C and D, Division 2 and for Class II, Group G, Division 2. Temperature Range T6.

TAG NUMBER

1CCF-PT-105  
1CCF-PT-107

CALIBRATED RANGE

0 to 150 psi

The Truesdell Company  
P O Box 77  
Skillman, NJ 08558  
908 526-2900  
Approved by: DPT

Drawing Number  
93089-3

Sheet  
1 of 1

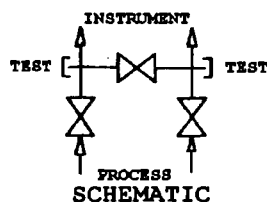
Revision  
0

Customer  
Glitsch Packaging Plants

Purchase Order Number  
19381

Requisition Number

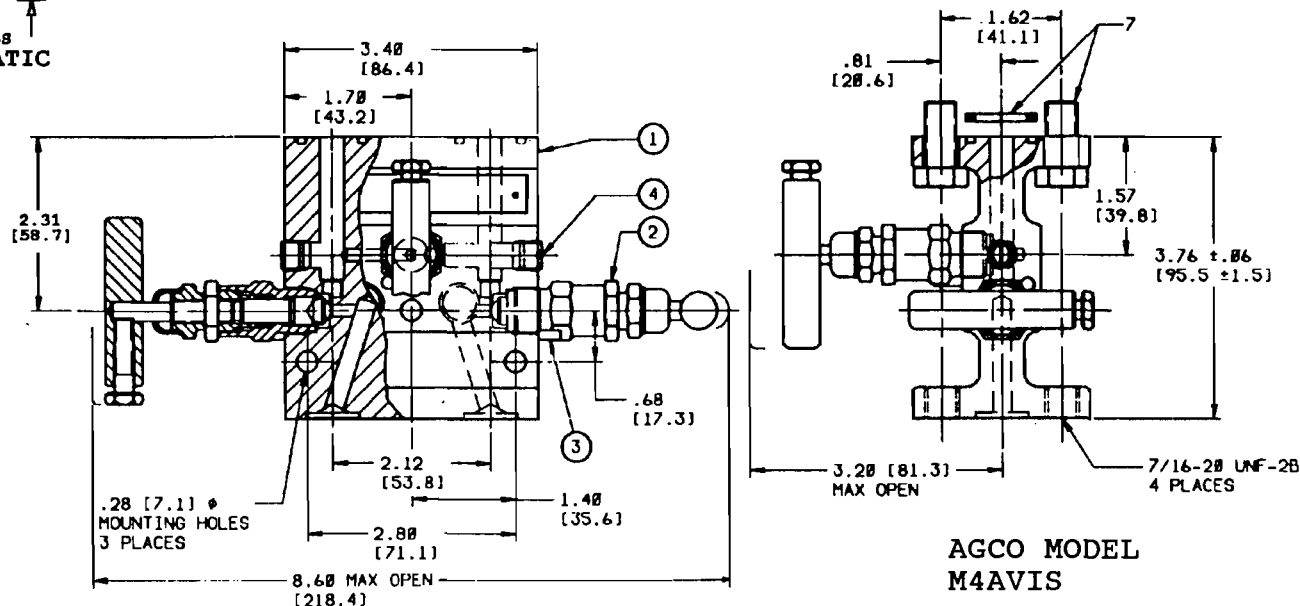
March 30, 1993



STEM PACKING  
TEFLON

BOLT MATERIAL  
AST A193-B7  
SST 18-8

ITEM NO	DESCRIPTION	MATERIAL			
		M4AVIC 5	M4AVIS	M4AVIS-SG	M4AVIM
1	BODY	STL A576-10L18	SST A479-316	SST A479-316	MONEL 400
2	BONNET ASSY	STL	SST	SST/MONEL	MONEL
3	PIN-ROLL	SST 316	SST 316	SST 316	SST 316
4	PLUG PIPE	AST	SST 316	SST 316	MONEL



- 7) Installation kit consists of 4 bolts, 7/16-20 X 7/8 AST A193-B7 and gaskets, teflon.  
 6) Orifice size: .156 [4.0] diameter, Valve Cv - .364 maximum.  
 5) Items 1 and 2 are cadmium plated per QQ-P-416, Cl 1, TP II.  
 4) M4AVIS-SG meets requirements of NACE MR-01-75.  
 3) Contact The Truesdell Company for service compatibility or special requirement.  
 2) Approximate valve weight: 6.0 pounds [2.72 Kg].  
 1) Dimensions are in inches, tolerance +/- .030 [.8]. Dimensions in [ ] are millimeters.  
 Tag: 1CCF-FT-1006; 1CCF-FT-2006; 1CCF-FT-3006; 1CCF-FT-104; 1CCF-LT-102; 1CCF-PDT-103

The Truesdell Company  
 P O Box 77  
 Skillman, NJ 08558  
 908 526-2900  
 Approved by: DPT

Drawing Number  
 93089-4

Customer  
 Glitsch Packaging Plants

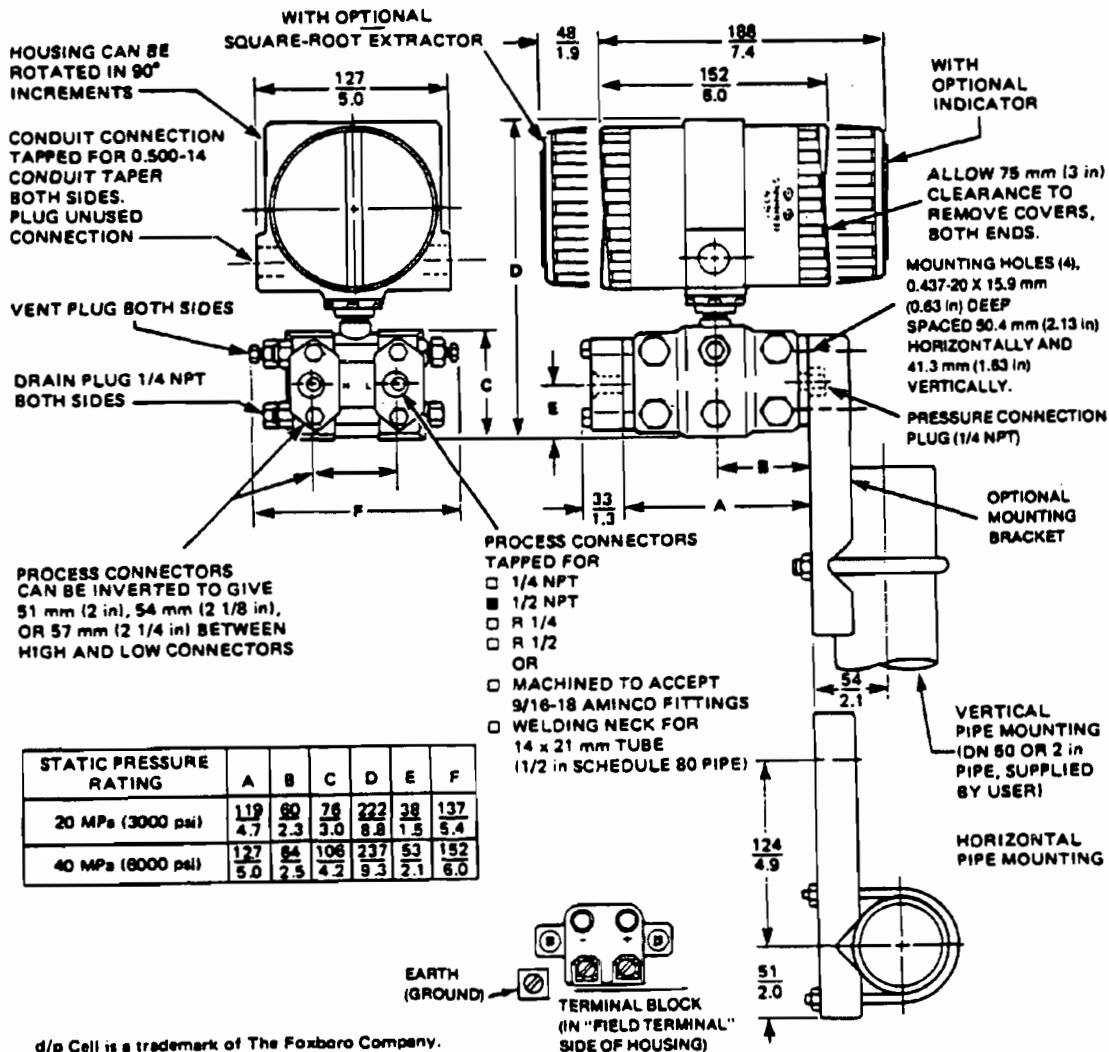
Sheet  
 1 of 1

Purchase Order Number  
 19381

March 30, 1993

Revision  
 0

Requisition Number



STATIC PRESSURE RATING	A	B	C	D	E	F
20 MPa (3000 psi)	119 4.7	80 2.3	76 3.0	222 8.8	38 1.5	137 5.4
40 MPa (6000 psi)	127 5.0	84 2.5	106 4.2	237 9.3	53 2.1	152 6.0

d/p Cell is a trademark of The Foxboro Company.

AMINCO: HIGH PRESSURE CONNECTION OF AMERICAN INSTRUMENT COMPANY

Foxboro Model 823DP-I3K1SH2-BM

Aux Spec: CS-E/FD-A, FM certified explosionproof for Class I, Groups B, C and D, Division 1. Dust-ignitionproof for Class II, Groups E and G, Division 1. Nonincendive-resistive for Class I, Groups A, B, C and D, Division 2 and for Class II, Group G, Division 2. Temperature range T6.

Tag Number: 1CCF-FT-104

Calibrated Range: 0 to 80.32" WC


The Truesdell Company P O Box 77 Skillman, NJ 08558 908 526-2900 Approved by: DPT	Drawing Number 93089-5	Customer Glitsch Package Plants
	Sheet 1 of 1	Purchase Order Number 19381
March 30, 1993	Revision 0	Requisition Number

DATE: 04/21/93

THE FOXBORO COMPANY  
SPARE PARTS QUOTATION NO. 3F12118

PAGE A 1

CUSTOMER

 THE TRUESDELL CO., INC  
356 Skillman Road  
Skillman, New Jersey 08558  
(908) 526-2900 (609) 466-3200  
800-257-9000 (Pa. & N.Y.)

PROJECT : GLITSCH 6J-7877

CUSTOMER I

FOXBORO REF. 93F12118

GENTLEMEN :

THIS QUOTATION HAS BEEN GENERATED SPECIFICALLY FOR YOUR ABOVE REFERENCED PROJECT. THE FOLLOWING LIST SUMMARIZES RECOMMENDED SPARE PARTS, AND PROVIDES A QUOTATION OF CURRENT PRICES FOR THE QUANTITIES OF SPARES WE SUGGEST YOU STOCK AT YOUR SITE TO PROVIDE MAXIMUM SPARE PARTS COVERAGE.

FOXBORO PART NO	PART NAME	TOTAL USED	MULTIPLE USAGE RECOMM			UNIT PRICE	EXTENDED PRICE
-----	-----	-----	SECTION	B	REF.	QTY	-----
B0138HS	SENSOR ASSY	6	6		7	1	600.00
B0138MJ	VENT SCREW	10	7			2	7.95
B0138QU	ORING3.609BUNAN	16	5	6	7	1	3.65
B0138RA	MODULE,POTTED	6	6		7	1	378.00
B0139ET	PLUG,VENT	10	7			2	15.00
B0139RB	GASKET	12	6	7		2	3.65
D0114FL	DISC,SCREEN	12	6	7		3	3.15
D0114RB	GASKET	12	6	7		2	1.85
D0135NE	TRANSDUCER ASSY	2	5			1	592.00
D0135PY	MODULE,POTTED	2	5			1	378.00
E0121AE	O-RING-BUNA-N	8	5	6	7	2	2.95
M0156AQ	PWA SPAN OPTION	1	8			1	275.00
M0156AV	PWR SUPPLY M896	1	8			1	984.00
P0121ST	GASKET	1	8			1	15.00

-PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE-

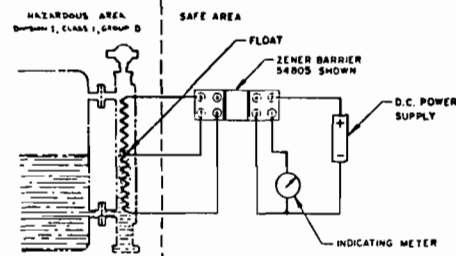
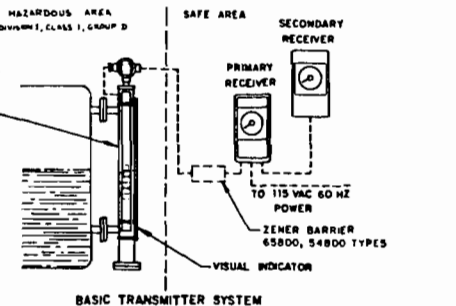
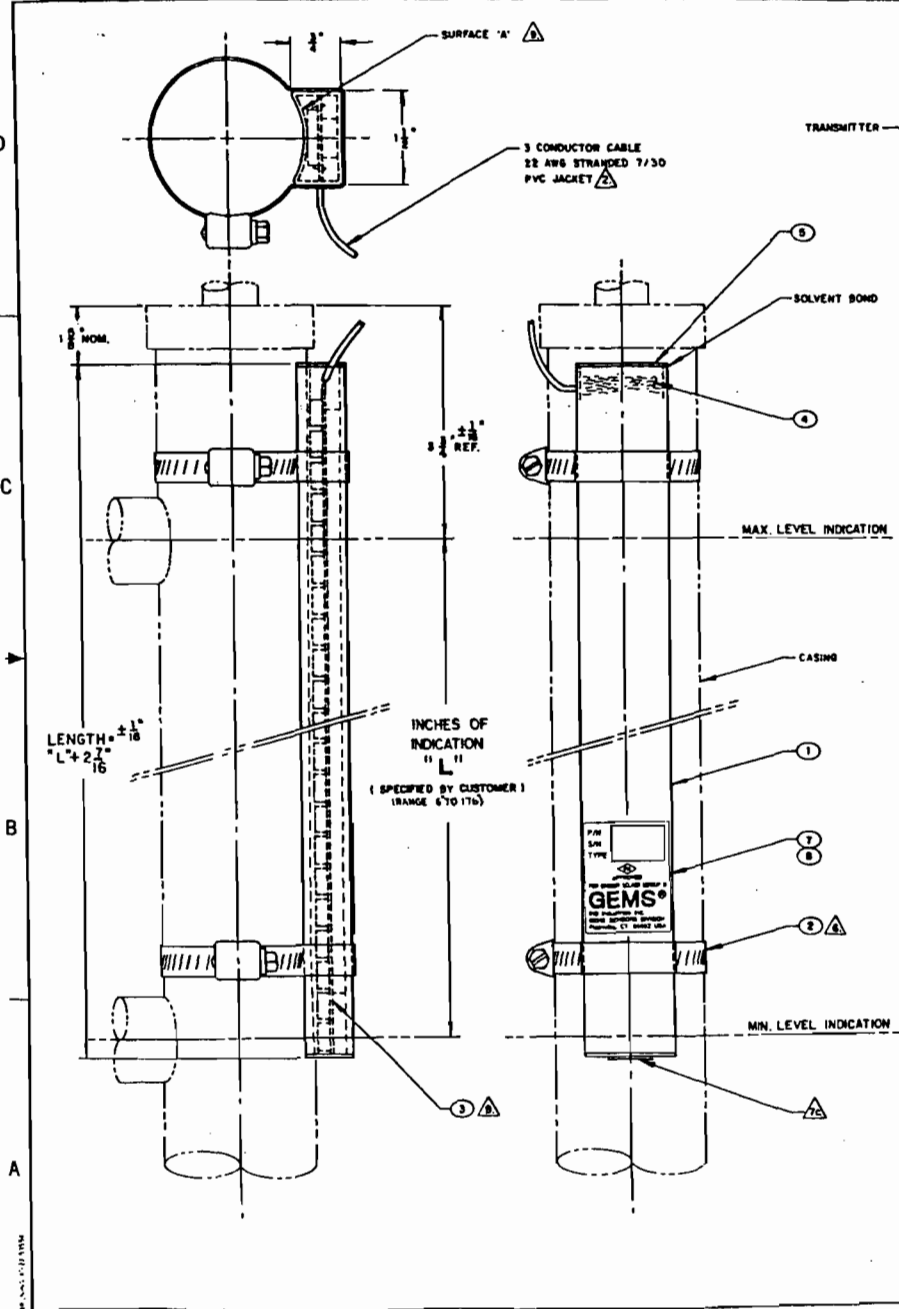
TOTAL \$3,297.90

\* UNAVAILABLE PRICES WILL BE FURNISHED WHEN ORDER IS PLACED

THE SPARES QUOTED IN THE PRECEEDING SUMMARY ARE INCLUDED IN THIS SECTION IDENTIFYING QUANTITY USED IN EACH INSTRUMENT/DEVICE.

REF	QTY	INSTRUMENT/DEVICE	MODEL NO.	STYLE	SPARE PART NAME	PART NO	QTY EACH
1	1	CS-E/FN-A	1042S260A		NO SPARE PARTS RECOMMENDED		
2	8	CS-E/FD-A	8002FD20A		NO SPARE PARTS RECOMMENDED		
3	1	CS-E/FN-A	8002FN25A		NO SPARE PARTS RECOMMENDED		
4	1	FLOWTUBE	2801-SABB-TSF-G	B	NO SPARE PARTS RECOMMENDED		
5	2	PRESSURE XMTR	821GM-IS1SM2-M	A	ORING3.609BUNAN	B0138QU	2
					TRANSDUCER ASSY	D0135NE	1
					MODULE,POTTED	D0135PY	1
					O-RING-BUNA-N	E0121AE	1
6	1	PRESSURE,XMTR	823DP-I3K1SM2-BM	A	SENSOR ASSY	B0138HS	1
					ORING3.609BUNAN	B0138QU	2
					MODULE,POTTED	B0138RA	1
					GASKET	B0139RB	2
					DISC,SCREEN	D0114FL	2
					GASKET	D0114RB	2
					O-RING-BUNA-N	E0121AE	1
7	5	PRESSURE,XMTR	823DP-I3S1SM2-M	A	SENSOR ASSY	B0138HS	1
					VENT SCREW	B0138MJ	2
					ORING3.609BUNAN	B0138QU	2
					MODULE,POTTED	B0138RA	1
					PLUG,VENT	B0139ET	2
					GASKET	B0139RB	2
					DISC,SCREEN	D0114FL	2
					GASKET	D0114RB	2
					O-RING-BUNA-N	E0121AE	1
8	1	MAG FLOW XMTR	896-TA-A	A	PWA SPAN OPTION	M0156AQ	1
					PWR SUPPLY M896	M0156AV	1
					GASKET	P0121ST	1

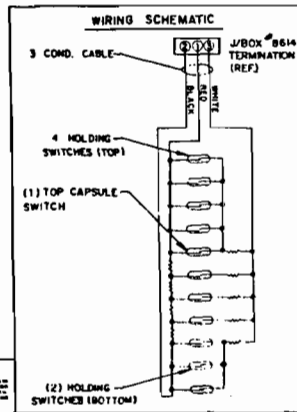
8 7 6 5 4 3 2 1



A FLOAT MOVES WITH LIQUID LEVEL ALONG A TRANSMITTER CONTAINING A VOLTAGE DIVIDER, TO VARY A TAPPED-OFF ELECTRICAL SIGNAL WHICH IS TRANSMITTED TO AN INDICATING METER. THIS SIGNAL, AND THEREFORE THE READOUT, ARE PROPORTIONATE TO THE LEVEL.

REVISIONS					
CDN NO	ZONE	LTR	DESCRIPTION	DATE	APPROVED
01-1182	M		REDESIGN & REDESIGNED	12-7	
01-1182	F		CABLE LENGTH 2' 11 1/2" TO 176" IN 1/2" INCREMENTS	12-12	
01-1182	F		REMOVED 100' SWG	12-12	
01-500	A1	Q	MAT'L POLYSULFONE WAS LEAKY	10/15	
	B7C7		ADDED RANGE 16" TO 185"		
	B7C4		REMOVED 60 OHM W & ADDED TWO CAPSULES		
	B7C4		REMOVED 1/2" W & ADDED DIM. 1 1/2"		
	B7C4		NOTE		
01-1223	N		THIS UNIT MODIFIED TO WORK WITH 70' SWG	3-72	
01-1223	T		REVISOR NOTE	12-19	
01-103	U		REVISED NOTE "REMOVED TITLE BLOCK"	2-68	
01-484	0166	V	REV. NOTE "2 - 12 1/2" WAS 12" PER C. NAME"	2-68	
01-790	B7	W	RANGE WAS 6" TO 165"	11-7	
01-294		Y	ADDED ZENER BARRIER TO BASIC SYSTEM'S TYPICAL CIRCUIT DIAGRAM	8-74	
71-381	Z		REV. NAMEPLATE TO PM APPARATUS	8-74	
01-1419	AA		ADDED SPACER STRIP TO NOTE "Q, REV. NOTE 2"	11-90	

- NOTES:**
- TRANSMITTER CAN BE USED ON MULTI-BALL SURESITES.
  - TRANSMITTER PART NO. (ORDERING PURCHASE NO.) SPECIFICATION:  
 P/M 85875 - 33 - 32  
 CABLE LENGTH (IN INCHES) 12" IF NOT SPECIFIED  
 GONG DESIGN TYPE \_\_\_\_\_ INCHES OF INDICATION (MUST BE GIVEN IN 1/2" INCREMENTS)
  - TRANSMITTER SPECIFICATIONS: ACCURACY ± 3/4%  
 REPEATABILITY ± 1/16"
  - FLUID TEMPERATURE: 225°F. MAX.
  - QUANTITY OF CLAMPS AS REQ'D.: SPACE APPROX. 12" APART (ON COMMERCIAL UNITS).  
 SPACE APPROX. 9" APART (ON HI-SPEED UNITS).
  - INSTALLATION OF TRANSMITTER ON SURESITE INDICATOR:  
 A. ATTACH WITH CLAMPS SUPPLIED.  
 B. LOCATE 90° TO THE RIGHT OF FLAG CHANNEL (125" FOR PIPE UNITS).  
 PRODUCTION NOTE: AFTER TRANSMITTER IS PROPERLY LOCATED, FIRM-ETCH A LINE DIRECTLY UNDER TRANSMITTER AS SHOWN.
  - ELECTRICAL DATA:  
 RED TO BLACK WIRE - MINIMUM RESISTANCE = 1000 OHMS, MAXIMUM VOLTAGE = 30 VDC, MAXIMUM CURRENT = 0.03 AMPS,  
 MAXIMUM POWER DISSIPATION = 0.10 WATTS PER 1/2" OF INDICATION.  
 RECOMMENDED MINIMUM LOADING RATIO = 20:1 THEREFORE 12-8 = 20.  
 POT THE SWITCHBOARD ASSEMBLY SO THAT THE SWITCHBOARD IS AGAINST SURFACE 'A'  
 USING SPACER STRIP 36599 AS REQUIRED.



QTY.	SYM.	DESCRIPTION	CODE	PART OR IDENTIFYING NO.	SPECIFICATION	MATERIAL OR NOTE	UNIT WT.	ZONE	ITEM NO.
		MYLAR LINER	61697			MYLAR		8	
1		NAMEPLATE	61696			PAPER		7	
1		END CAP	87323			POLYSULFONE		5	
AR		POTTING COMPOUND	17880			SIL RUBBER		4	
1		SWITCHBOARD ASSY.	87360			VARIOUS		3	
AR		CLAMP	87316			18-8 SS		2	
1		SLEEVE ASSY.	87429			POLYSULFONE		1	

**LIST OF MATERIALS OR PARTS LIST**

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.	CONTRACT NO.	DATE
TOLERANCES EXCEPT AS NOTED: FRACTIONAL ± 1/16" .001	DATE	12-7-68
ANGLE	DATE	12-10-68
WACUM PALLETS AND AIR OR MACHINES EXCEPT AS NOTED	DATE	12-9-68
DATE	DATE	12-9-68
DATE	DATE	12-9-68

DESIGNED BY	DATE	12-7-68
CHECKED BY	DATE	12-10-68
APPROVED BY	DATE	12-9-68
DATE	DATE	12-9-68

MEET ASST. USED ON	DATE	12-7-68
APPLICATION	DATE	12-9-68
DATE	DATE	12-9-68

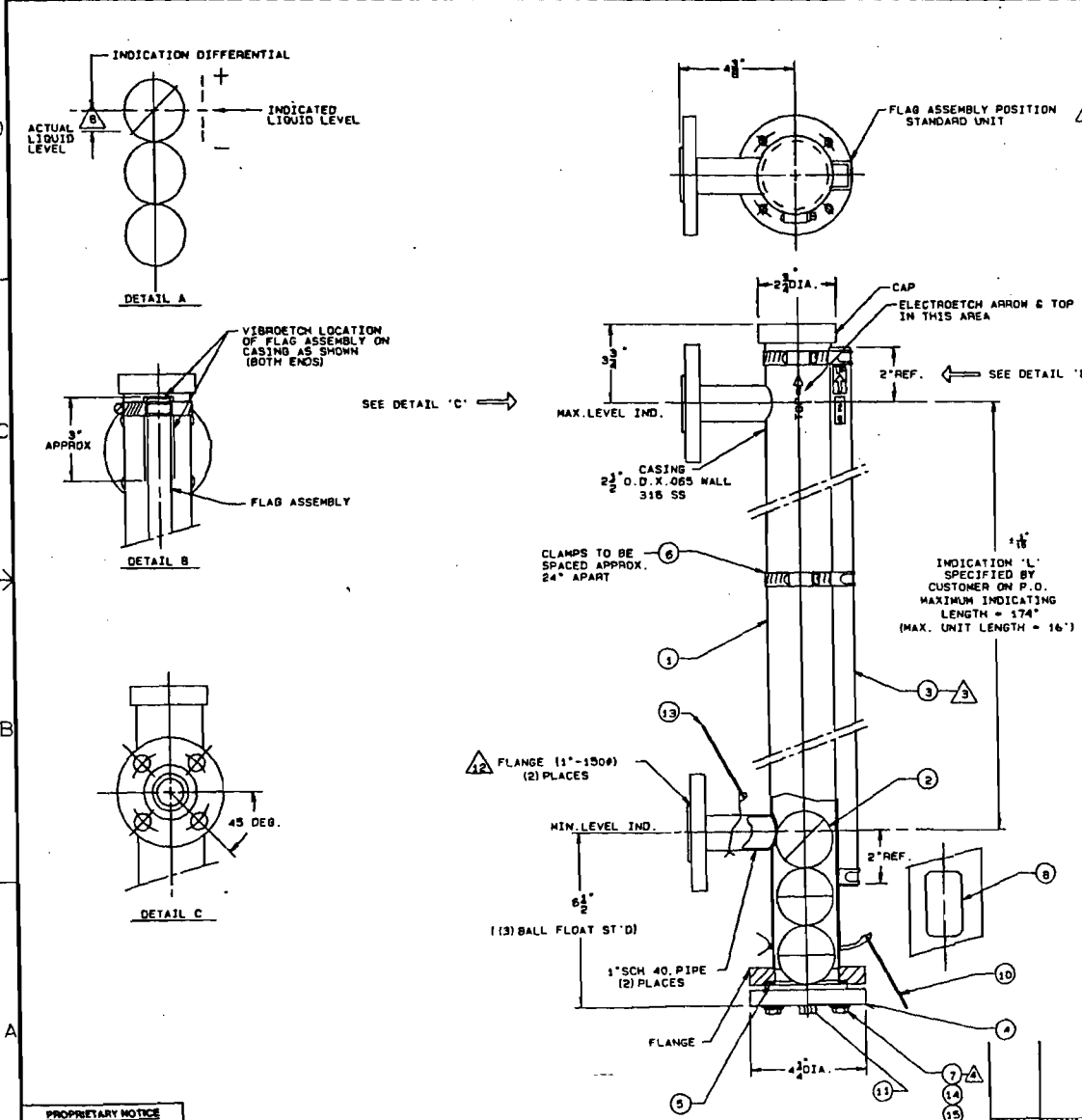
ITEM NO.	QTY.	DESCRIPTION	UNIT WT.	ZONE	ITEM NO.
04034	85875	TRANSMITTER SURESITES MULTI-BALL FLOAT APPLICATIONS			

**PROPRIETARY NOTICE**  
 THIS DOCUMENT AND THE DESIGN HEREIN ARE THE PROPERTY OF SURESITES, INC. AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF SURESITES, INC.

85875

AA

8 7 6 5 4 3 2 1



REVISIONS				
CON. NO.	DATE	BY	DESCRIPTION	APPROVED
02-313			UPDATED TO NEW COMPUTER DWG.	B-29
07-064	11/83		REVISED PER ASSEMBLY DRAWING VLI-86504 SH. NO. 5.	

- NOTES:
1. TO PURCHASE AND SPECIFY UNIT, USE GEMS SURESITE INQUIRY/ORDER SHEET.
  2. UNIT SPECIFICATIONS: OPERATING TEMPERATURE AND PRESSURE LIMITS:  
TEMPERATURE-0 DEG. TO 300 DEG. F (+225 DEG. F MAX. FOR TRANSMITTER OPTION)  
PRESSURE-150 P.S.I. MAXIMUM  
SPECIFIC GRAVITY OF LIQUID: 0.75 TO 1.1 (STANDARD)  
(CONSULT FACTORY FOR OTHER OPTIONS)  
VISCOSITY EFFECTS: INCREASED VISCOSITY INCREASES TIME RESPONSE.
  3. NORMAL INSTALLATION OF FLAG ASSEMBLY: WHEN FLOAT TRAVELS UPWARD, THE FLAGS MUST FLIP TO SHOW COLORED ORANGE SURFACE. VIBROETCH FLAG ASSEMBLY LOCATION AS SHOWN IN DETAIL 'B'.
  4. RECOMMENDED TORQUE 70-80 IN. LBS. AT INSTALLATION.
  5. THIS UNIT IS NOT TO BE USED TO MONITOR INTERFACE CONDITIONS.
  6. U.S. PATENT NO. 4,457,171.
  7. OPTIONS: SWITCH MODULE-ELECTRICAL OUTPUT-SEE DWG. VLI-85004 SH. NO. 3.  
TRANSMITTER-ELECTRICAL OUTPUT-SEE DWG. VLI-85004 SH. NO. 5.  
INDICATING SCALE-SEE DWG. VLI-85004 SH. NO. 6.
  8. INDICATION DIFFERENTIAL: THE DIFFERENCE BETWEEN THE ACTUAL LIQUID LEVEL AND THE INDICATED LEVEL SHOWN ON THE FLAG CHANNEL-1.6" (MAX.) AT THE SPECIFIC GRAVITY OF 1.1.
  9. STANDARD UNIT SUPPLIED WITH SYNTHETIC FIBER NITRILE BINDER GARLOCK STYLE 3000 GASKET.
  - 10.
  11. FLAG ASSEMBLY, SWITCH MODULE AND TRANSMITTER CAN BE ROTATED BY LOOSENING CLAMPS AND REPOSITIONING.
  12. MOUNTING FLANGES MUST ALIGN WITH MATING FLANGES AT INSTALLATION. ANY ATTEMPT TO FORCE ALIGNMENT MAY DAMAGE WELDS AND/OR COMPROMISE CASING INTEGRITY.
  13. CASING ASSEMBLY PART NUMBERS: STANDARD UNIT-86509  
TRANSMITTER OUTPUT UNIT-86511

QTY.	SYMBOL	DESCRIPTION	PART NO.	CODE IDENTIFY NO.	SPECIFICATION	MATERIAL OR NOTE	UNIT WT.	ZONE NO.	ITEM NO.
4		LOCKWASHER, 3/8"	22139			302 SS			15
4		FLATWASHER, 3/8"	36383			18-8 SS			14
1		TAB, WARNING	87246			TYVCK			13
1		PIPE PLUG, 3/8"	86436			316 SS			12
1		TAB, FLOAT	86375			TYVCK			10
1		NAMEPLATE	85143			PAPER			8
4		BOLT, HEX HD.	79741			18-8 SS			7
AR		CLAMP	80210			18-8 SS			6
1		GASKET	86104			NOTE 9			5
1		BOTTOM CAP	86434			316 SS			4
1		FLAG ASSEMBLY	86556			PLASTIC			3
1		FLOAT ASSEMBLY	86523			SS			2
1		CASING ASSEMBLY	NOTE 13			316 SS			1

LIST OF MATERIALS OR PARTS LIST

DATE: 3/5/85  
BY: D. LUCIA  
CHECKED: [Signature]  
SCALE: 1/2"

APPLICATION: [Blank]

CON. NO. DESCRIPTION DATE DRAWING LEVEL

04034 VLI-86501 H

MADE 1/2 SHEET 1 OF 1

PROPRIETARY NOTICE  
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# GEMS®

Instruction Bulletin  
No. 128616

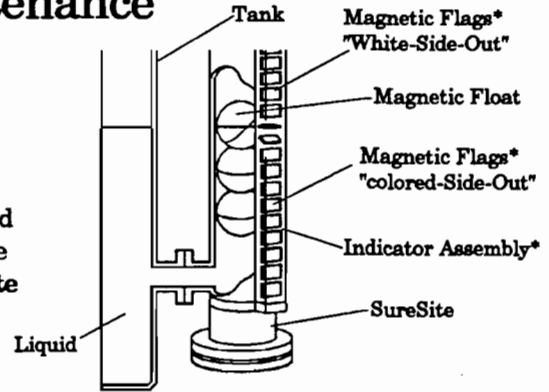
## SureSite® Liquid Level Indicators

### Installation and Maintenance

#### SureSite Operating Principle . . .

As it rises with liquid level, a magnet-equipped float within the SureSite inverts the magnetic flags in the external indicator to "colored-side-out". The flags remain magnetically interlocked in a column, until again inverted to "white-side-out" by the float as liquid level falls. Level is indicated by the junction of the "colored" and "white" portions of the column. **Note: SureSite units are not designed to monitor interface between liquids.**

\* Patent No. 4.457.171



**IMPORTANT: Read these instructions carefully before installing the SureSite**

#### Pre-Installation Precautions . . .

1. When locating tank ports for the SureSite, make sure that:
  - a. No strong magnetic fields or magnets will be in close proximity to the SureSite.
  - b. No magnetic materials, railings, protective cages, I-beams, etc., will be closer than 2" (76.2mm) from the SureSite unit.

**Failure to observe these precautions will inhibit operation of the unit.**

2. Make sure that mating flanges, NPT ports or shut-off valves (if used) on the tank will align properly with SureSite connections. Improper alignment may damage welds and compromise integrity of the SureSite.
3. Mating flanges on the tank must be clean for proper gasket sealing.

#### Installation . . . (Caution: Handle the SureSite with care to avoid damaging threads, flange surfaces, etc.)

See "Standard Models" charts for dimensional data and specifications on all units. SureSite Types A, B, C, D and Mini-Types 1 and 2 are supplied with floats packed separately. Types E and F are supplied with floats installed and supported by a cardboard support tube.

1. Remove all packing from SureSite housing.
2. Prepare unit for installation. (Note: When preparing unit, manually move float up and down along flag cage and observe that magnetic flags flip over properly.)

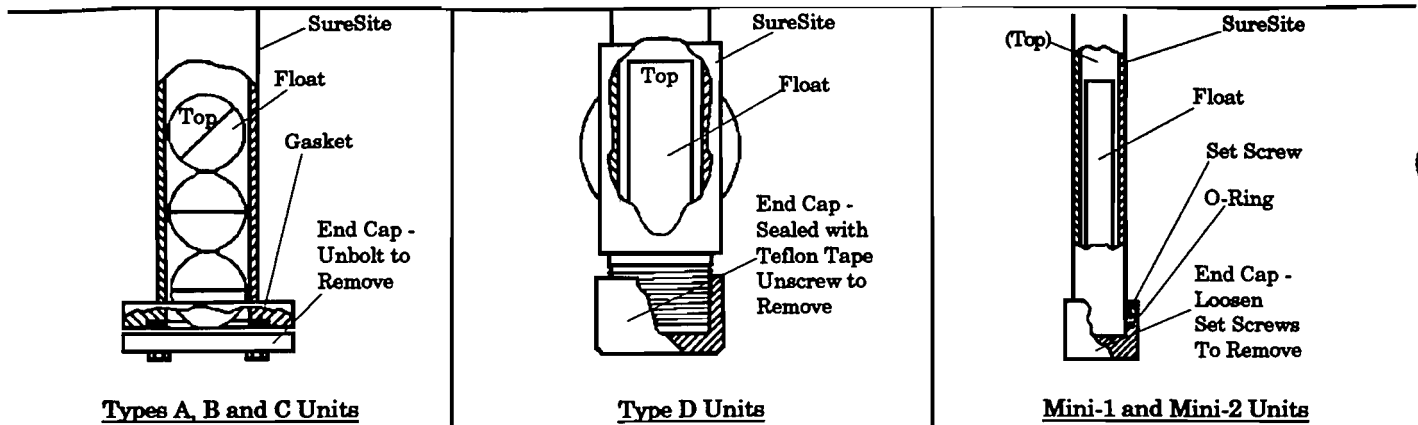
#### SureSite Types A, B, C, D, Mini-1 and Mini-2:

- a. Remove end cap (Fig. 1)
- b. Insert float assembly in housing. End of float marked "TOP" must be upward when SureSite is installed.
- c. Reassemble end cap with gasket (or O-Ring) properly seated and tighten securely. Torque bolted end cap to 70-80 in lbs. Torque setscrews on Mini-1 and Mini-2 to 14-16 in. lbs.

#### SureSite Type E:

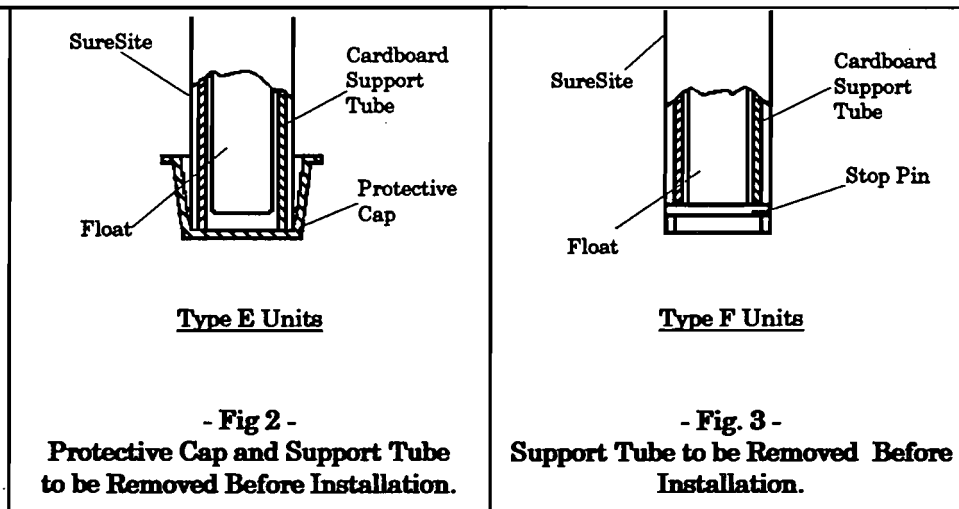
- a. Remove protective cap from bottom of unit (Fig. 2) and withdraw cardboard support tube.





(Note: End of float marked "Top" must be upward when installed.)

**Fig. 1 : Float (Packed Separately) Installed in SureSite**



**- Fig 2 -  
Protective Cap and Support Tube  
to be Removed Before Installation.**

**- Fig. 3 -  
Support Tube to be Removed Before  
Installation.**

## Installation (Cont) . .

### SureSite Type F:

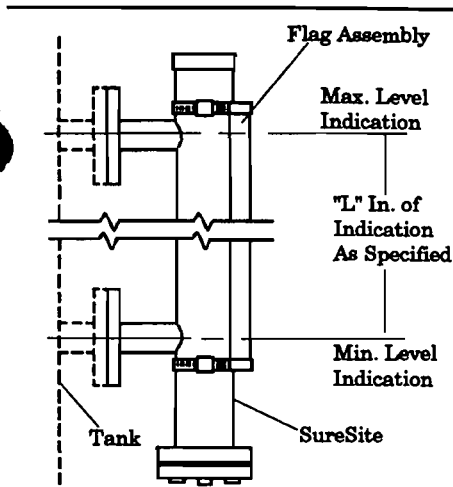
- a. Remove stop pin (Fig. 3).
- b. Withdraw cardboard support tube.
- c. Reinstall Stop Pin.

3. Install unit vertically on tank (Figs. 4, 5 or 6) with end marked "Top" upward, using standard procedures. Make sure that mating port flanges or NPT connections are properly aligned with unit. Do not attempt to force alignment, as this may damage welds and compromise unit integrity. Tighten connections securely.

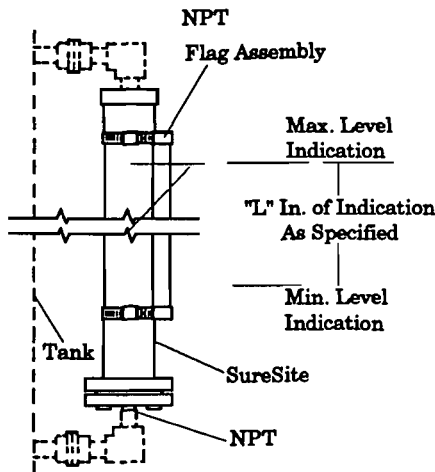
**Note:** Gaskets are not supplied for port flanges.

## Before Filling Tank . . .

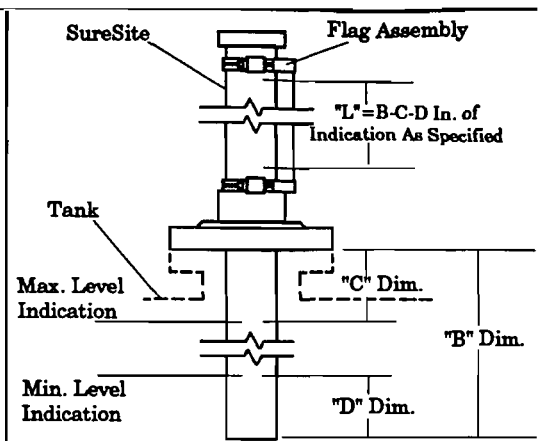
Be sure the installation is free of foreign particles . . . especially any that are magnetic. Check that all connections are secure. A hydrostatic pressure test of the complete assembly is recommended.



- Fig 4 -  
SureSite Side-Mounted and  
Side-Connected on Tank.



- Fig 5 -  
SureSite Side-Mounted and  
Connected on Tank.



- Fig 6 -  
SureSite Top-Mounted on Tank.

## Maintenance . . .

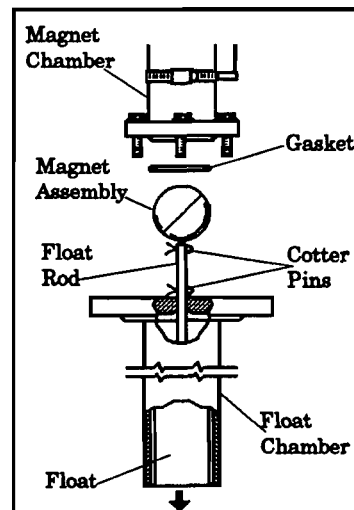
For occasional "wipe-down" cleaning, the only maintenance normally required: Remove float assembly from unit and wipe down float and inside of unit housing. (CAUTION: Make sure tank is depressurized and liquid removed before removing float.)

**SureSite Types Mini-2, B, C and D:** It is not necessary to disturb the installation on the tank. Remove end cap (Fig. 1) and withdraw float. When reinstalling float, make sure end marked "TOP" is up. Reassemble end cap with gasket properly seated (Fig. 1) and tighten securely. Torque bolted end cap to 70-80 in lbs. or tighten set screws firmly in place (as applicable).

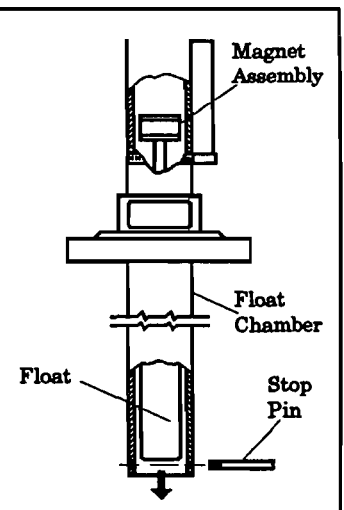
**SureSite Types Mini-1 and A:** Disconnect top and bottom NPT connections and remove unit from tank. Remove end cap (Fig. 1) and withdraw float from unit. Reinstall float in unit so that end marked "TOP" will be up when unit is reinstalled on tank. Reassemble end cap with O-Ring or gasket properly seated (Fig. 1) and tighten securely. Torque bolted end cap to 70-80 in lbs. or tighten set screws firmly in place (as applicable). Reinstall unit on tank.

**SureSite Type E:** To remove float, unbolt and remove unit from tank (Fig 7). Unbolt and remove magnet chamber from float chamber. Remove two cotter pins and magnet assembly from float rod and withdraw float and rod. To reinstall float, insert float with rod up and through top of float chamber, then secure with cotter pin (Fig. 7). Reinstall magnet assembly on float rod with second cotter pin. Assemble gasket and magnet chamber on float chamber. Torque bolts to 70-80 in. lbs. Reinstall SureSite on tank.

**SureSite Type F:** Unbolt and remove unit from tank. Unscrew and remove stop pin at bottom of unit and withdraw float assembly from unit (Fig. 8). Reassemble float in unit with magnet assembly up and reinstall stop pin. Reinstall unit on tank.



- Fig 7 -  
SureSite Type E  
Float Removal

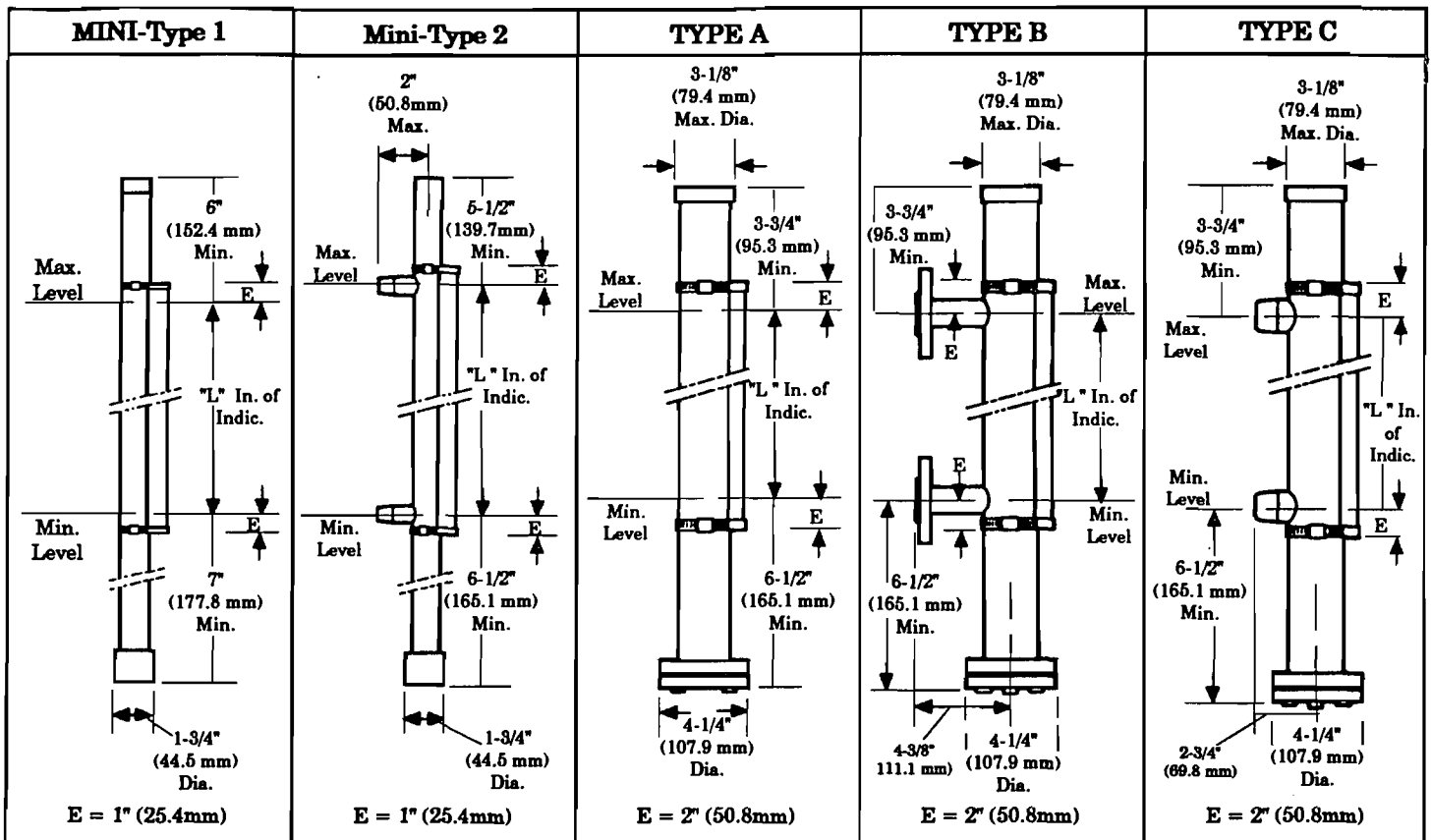


- Fig 8 -  
SureSite Type F  
Float Removal

**IMPORTANT:** Float assembly contains a magnet. Float should be inspected after tank cleaning or flushing and cleaned to remove any metal particles that may have been attracted to it. Especially important on new installations, this should be done during regular maintenance.

To order replacement parts for SureSite units, contact Gems Sensors Division for proper specifications.

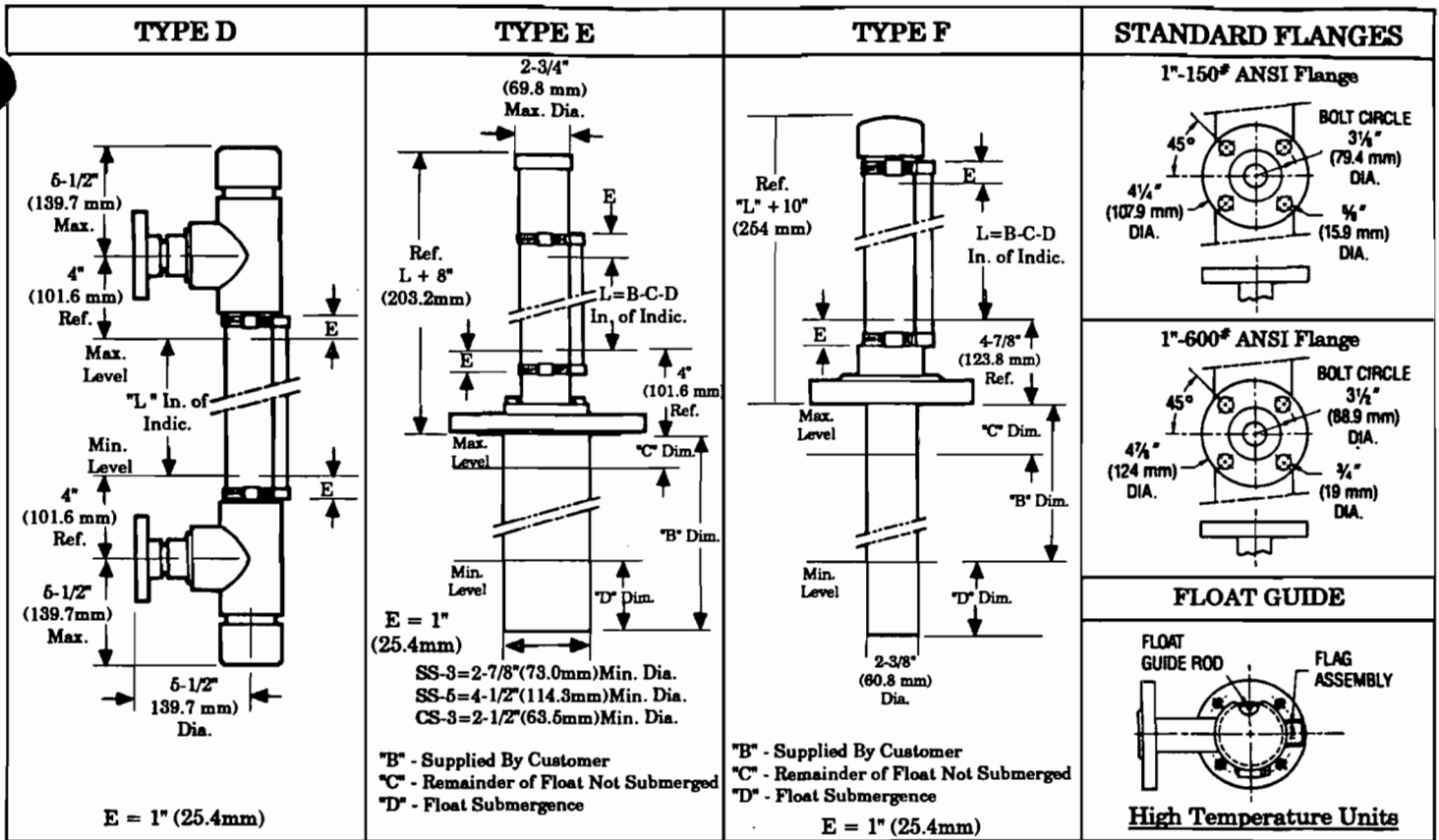
# Standard Models Dimensional Data . . .



## Specifications . . .

	Design Type	Model Number	Housing Material	Float Material	Flag Mat'l.	Max. Pressure	Max. Temperature	Connection	Max. Length of Indication	Max. Overall Unit Length
MINI	1	86210	304 SS	304 SS	P	150 PSI	+300°F (+149°C)	End 1/2" NPT	240" (6096 mm)	21' (6.4 m)
	2			Buna N	P	150 PSI	+180°F (+82°C)	Side 1/2" NPT	240" (6096 mm)	21' (6.4 m)
STANDARD	A >	86500	316 SS	316 SS	P	150 PSI	+300°F (+149°C)	Top & Bottom 1" NPT (Female)	240" (6096 mm)	21' (6.4 m)
		87055		316 SS	P	600 PSI	+300°F (+149°C)			
		87110		316 SS	A	600 PSI	+500°F (+260°C)			
	B	86501	316 SS	316 SS	P	150 PSI	+300°F (+149°C)	Side 1"-150# Flange**	240" (6096 mm)	21' (6.4 m)
		87040		316 SS	P	600 PSI	+300°F (+149°C)	Side 1"-600# Flange**	240" (6096 mm)	21' (6.4 m)
	87120	316 SS	A	600 PSI	+500°F (+260°C)					
	B Inverted >>	86503	316 SS	316 SS	P	150 PSI	+300°F (+149°C)	Side 1"-150# Flange**	240" (6096 mm)	21' (6.4 m)
		87140		316 SS	P	600 PSI	+300°F (+149°C)	Side 1"-600# Flange**	240" (6096 mm)	21' (6.4 m)
	87125	316 SS	A	600 PSI	+500°F (+260°C)					
	C	C	86502	316 SS	316 SS	P	150 PSI	+300°F (+149°C)	Side 1" NPT (Male)	240" (6096 mm)
87050			316 SS		P	600 PSI	+300°F (+149°C)			
87130			316 SS		A	600 PSI	+500°F (+260°C)			
C Inverted >>	C Inverted >>	86504	316 SS	316 SS	P	150 PSI	+300°F (+149°C)	Side 1" NPT (Male)	240" (6096 mm)	21' (6.4 m)
		87150		316 SS	P	600 PSI	+300°F (+149°C)			
87135	316 SS	A	600 PSI	+500°F (+260°C)						

# Standard Models Dimensional Data . . .



## Specifications . . .

	Design Type	Model Number	Housing Mat'l.	Float Material	Flag Mat'l.	Max. Pressure	Max. Temperature	Connection	Max. Length of Indication	Max. Overall Unit Length	
STANDARD	D	86195	PVC	PVC	P	40 PSI	+140°F(+60°C)	Side 1"-150# Flange	125" (3175.0mm)	12' (3.65m)	
	E	86200	SS-3	316 SS	316 SS	P	150 PSI	+300°F(+149°C)	Top 3"-150# SS Flange	60" (1524mm) S.G.: .85 - 1.4	11'5" (3.48m)
			SS-5	316 SS	316 SS	P	150 PSI	+300°F(+149°C)	Top 5" 150 # SS Flange	60" (1524mm) S.G.: .7 - 1.4	11'3" (3.43m)
			CS-3	CS 316 SS	Buna N	P	150 PSI	+180°F(+82°C)	Top 3"-150# CS Flange	60" (1524mm) S.G.: .75 - 1.4	11'3" (3.43m)
	F	86205	PVC	PVC	P	40 PSI	+140°F(+60°C)	Top 3"-150# Flange	60" (1524mm) S.G.: 1.0 & Up	11'4" (3.45m)	

## Key to Specifications . . .

P = Plastic                      A = Aluminum

\* 230°F (110°C) Maximum in Oil.

\*\*Other Flange Sizes Available

> Mounting Bracket - P/N 36406 - Recommended for Type "A" units only (Over 10' (3.048m) Length.

> > Use Inverted units when float removal must come from top of unit. On inverted models of Type B or C units, "Min" dimensions in "Dimensional Data" (above) must be transposed from end to end of units.

Viscosity Effects: Increased viscosity increases response time.

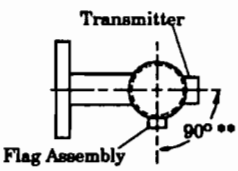
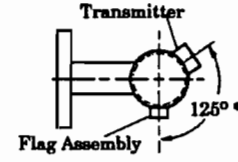
## SureSite Accessories . . . Installation

### Liquid Level Transmitters, P/N 85875 . . .

Transmitters mount along with flag assemblies on specific SureSite models, as in Fig. 9, and are operated by the SureSite float. Units connect to all GEMS receivers or, when signal-conditioned, connect directly to User's instrumentation.

### Specifications . . .

Housing Material	Polysulfone
Transmitter Resolution	1/2" (12.7mm) Max.
Accuracy	Within $\pm 1/2"$ (12.7mm)
Oper. Temperature	+225° F (+109° C) Max.
Cable	#22 awg. 18"L

Top View	SureSite	
	Type	P/N
	A	86500
	B	86501
	C	86502
	B Inv.	86503
	C Inv.	86504
	A	87055
	B	87040
	C	87050
	B Inv.	87140
	C Inv.	87150

\* 125° - All models utilizing pipe construction.

\*\* 90° - All models utilizing tubing construction.

- Fig 9-

### Transmitter Mounting Positions on Specific SureSite Models

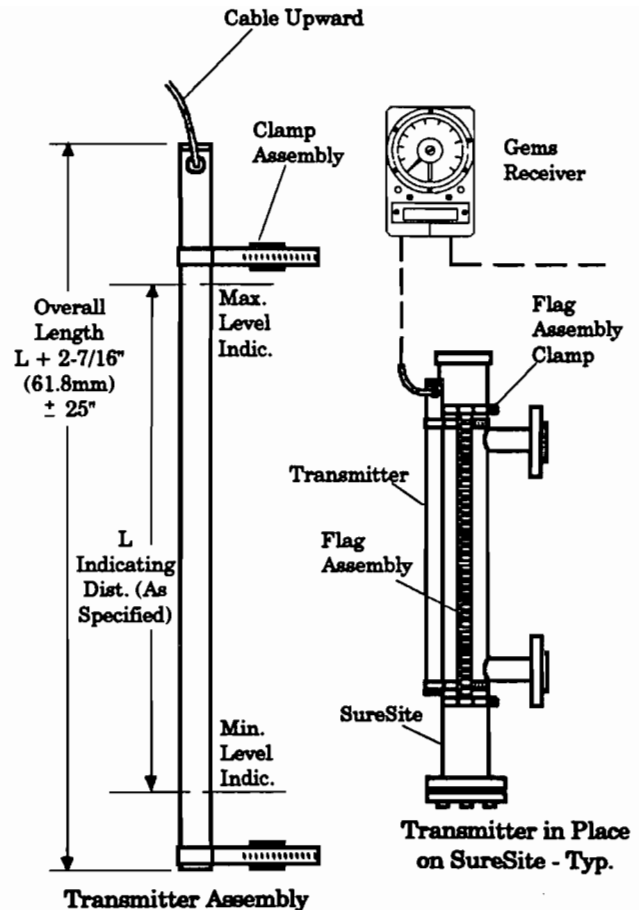
### To Install . . .

1. Position transmitter on SureSite, as in Figs. 9 and 10.
2. Loosen upper flag assembly clamp and slide upper transmitter clamp under flag assembly (Fig. 10). Retighten flag assembly clamp. Repeat for lower clamp(s).
3. Tighten all transmitter clamps securely.
4. Connect transmitter cable to receiver. See appropriate GEMS receiver instructions.

### Indicating Scale - P/N 85684 . . .

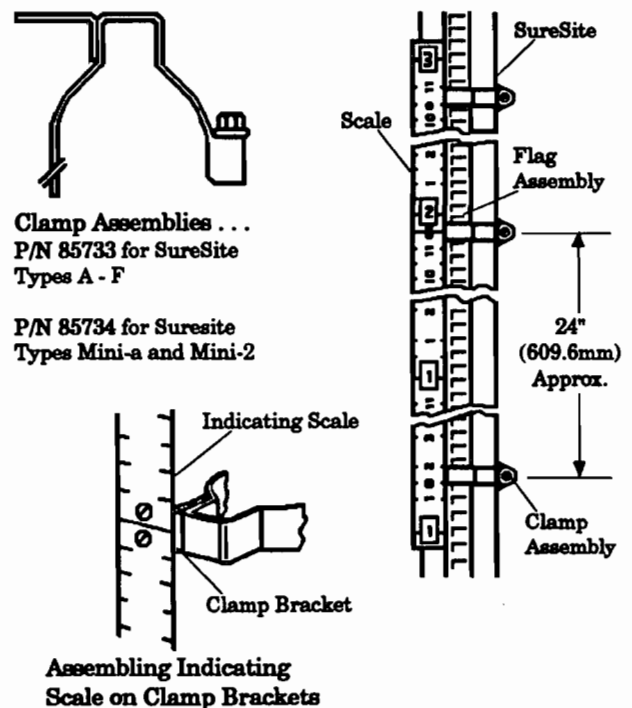
Mounts with bracketed clamps alongside flag assembly on all SureSite models. **To install:**

1. Assemble bracketed clamps on scale approx. 24" apart (Fig. 11).
2. Mount scale on SureSite with clamps around flag assembly and SureSite. Tighten clamps securely.



- Fig 10-

### Transmitter Installation on SureSite



- Fig 11-

### Installing Indicating Scale on SureSite

# SureSite Accessories . . . Installation

## Switch Modules . . .

Modules mount opposite flags on the SureSite (Figs. 12 and 13) and are operated by the SureSite float. With lead wires up, switch closes on rising level and remains closed until opened by falling level. With lead wires down, switch opens on rising level and remains open until closed by falling level.

### Specifications . . .

#### Modules P/N 85350, 86435, 87480, 86567 . . .

Housing Material: Polysulfone  
 Length: 3-1/2" (88.9mm)  
 Temperature; Max.: +300°F (+149°C)  
 Switch: SPST, 20 VA, Latching Reed, N.O. or N.C.

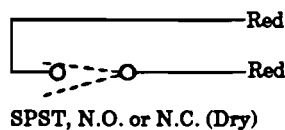
#### High Temperature Module, P/N 85825 . . . For use with SureSite Types A, B and C, only.

Housing Material: Aluminum  
 Clamp Assembly: P/N 86440 (18-8SS)  
 Temperature; Max.: +500°F (+260°C)  
 Switch: SPST, 20 VA, Latching Reed, N.O. or N.C.

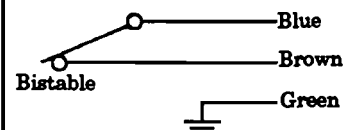
### To Install . . .

1. Position switch module . . . lead wires up or down . . . at proper actuation level on SureSite (Fig. 12).
2. Slide module clamp under flag assembly and tighten securely.
3. Connect module to load circuit.

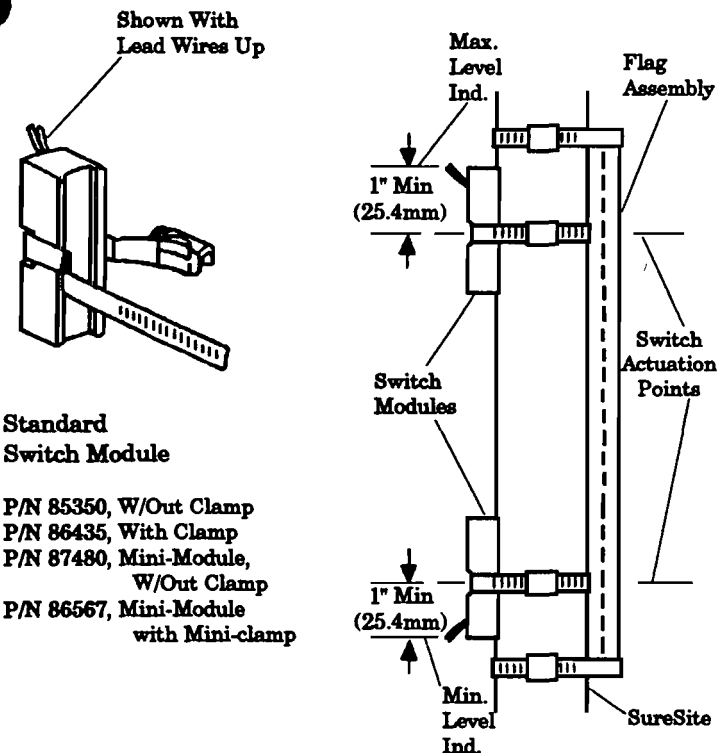
### Typical Wiring Diagrams . . .



Switch Module  
 P/N 85350 or P/N 87480



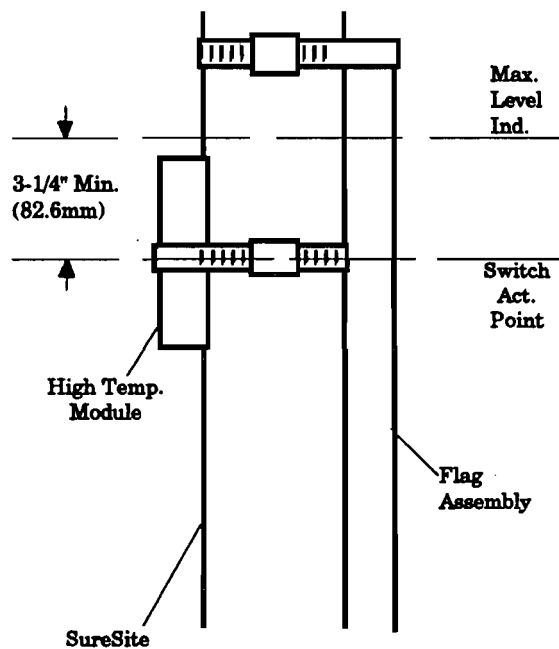
High Temperature Switch  
 Module P/N 85825



#### Standard Switch Module

P/N 85350, W/Out Clamp  
 P/N 86435, With Clamp  
 P/N 87480, Mini-Module, W/Out Clamp  
 P/N 86567, Mini-Module with Mini-clamp

- Fig 12 -  
 Installing Standard Switch Module on SureSite



- Fig 13 -  
 Installing High temperature Switch Module on SureSite

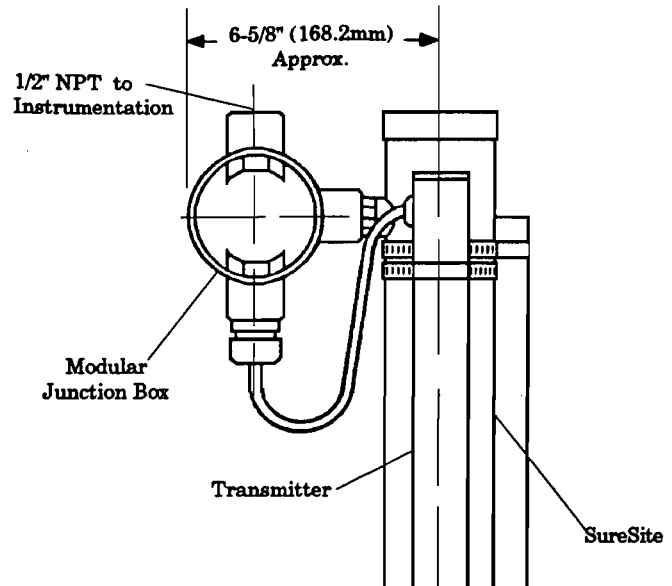
## SureSite Accessories . . . Installation . . .

### Modular Junction Boxes with Conditioned Outputs . . .

Junction boxes are supplied assembled on the SureSite and connected to transmitter (Fig. 14). See instruction sheet packed in junction box for connection to instrumentation.

### Standard Models . . . Specifications.

P/N	Input Voltage	Configuration	Output Signal
86140	—	Terminal Block	—
86156	8-24 VDC	Signal Conditioner	0-5 VDC
85997	14-30 VDC	Signal Conditioner	0-12 VDC
86157	18-30 VDC	Signal Conditioner with Alarms	0-12 VDC
86158	10-40 VDC	Two-Wire Converter	4-20 MA
52560	115 VAC	Power Supply	24 VDC
52570	230 VAC	Power Supply	24 VDC



- Fig 14 -  
Modular Junction Box Assembled on SureSite

### Troubleshooting . . .

Problem	Possible Cause	Remedy
No Flag Indication with Liquid in Housing	<ol style="list-style-type: none"> <li>1. Float Sticking</li> <li>2. Float Upside Down</li> <li>3. Liquid in Float</li> <li>4. Ferrous Particles on Float</li> <li>5. Flag Assembly Upside Down or Incorrectly Mounted</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean Float and Unit</li> <li>2. Remove and Reinstall Float Correctly</li> <li>3. Replace Float</li> <li>4. Clean Housing and Filter Out Particles</li> <li>5. Invert Flag Assembly or Rotate Around SureSite Until Indication Appears</li> </ol>
Switch Module Inoperative	<ol style="list-style-type: none"> <li>1. Module Wired Incorrectly</li> <li>2. Module Positioned Incorrectly on SureSite</li> <li>3. Module Ratings Exceeded</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and Correct Wiring</li> <li>2. Check Alarm Level and Position Module 180° from Flags</li> <li>3. Replace Module</li> </ol>

### Warnings/Cautions . . .

1. Product must be maintained and installed in strict accordance with the GEMS technical brochure and Instruction Bulletin. Failure to observe this warning could result in serious injuries or damages.
2. The pressure and temperature limitations shown on the individual catalog pages and drawings for the specified Liquid Level Indicators must not be exceeded. These pressures and temperatures must take into consideration possible system surge pressures/temperatures and their frequencies.
3. For hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammables, use an appropriate intrinsically safe interface device for any electrical accessories.
4. The liquids used must be compatible with the materials of construction. Specifications of materials will be given upon request.
5. Troubleshooting and maintenance of Liquid Level Indicators should be in strict compliance with procedures set forth in the troubleshooting and maintenance sections of the technical brochure or an Instruction Bulletin.

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Gems Sensors Division  
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Plainville, CT. 06062-1198 U.S.A.  
Tel. 203-677-1311 Fac. 203-747-4244





# **SAFETY AND RELIEF VALVE USER INSTALLATION MANUAL**



 **TELEDYNE  
FARRIS ENGINEERING**



# SAFETY-RELIEF VALVE USER INSTALLATION MANUAL

This booklet is designed to assist in the proper installation of an important safety device, the pressure relief valve. The pressure relief valve which you have received is a precision instrument. Correct installation is essential for plant, property, personnel and

public safety. Failure of a pressure relief valve could lead to catastrophic overpressure of pressurized equipment and/or release of fluids under pressure. The discharge of contained fluids may be hazardous and all precautions should be taken to insure safe disposal.



## TELEDYNE FARRIS SAFETY-RELIEF VALVES GENERAL INFORMATION

These definitions are intended to assist you in the correct installation of Teledyne Farris Pressure Relief Valves.

**Safety Valve**—An automatic pressure relieving device actuated by the static pressure upstream of the valve, and characterized by rapid full opening or pop action. It is used for steam, gas or vapor service.

**Relief Valve**—An automatic pressure relieving device actuated by the static pressure upstream of the valve, which opens in proportion to the increase in pressure over the opening pressure. It is used primarily for liquid service.

**Safety Relief Valve**—An automatic pressure actuated relieving device suitable for use as either a safety or relief valve, depending on application.

**Pressure Relief Valve**—A pressure relief valve is a pressure relief device which is designed to reclose and prevent the further flow of fluid after normal conditions have been restored.

**Set Pressure**—Set pressure, in pounds per square inch gage, is the inlet pressure at which the pressure relief valve is adjusted to open under service conditions. In a safety or safety relief valve in gas, vapor, or steam service, the set pressure is the inlet pressure at which the valve pops under service conditions. In a relief or safety relief valve in liquid service, the set pressure is the inlet pressure at which the valve starts to discharge under service conditions.

**Differential Set Pressure**—The pressure differential in pounds per square inch between the set pressure and the constant superimposed back pressure. It is applicable only when a conventional type safety relief valve is being used in service against constant superimposed back pressure.

**Cold Differential Test Pressure**—Cold differential test pressure, in pounds per square inch gage, is the inlet static pressure at which the pressure relief valve is adjusted to open on the test stand. This pressure includes the corrections for service conditions of back pressure or temperature, or both.

**Operating Pressure**—The operating pressure of a vessel is the pressure, in pounds per square inch gage, to which the vessel is usually subjected in service. A vessel is usually designed for a maximum allowable working pressure, in pounds per square inch gage, which will provide a suitable margin above the operating pressure in order to prevent any undesirable operation of the relief device. (It is suggested that this margin be as great as possible consistent with economical vessel and other equipment design, system operation and the performance characteristics of the pressure relieving device.)

**Maximum Allowable Working Pressure**—Maximum allowable working pressure is the maximum gage pressure permissible at the top of a completed vessel in its operating position for a designated temperature. This pressure is based on calculations for each element in a vessel using

nominal thicknesses, exclusive of allowances for corrosion and thickness required for loadings other than pressure. It is the basis for the pressure setting of the pressure-relieving devices protecting the vessel. The design pressure may be used in place of the maximum allowable working pressure in cases where calculations are not made to determine the value of the latter.

**Overpressure**—Overpressure is a pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of set pressure.

**Accumulation**—Accumulation is the pressure increase over the maximum allowable working pressure of the vessel during discharge through the pressure relief valve, expressed as a percent of that pressure or in pounds per square inch.

**Blowdown**—Blowdown is the difference between actual popping pressure of a pressure relief valve and actual reseating pressure expressed as a percentage of set pressure or in pressure units.

**Lift**—Lift is the actual travel of the disk away from closed position when a valve is relieving.

**Back Pressure**—Back pressure is the static pressure existing at the outlet of a pressure relief device due to pressure in the discharge system.

**Constant Back Pressure**—Back pressure which does not change appreciably under any condition of operation whether the pressure relief valve is closed or open.

**Variable Back Pressure**—Back pressure which may change appreciably when the valve is open.

**Built-Up-Back Pressure**—Built-up back pressure is pressure existing at the outlet of a pressure relief device occasioned by the flow through that particular device into a discharge system.

**Superimposed Back Pressure**—Superimposed back pressure is the static pressure existing at the outlet of a pressure relief device at the time the device is required to operate. It is the result of pressure in the discharge system from other sources.

## STORAGE & HANDLING PRECAUTIONS

Because cleanliness is essential to the satisfactory operation and tightness of a pressure relief valve, all necessary precautions should be taken to keep out all foreign materials. Valves which are not installed soon after receipt should be closed off properly at both inlet and outlet flanges or screwed ends. Particular care should be taken to keep the valve inlet and internals absolutely clean. Preferably, valves should be stored indoors or in a location where dirt and other forms of contamination are at a minimum. Valves should be handled carefully and not subjected to heavy shocks. If due consideration is not given to this point, some internal damage or misalignment can result and seat tightness may be adversely affected. Store, transport and install valves with the stem in the vertical position.

## INSPECTION ON DELIVERY

**Visual Inspection**—When a valve is first received, it should be given a visual inspection to note its condition. If any problems are noticed, they should be reported to the manufacturer, or his local representative. All wire seals must remain intact to insure warranty.

Points that should be checked:

1. Look for any shipping damage.
2. Confirm the nameplate data and the valve size, type and trim/options against ordering documents.
3. Insure that factory wire seals are intact.
4. If the valve will not be installed immediately, store it properly.
5. Confirm by test that valve is ready for installation.

## DETERMINATION OF AS-RECEIVED RELIEVING PRESSURE

Before the valve is installed, it is considered important to determine the set pressure of the valve as received. Test procedures for determining relieving pressure vary with local plant practices. Note, cold differential test pressures must be taken into account.

## CHECKING THE VALVE FOR TIGHTNESS

After the valve is satisfactorily checked for set pressure, check for leakage. It is important to minimize leakage from pressure relief valves. Excessive leakage could lead to fouled or inoperable valves and serious product loss, and could also be hazardous to personnel and equipment.

The valve can be tested for tightness on the test stand by increasing the pressure on the valve up to 90 percent or more of the set pressure and observing the discharge side of the valve for evidence of leakage. Methods of determining leakage are covered by applicable standards and specific user requirements. One reference for seat

tightness testing is API Standard 527. A summary of set pressure tolerances and leak rates is contained in the tables on this page.

## COMPLETION OF NECESSARY RECORDS

All necessary records should be completed before the valves go into service. These records are important for effective future use of the valve. They will provide some guidance as to when to retire valves and replace components as well as providing the historical record of the conditions and services under which the valve operated. One publication for reference on pressure relieving devices is the American Petroleum Institute's "Guide for Inspection of Refinery Equipment, Chapter XVI".

## OPERATING DIFFERENTIALS GENERAL GUIDE FOR SELECTING DIFFERENTIAL BETWEEN OPERATING AND SET PRESSURES

The variety of service conditions encountered in Section VIII applications precludes a rigid set of rules. Operational difficulties will be minimized by providing as much differential as possible for known conditions of a particular application. The following are suggested minimum differentials:

### General Gases, Vapors & Liquids

Seat Type & Construction	Pressures		
	Set Pressure PSIG	Set Pressure Tolerance (+) or (-)	Minimum Differential Suggested
Metal Seat & Soft Seat	16 to 70	2 PSIG	5 PSIG
Metal Seat	71 to 1000	3%	10%
Special Category Metal Seat			7%
Soft Seat			5%
Metal Seat	1001 to 6000	3%	7%
Soft Seat			5%

### Leakage Rates for Safety Relief Valves for Set Pressures to 1000 Pounds Per Square Inch Gage (6.9 Megapascals at 60° F) (15.6 °C)

Type of Valve	Manufacturer's Orifice Size	Maximum Leakage Rate (Bubbles per Minute)	Approximate Leakage Rate	
			(Standard Cubic Feet per 24 Hour)	(Standard Cubic meter per 24 Hour)
Conventional	F and smaller	40	0.60	0.017
	G and larger	20	0.30	0.0085
Balanced bellows	F and smaller	50	0.75	0.021
	G and larger	30	0.45	0.013

Note: Leak tests are performed as follows: For Flanged Valves – 90% of set pressure. For Screwed Valves – 85% of set pressure.

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## FOR SAFE INSTALLATION

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### DO

Store valves in original packing in a clean, dry area until ready to install.

Test valves, if possible, prior to installing.

Install close to pressure source; in no case exceed a 2 to 3% pressure drop

Allow space for disassembly.

Install to allow in-line maintenance and adjustment.

Remove body pipe plug to allow valve body to drain and check periodically.

Remove plastic push plug from the bonnet of bellows type valves.

Remove inlet and outlet flange protectors.

### DO NOT

Lift valves up by the test lever.

Remove flange protectors until just before installing.

Tighten flange bolts unevenly.

Place intervening valves of any sort between the safety-relief valves and the vessels or lines they protect.

Place heavy discharge piping on valve outlets without sufficient support.

Install valve other than in a vertical position.

Install a valve fitting with diameter less than valve inlet.

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## INSPECTION OF INLET AND OUTLET PIPING

Before pressure relief valve is installed in service the upstream and downstream piping is open and available for inspection. New systems, especially, are likely to contain welding beads, pipe scale or other foreign material which can be inadvertently trapped during construction and destroy the seating surface the first few times the valve opens. Wherever possible, the system should be purged thoroughly before the valve is installed.

A reference on pressure relief valve installation is the American Petroleum Institutes RP-520 Pt. II, Installation of Pressure Relief Valves.

## VALVE LOCATION AND POSITION

Always install pressure relief valves with the stem in a vertical position, inlet at the bottom, outlet on the side. There are some rare exceptions, but there are very few valves which can operate dependably in other positions.

On installations where there are pressure fluctuations at the pressure source (as with valves on compressor discharge) which peak close to the set pressure of the valve, it will be beneficial to locate the pressure relief valve farther from the source and in a more stable pressure region.

Regarding proximity to other valve equipment, it is recommended that valves be mounted a sufficient distance downstream from any source of turbulence, such as:

- Reducing Stations
- Orifice Plates and Flow Nozzles
- Other Valves and Fittings

Also, most top guided pressure relief valves are suitable for mounting on stationary equipment only, otherwise, they cannot operate dependably.

Where liquid valves are installed, ensure the inlet is below the liquid level.

## LIFTING LEVER

To prevent stem damage, the valve should have a minimum of 75% of set pressure under the disc before engaging the test lever.

# PRESSURE RELIEF VALVE INSTALLATION

Caution should be taken to be certain that all protective material on the valve flanges and any extraneous materials inside the valve body or nozzle are completely removed. Some of these materials may damage the seats or be trapped between the seats causing leakage.

Be sure the bonnets on balanced bellows valves are vented. Remove the plastic push plug inserted for shipment. Plan the disposal of the potential small fluid discharge to a safe place to avoid possible ignition or hazard to personnel.

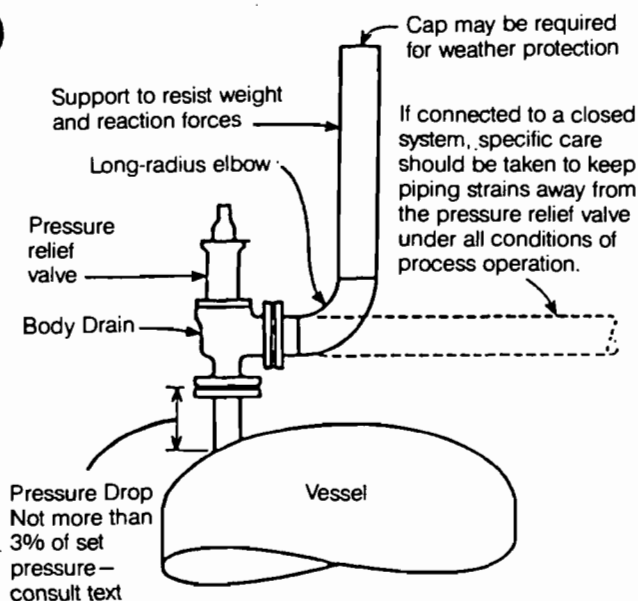
Whenever any connection is made to an outlet, provide drainage from that piping or from the valve

body. This can also be handled by sloping the piping, thus avoiding disposal problems. Properly support discharge piping. Confirm that the pressure relief valve is being installed in the proper location. Use proper gaskets or sealants to install the valve, insuring that they do not block or contaminate the inlet or outlet of the valve. Torque flange bolting or use wrenching flats for screwed type valves. Release any shipping straps from lifting levers and confirm proper lever freedom.

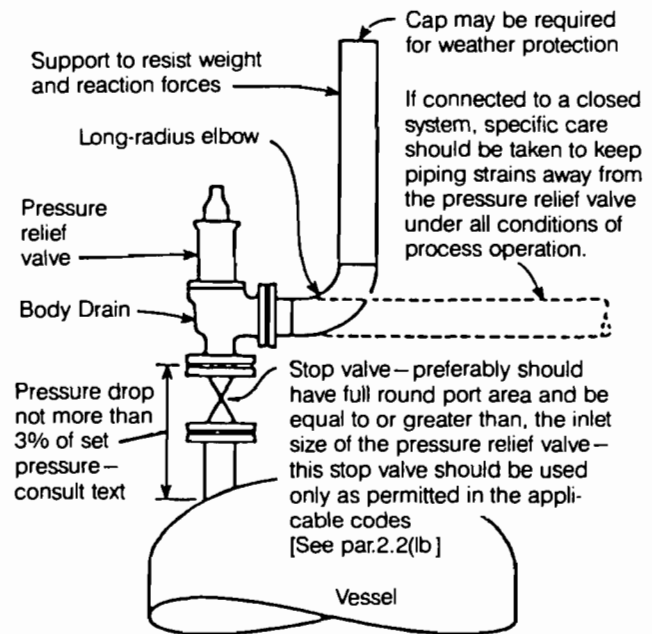
It is recommended that the valve be isolated during pressure testing of the system, either by blanking or closing a stop valve. If gagging is used, extreme caution must be exercised to avoid damaging the valve and to insure that the gag is removed after use.

## INSTALLATION

API RP 520, Part II – Installation



Recommended Typical Pressure Relief Valve Installation Without Shutoff Valve



Recommended Typical Pressure Relief Valve Installation With Shutoff Valve

## GENERAL NOTES

These reference materials are available and should be helpful in the installation and testing of Pressure Relief Valves.

Since it is impossible to include all the industry practices that are used in the installation of a Pressure Relief Valve, this manual has been prepared to describe routine field handling and installation procedures to make a safe and acceptable installation.

### **American National Standards Institute, New York, N.Y.**

ANSI B16.5—Steel Pipe Flanges and Flanged Fittings

ANSI B16.34—Steel Valves, Flanged and Butt-welding End.

ANSI B95.1—Terminology for Pressure Relief Devices.

ANSI/ASME PTC 25.3—Performance Test Code, Safety and Relief Valves.

ANSI/ASHRAE 15-78—Safety Code for Mechanical Refrigeration, [B9.1].

### **American Petroleum Institute Washington, D.C.**

API RP 520, Recommended Practice for the Design and Installation of Pressure Relieving Systems in Refineries, Part I—Design.

API RP 520, Part II—Installation.

API RP 521, Guide for Pressure Relief and Depressuring Systems.

API Standard 526, Flanged Steel Safety Relief Valves.

API Standard 527, Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats.

API Standard 2510, Design and Construction of LP-Gas Installations at Marine and Pipeline Terminals, Natural Gas Processing Plants, Refineries, and Tank Farms.

Guide for Inspection of Refinery Equipment, Chapter XVI, Pressure-Relieving Devices.

API PAPER 62-73, Computerized Safety Valve Maintenance Records by J.H. Forrester, Jr., May 17, 1973.

### **American Society of Mechanical Engineers, New York, N.Y.**

Section VIII, Rules for Construction of Pressure Vessels, Division I.

Section I, Rules for Construction of Power Boilers.

### **Compressed Gas Association, Inc., New York, N.Y.**

Safety Relief Device Standards:

Part 1—Cylinders for Compressed Gases, Pamphlet S-1.1.

Part 2—Cargo and Portable Tanks for Compressed Gases, Pamphlet S-1.2.

Part 3—Compressed Gas Storage Containers, Pamphlet S-1.3.

### **National Board of Boiler and Pressure Vessel Inspectors, Columbus, Ohio.**

National Board Inspection Code, NB-23.

National Board Authorization to Repair ASME and National Board Stamped Safety Valves and Safety Relief Valves, NB-65.

### **National Fire Protection Association, Quincy, Massachusetts.**

NFPA No. 30, Flammable and Combustible Liquids Code.

NFPA no. 58, Standard for the Storage and Handling of Liquefied Petroleum Gases.

NFPA No. 59, Standard for the Storage & Handling of Liquefied Petroleum Gases at Utility Gas Plants.

NFPA No. 59A, Standard for the Production, Storage & Handling of Liquefied Natural Gases (LNG).



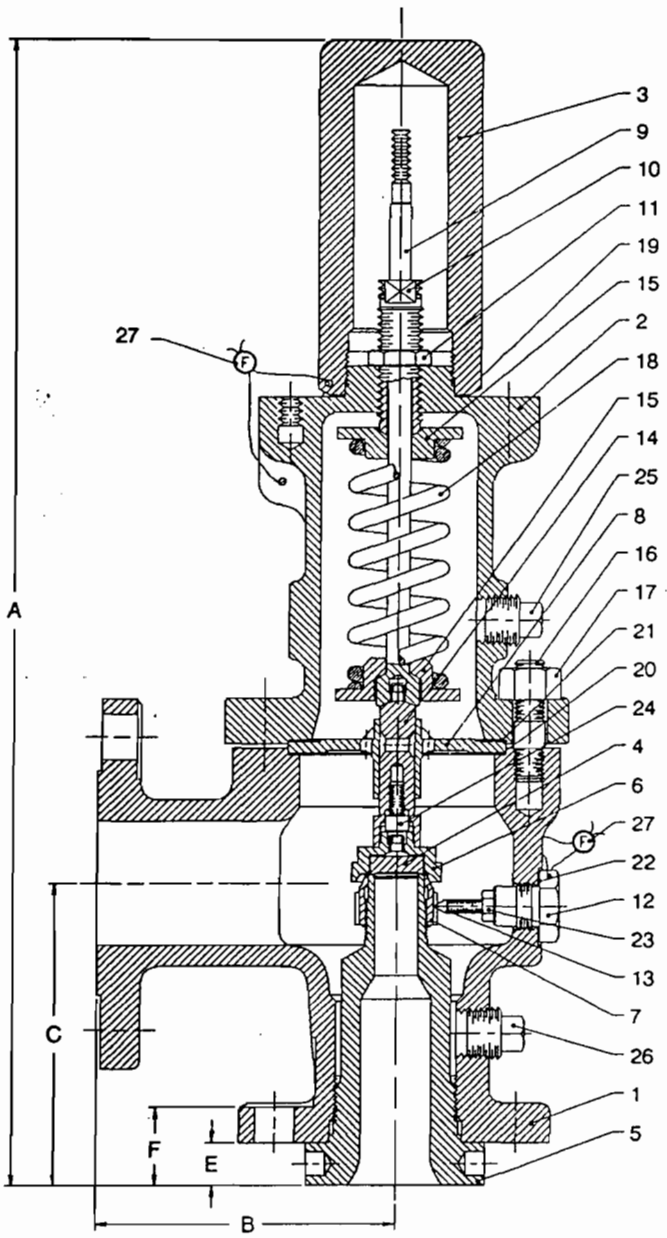
*Farris*

## **GUARANTEE**

All products manufactured by Teledyne Farris Engineering are guaranteed free of defects in material and workmanship, when used within the range recommended, for a period of one year. When authorized, any defective product may be returned to the factory, and if found defective, will be repaired or replaced free of charge, F.O.B. our factory. No charge for labor or other expense incurred will be allowed as the liability of Teledyne Farris Engineering is measured by the refund price of the defective product only.

## **TELEDYNE FARRIS ENGINEERING**

400 Commercial Ave. • Palisades Park, N.J. 07650 • Phone: 201-944-6300 • Telex: 135486  
Plants in: U.S.A., Canada, England, Scotland, France, Australia and Brazil



### BILL OF MATERIALS

ITEM	PART NAME		MATERIALS
1	BODY	26JA10 TO 26JA25	SA-216 GRADE WCB, CARB. ST.
		<del>26JA20 TO 26JA35</del>	<del>SA-217 GRADE WCB, ALLOY ST.</del>
2	BONNET	26JA10 TO 26JA25	SA-216 GRADE WCB, CARB. ST.
		<del>26JA20 TO 26JA35</del>	<del>SA-217 GRADE WCB, ALLOY ST.</del>
3	CAP, PLAIN SCREWED		ASTM A108 GR. 1117 CARB. ST.
4	DISC		<del>PRECIPITATION HARDENED ST. ST.</del>
5	NOZZLE		ASTM A351 GR. CF8M ST. ST. OR A479 TYPE 316 ST. ST.
6	DISC HOLDER		AISI 303 ST. ST.
7	BLOW DOWN RING		AISI 316 ST. ST.
8	SLEEVE GUIDE		AISI 316 ST. ST.
9	STEM		ASTM A582, TYPE 416 ST. ST.
10	SPRING ADJUSTING SCREW		ASTM A582, TYPE 416 ST. ST.
11	JAM NUT (SPR. ADJ SCREW)		AISI 316 ST. ST.
12	LOCK SCREW (B.D.R.)		AISI 316 ST. ST.
13	LOCK SCREW STUD		AISI 316 ST. ST.
14	STEM RETAINER		<del>PRECIPITATION HARDENED ST. ST.</del>
15	SPRING BUTTON		ASTM A108 GR. 1117, CARB. ST., PLTD
16	BODY STUD		ASTM A193 GR. B7, ALLOY ST.
17	HEX. NUT (BODY)		ASTM A194 GR. 2H, ALLOY ST.
18	SPRING	26JA10 TO 26JA15	CARB. ST., RUST PROOFED
		<del>26JA20 TO 26JA35</del>	<del>HIGH TEMP ALLOY, RUST PROOFED</del>
19	CAP GASKET		SOFT IRON OR STEEL
20	BODY GASKET		SOFT IRON OR STEEL
21	BONNET GASKET		SOFT IRON OR STEEL
22	LOCK SCREW GASKET		SOFT IRON OR STEEL
23	HEX NUT (B.D.R.L.S.)		STAINLESS STEEL
24	LOCK SCREW (D.H.)		STAINLESS STEEL
25	PIPE PLUG (BONNET) 1/2 NPT		STEEL
26	PIPE PLUG (BODY) 1/2 NPT		STEEL
27	WIRE SEAL		ST. ST. WIRE/LEAD SEAL
28	NAME PLATE (NOT SHOWN)		STAINLESS STEEL

COMPLIES WITH ASME BOILER & PRESSURE VESSEL CODE: SECTION VIII, DIV. 1 MARKED

FARRIS; IT#1



REQUIRING TEST LEVER FOR STEAM, AIR AND HOT WATER SERVICE PER AUXILIARY DWG. 12438-F. OTHER CODES MAY APPLY, SUBJECT TO VERIFICATION BY THE FACTORY. UNLESS OTHERWISE SPECIFIED, ALL VALVES ARE FURNISHED WITH PLAIN SCREWED CAP, ALL FLANGES ARE FURNISHED WITH SERRATED FINISH.

VALVE SIZE	ANSI FLANGE RATING		TYPE NUMBER	DIMENSIONS					APPROX. WGT. LBS.	TAG NUMBERS AND SPECIFICATIONS	
	INLET RF/FJ	OUTLET RF		CONVENTIONAL	A ALL CAP CONSTRUCTION	B	C	E			F
2 J 3	150	150	26JA10	22-1/4	4-7/8	5-3/8	11/16	1-5/16	58	26JC10-120/S1 2 J 3 W/KALREZ 65 DURO O'RING SET PR 25 PSIG BP OPSIG  DTP 25 PSIG CDTP 25 PSIG  SN: 207217-A10  ME TAG; RV-006 SEE DWG; 17774-F REV.E FOR O'RING CONSTRUCTIONS AND DWG; 17548-F REV.E FOR S1 CONSTRUCTIONS.	
			26JA20	22-1/4	4-7/8	5-3/8	11/16	1-11/16			
2-1/2 J 4	300	150	26JA11	22-1/4	4-7/8	5-3/8	11/16	1-11/16	58		
			26JA21	24-3/8	5-5/8	5-3/8	11/16	1-13/16			150
	300	150	26JA32	24-3/8	5-5/8	5-3/8	11/16	1-13/16	150		
			26JA12	24-3/8	5-5/8	5-3/8	11/16	1-13/16			
	600	150	150	26JA22	24-3/8	5-5/8	5-3/8	11/16	1-13/16		150
				26JA33	24-3/8	5-5/8	5-3/8	11/16	1-13/16		
600	150	150	26JA13	24-3/8	6-3/4	6-1/8	11/16	1-13/16	150		
			26JA23	24-3/8	6-3/4	6-1/8	11/16	2-5/16			
800	150	150	26JA34	24-3/8	6-3/4	6-1/8	11/16	2-5/16	170		
			26JA14	33-19/8	7-1/8	7-1/4	11/16	2-3/16			
3 J 4	900	150	26JA24	33-19/8	7-1/8	7-1/4	11/16	2-3/16	175		
			26JA14	33-1/8	7-1/8	7-1/4	11/16	2-9/16			
	1500	300	26JA35	33-1/8	7-1/8	7-1/4	11/16	2-9/16	175		
			26JA15	33-1/8	7-1/8	7-1/4	11/16	2-9/16			
1500	300	26JA25	33-1/8	7-1/8	7-1/4	11/16	2-9/16	175			

2600 SERIES, SAFETY-RELIEF VALVE, SERIAL A10

**TELEDYNE FARRIS ENGINEERING**  
PAUSADES PARK, NEW JERSEY

DRAWING NO.16966-F, REV. D

CUSTOMER GLITSCH PACKAGE PLTS  
PURCHASE ORDER NO. 19385  
FACTORY ORDER NO. C309870

**J**  
1.287  
SQ. IN.



FARRIS; IT#1

ITEM	PART NAME	MATERIAL
1	DISC	ASTM A582, TYPE 303 ST. ST.
2	DISC HOLDER	AISI 303 ST. ST.
3	NOZZLE	ASTM A479 TYPE 316 ST. ST.
4	"O" RING SEAT SEAL	BUNA-N SILICONE VITON OTHER:

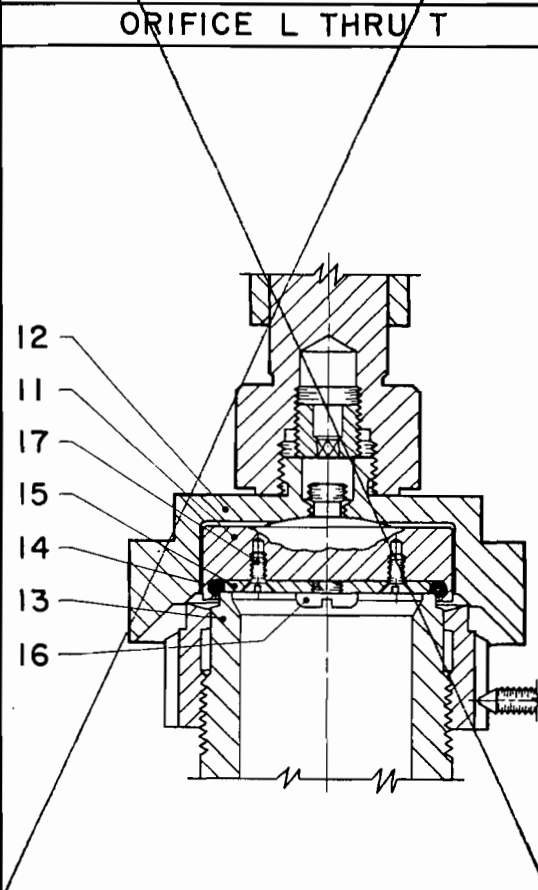
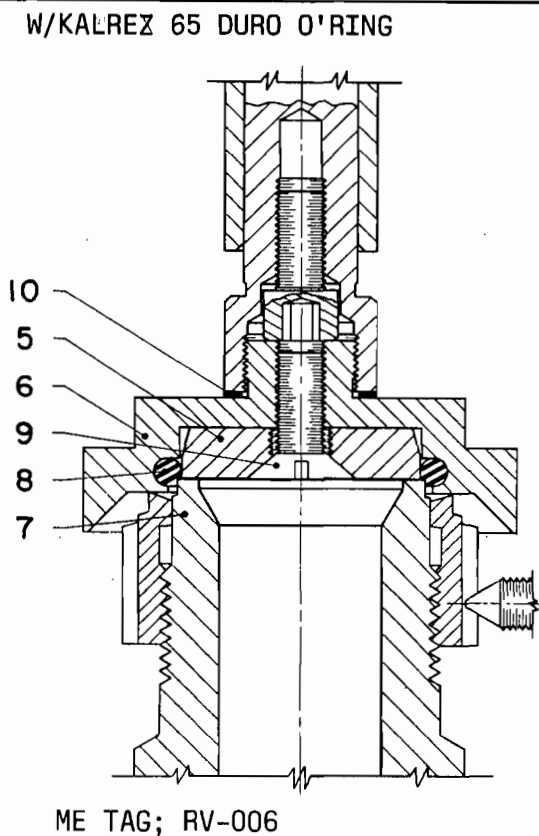
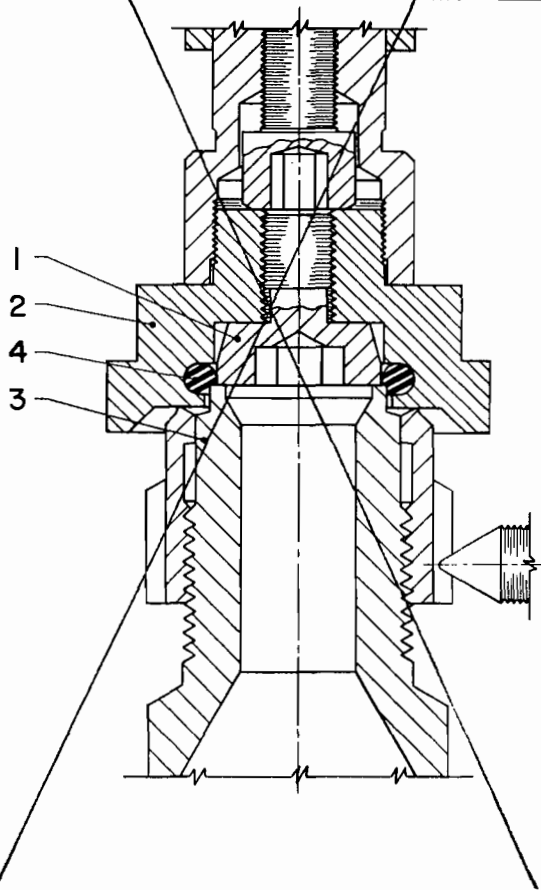
ITEM	PART NAME	MATERIAL
5	DISC	ASTM A582, TYPE 303 ST. ST.
6	DISC HOLDER	AISI 303 ST. ST.
7	NOZZLE	A351 GR. CF8M ST. ST. ASTM OR A479 TYPE 316 ST. ST.
8	"O" RING SEAT SEAL	<del>BUNA-N SILICONE VITON</del> OTHER: KALREZ
9	FLAT HD. MACH SCREW	18-8 ST. ST.
10	GASKET DISC HOLDER	FLEXIBLE GRAPHITE

ITEM	PART NAME	MATERIAL
11	DISC	ASTM A582, TYPE 303 ST. ST. OR ASTM A351 GR. CF8 ST. ST.
12	DISC HOLDER	AISI 304 ST. ST.
13	NOZZLE	ASTM A351 GR. CF8M ST. ST.
14	"O" RING SEAT SEAL	BUNA-N SILICONE VITON OTHER:
15	"O" RING RETAINER	AISI 303 ST. ST.
16	BACK SCREW PLUG	NYLON
17	FLAT HD. MACH SCREW	18-8 ST. ST.

ORIFICE D & E

ORIFICE F THRU K

ORIFICE L THRU T



TAG NUMBERS & SPECIFICATIONS :

"O" RING SEAT CONSTRUCTION

2600 SERIES SAFETY-RELIEF VALVE, SERIAL A10  
**TELEDYNE FARRIS ENGINEERING**

PALESDALE PARK, NEW JERSEY

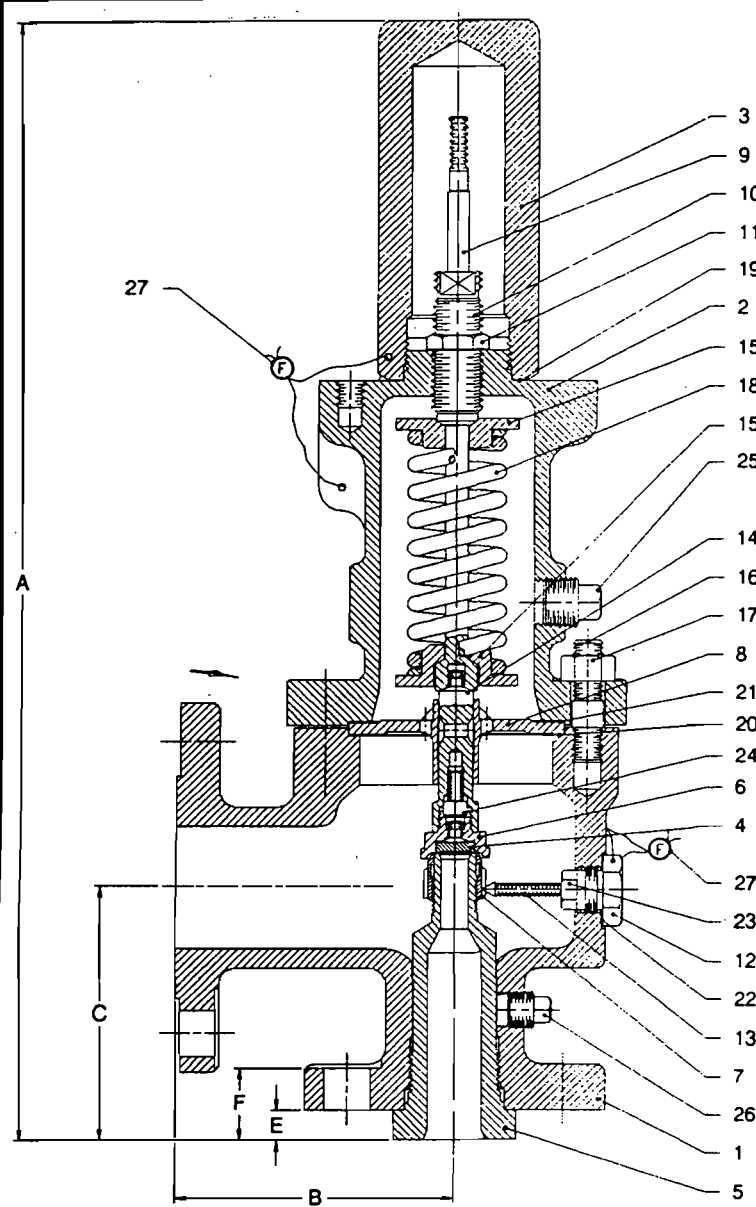
DRAWING NO. 17774-F, REV. E

CUSTOMER GLITSCH PACKAGE PLTS

INQUIRY NO. \_\_\_\_\_

ORDER NO. 19385

CERTIFIED FOR INSTALLATION C309870

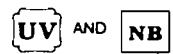


**BILL OF MATERIALS**

ITEM	PART NAME	MATERIALS
1	BODY	26DA10 TO 26DA26 SA-216 GRADE WCB, CARB. ST.
		26DA22 TO 26DA36 SA-217 GRADE WCB, ALLOY ST.
2	BONNET	26DA10 TO 26DA26 SA-216 GRADE WCB, CARB. ST.
		26DA22 TO 26DA36 SA-217 GRADE WCB, ALLOY ST.
3	CAP, PLAIN SCREWED	ASTM A108 GR. 1117, CARB. ST.
4	DISC	PRECIPITATION HARDENED ST. ST.
5	NOZZLE	ASTM A479 TYPE 316 ST. ST. OR A351 GR. CF8M ST. ST.
6	DISC HOLDER	AISI 303 ST. ST.
7	BLOW DOWN RING	AISI 316 ST. ST.
8	SLEEVE GUIDE	AISI 316 ST. ST.
9	STEM	ASTM A582, TYPE 416 ST. ST.
10	SPRING ADJUSTING SCREW	ASTM A582, TYPE 416 ST. ST.
11	JAM NUT (SPR. ADJ SCREW)	AISI 316 ST. ST.
12	LOCK SCREW (B.D.R.)	AISI 316 ST. ST.
13	LOCK SCREW STUD	AISI 316 ST. ST.
14	STEM RETAINER	PRECIPITATION HARDENED ST. ST.
15	SPRING BUTTON	ASTM A108 GR. 1117, CARB. ST. PLTD.
16	BODY STUD	ASTM A193 GR. B7, ALLOY ST.
17	HEX. NUT (BODY)	ASTM A194 GR. 2H, ALLOY ST.
18	SPRING	26DA10 TO 26DA16 CARB. ST. RUST PROOFED
		26DA20 TO 26DA30 HIGH TEMP. ALLOY, RUST PROOFED
19	CAP GASKET	SOFT IRON OR STEEL
20	BODY GASKET	SOFT IRON OR STEEL
21	BONNET GASKET	SOFT IRON OR STEEL
22	LOCK SCREW GASKET	SOFT IRON OR STEEL
23	HEX. NUT (B.D.R.L.S.)	STAINLESS STEEL
24	LOCK SCREW (D.H.)	STAINLESS STEEL
25	PIPE PLUG (BONNET) 1/2 NPT.	STEEL
26	PIPE PLUG (BODY) 1/2 NPT.	STEEL
27	WIRE SEAL	ST. ST. WIRE/LEAD SEAL
28	NAME PLATE (NOT SHOWN)	STAINLESS STEEL

COMPLIES WITH ASME BOILER & PRESSURE VESSEL CODE: SECTION VIII, DIV. 1 MARKED

FARRIS; IT#2



REQUIRING TEST LEVER FOR STEAM, AIR AND HOT WATER SERVICE PER AUXILIARY DWG. 12438-F. OTHER CODES MAY APPLY, SUBJECT TO VERIFICATION BY THE FACTORY. UNLESS OTHERWISE SPECIFIED, ALL VALVES ARE FURNISHED WITH PLAIN SCREWED CAP, ALL FLANGES ARE FURNISHED WITH SERRATED FINISH.

VALVE SIZE	ANSI FLANGE RATING		TYPE NUMBER	DIMENSIONS					APPROX. WGT. LBS.
	INLET X OUTLET	INLET RF/RJ		OUTLET RF	A	B	C	E	
102	150	150	26DA10	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26DA20	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	300	150	26DA11	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26DA21	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	300	150	26DA32	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26DA12	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	300	150	26DA22	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26DA33	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
600	150	26DA13	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42	
		26DA23	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42	
1-1/2 D2	900	300	26DA34	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
			26DA24	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
	1500	300	26DA14	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
			26DA35	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
1-1/2 D 2-1/2	2500	300	26DA15	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
			26DA25	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
1-1/2 D 2-1/2	2500	300	26DA36	22-3/4	5-1/2	5-1/2	11/16	2-7/16	80
			26DA16	22-3/4	5-1/2	5-1/2	11/16	2-7/16	80
			26DA26	22-3/4	6-1/2	5-1/2	11/16	2-7/16	30

**TAG NUMBERS AND SPECIFICATIONS**

26DC10-120/S1 1 D 2  
 W/KALREZ 80 DURO O'RING  
 SET PR 150 PSIG BP 0 PSIG  
 DTP 150 PSIG CDTP 153 PSIG  
 SN: 207218-A10  
 ME TAG; RV-039  
 SEE DWG; 17774-F REV.E FOR O'RING CONSTRUCTIONS.  
 AND DWG; 17548-F REV.E FOR S1 CONSTRUCTIONS.

2600 SERIES, SAFETY-RELIEF VALVE. SERIAL A10



DRAWING NO.16961-F, REV. D

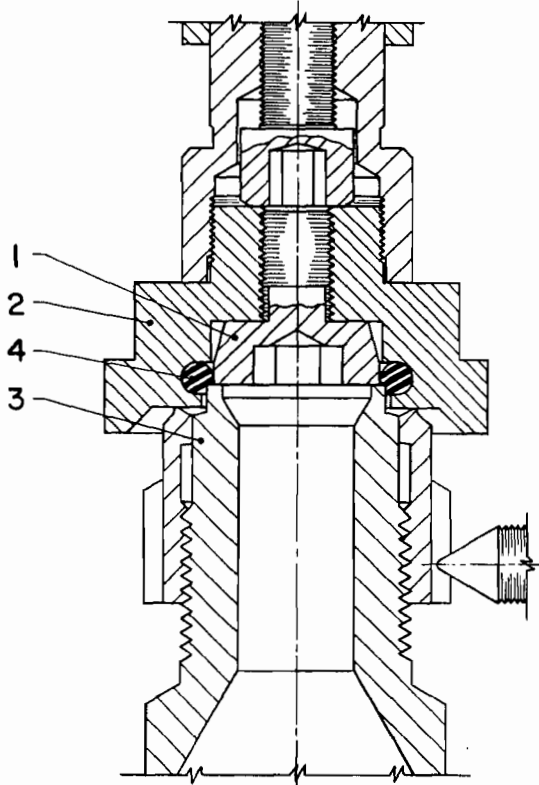
CUSTOMER	GLITSCH PACKAGE PLTS	<b>D</b>
PURCHASE ORDER NO.	19385	0.110
FACTORY ORDER NO.	C309870	SO. IN.

FARRIS; IT#2

ITEM	PART NAME	MATERIAL
1	DISC	ASTM A582, TYPE 303 ST. ST.
2	DISC HOLDER	AISI 303 ST. ST.
3	NOZZLE	ASTM A479 TYPE 316 ST. ST.
4	"O" RING SEAT SEAL	BUNA-N SILICONE VITON OTHER: <b>KALREZ</b>

W/KALREZ 80 DURO O'RING

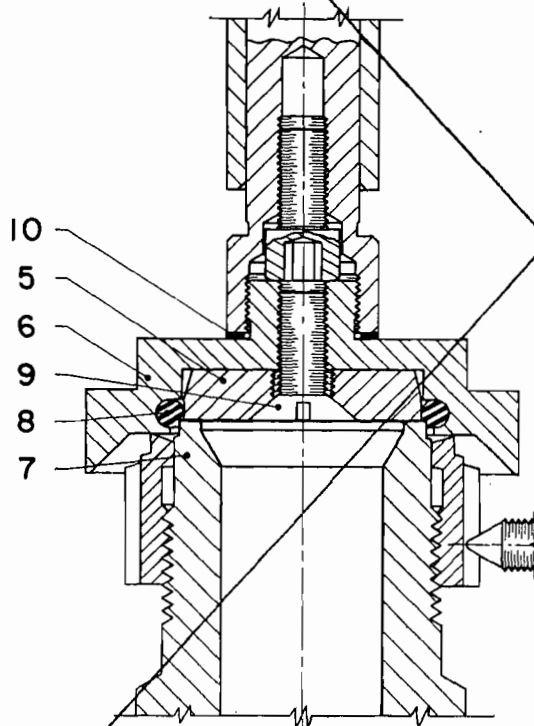
ORIFICE D & E



ME TAG; RV-039

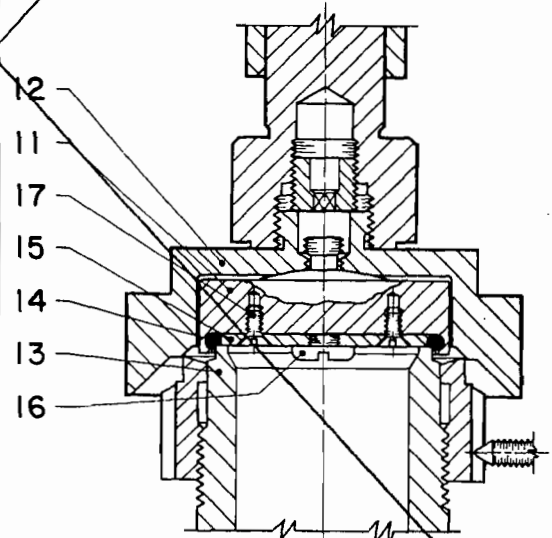
ITEM	PART NAME	MATERIAL
5	DISC	ASTM A582, TYPE 303 ST. ST.
6	DISC HOLDER	AISI 303 ST. ST.
7	NOZZLE	ASTM A351 GR. CF8M ST. ST. OR A479 TYPE 316 ST. ST.
8	"O" RING SEAT SEAL	BUNA-N SILICONE VITON OTHER:
9	FLAT HD. MACH. SCREW	18-8 ST. ST.
10	GASKET DISC HOLDER	FLEXIBLE GRAPHITE

ORIFICE F THRU K



ITEM	PART NAME	MATERIAL
11	DISC	ASTM A582, TYPE 303 ST. ST. OR ASTM A351 GR. CF8 ST. ST.
12	DISC HOLDER	AISI 304 ST. ST.
13	NOZZLE	ASTM A351 GR. CF8M ST. ST.
14	"O" RING SEAT SEAL	BUNA-N SILICONE VITON OTHER:
15	"O" RING RETAINER	AISI 303 ST. ST.
16	JACK SCREW PLUG	NYLON
17	FLAT HD. MACH. SCREW	18-8 ST. ST.

ORIFICE L THRU T



TAG NUMBERS & SPECIFICATIONS:

"O" RING SEAT CONSTRUCTION


**TELEDYNE FARRIS ENGINEERING**  
 2600 SERIES SAFETY-RELIEF VALVE, SERIAL A10  
 PAUSADES PARK, NEW JERSEY

DRAWING NO. 17774-F, REV. E

CUSTOMER GLITSCH PACKAGE PLTS  
 INQUIRY NO. \_\_\_\_\_  
 ORDER NO. 19385  
 CERTIFIED FOR INSTALLATION C309870

FARRIS; IT#1 & 2

ME TAGS;

1)RV-006

2)RV-039

**2600 SERIES, SERIALS A10/A11**

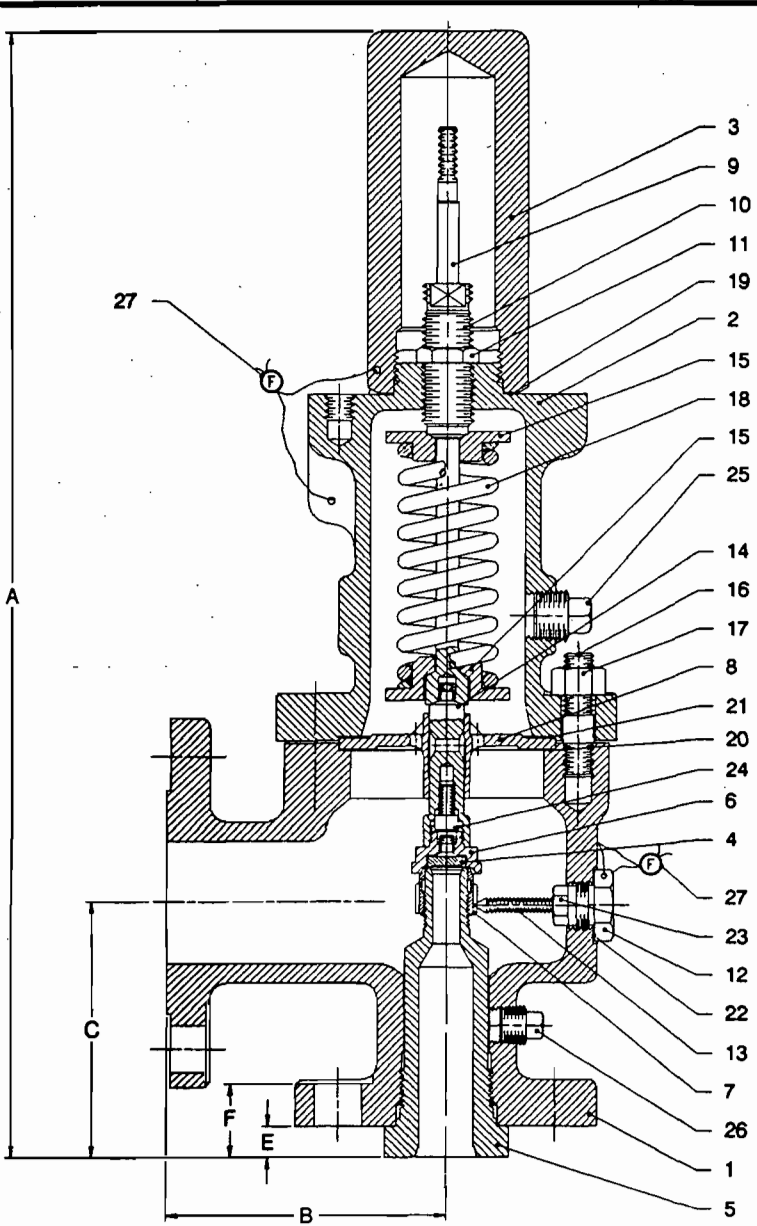
STANDARD MATERIAL FOR CORROSIVE SERVICE - 316 ST. ST.  
 CONVENTIONAL (A10) AND BALANSEAL (A11) VALVE CONSTRUCTION  
 PLAIN SCREWED CAP, PACKED LEVER AND OPEN LEVER CONSTRUCTION

CAP CONSTRUCTION	ITEM No.		PART NAME	S1		S2		S3		S4	
	A10	A11		NOZZLE & DISC		INTERNAL PARTS EXC. SPR. ASS'Y.		COMPLETE VALVE EXC. SPR. ASS'Y.		COMPLETE VALVE	
				-20°F TO +800°F		-20°F TO +800°F		-20°F TO +800°F		-450°F TO +450°F (note 4)	
				A10	A11	A10	A11	A10	A11	A10	A11
PLAIN SCREWED CAP	1	1	BODY	-	-	-	-	SA-351 GR. CF8M	-	SA-351 GR. CF8M	-
	2	2	BONNET	-	-	-	-	SA-351 GR. CF8M	-	SA-351 GR. CF8M	-
	3	3	CAP, PLAIN SCREWED	-	-	-	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-
	4	4	DISC	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-
	5	5	NOZZLE	-	-	-	-	-	-	-	-
	6	6	DISC HOLDER	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	7	7	BLOWDOWN RING	-	-	-	-	-	-	-	-
	8	8	SLEEVE GUIDE	-	-	-	-	-	-	-	-
	9	9	STEM	-	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	-
	10	10	SPRING ADJUSTING SCREW	-	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	-
	11	11	JAM NUT (SPR. ADJ. SCR.)	-	-	-	-	-	-	-	-
	12	12	LOCK SCREW (B.D.R.)	-	-	-	-	-	-	-	-
	13	13	LOCK SCREW STUD	-	-	-	-	-	-	-	-
	14	14	STEM RETAINER	A479 TYPE 316 ST. ST.	-	-	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	-
	15	15	BELLOWS	NONE	-	NONE	-	NONE	-	NONE	-
	16	16	BELLOWS GASKET	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER
	17	17	SPRING BUTTON	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	18	18	BODY STUD	-	-	-	-	ASTM A193 GR. B8T	-	ASTM A193 GR. B8T	-
	19	19	HEX. NUT (BODY)	-	-	-	-	ASTM A194 GR. 8T	-	ASTM A194 GR. 8T	-
	20	20	SPRING	-	-	CARB. ST. OR HI. TEMP. ALLOY NI. PLTD.	-	CARB. ST. OR HI. TEMP. ALLOY NICKLE PLTD.	-	AISI 316 ST. ST.	-
	21	21	CAP GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	22	22	BODY GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	23	23	BONNET GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	24	24	LOCK SCREW GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	25	25	HEX. NUT (B.D.R.L.S.)	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	26	26	LOCK SCREW (D.H.)	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
27	27	PIPE PLUG (BONNET) 1/2 NPT	-	NONE	-	NONE	AISI 316 ST. ST.	NONE	AISI 316 ST. ST.	NONE	
28	28	PIPE PLUG (BODY) 1/2 NPT	-	-	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	
PACKED LEVER	1	1	CAP	-	-	-	-	ASTM A351 GR. CF8M	-	ASTM A351 GR. CF8M	-
	2	2	TEST LEVER	-	-	-	-	-	-	-	
	3	3	CAM	-	-	ASTM A351 GR. CF8M	-	ASTM A351 GR. CF8M	-	ASTM A351 GR. CF8M	-
	4	4	CAM SHAFT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	5	5	GLAND	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	6	6	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	7	7	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	8	8	PACKING RING	-	-	-	-	-	-	-	-
	9	9	RETAINING RING	-	-	NONE	-	NONE	-	NONE	-
	10	10	PLAIN WASHER	-	-	-	-	-	-	-	-
	11	11	HEX. JAM NUT (LEVER)	-	-	-	-	-	-	-	-
	12	12	CAP STUD	-	-	-	-	ASTM A193 GR. B8T	-	ASTM A193 GR. B8T	-
	13	13	HEX. NUT (CAP)	-	-	-	-	ASTM A194 GR. 8T	-	ASTM A194 GR. 8T	-
OPEN LEVER (DOUBLE ACTING LEVER)	14	14	CAP	-	-	-	-	-	-	-	
	15	15	TEST LEVER	-	-	-	-	-	-	-	
	16	16	TEST LEVER (FORK)	-	-	-	-	-	-	-	
	17	17	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	18	18	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	19	19	CAP SCREW	-	-	-	-	-	-	-	
OPEN LEVER (SINGLE ACTING LEVER)	20	20	RD. HD. RIVET (FORK)	-	-	-	-	-	-	-	
	21	21	RD. HD. RIVET (LEVER)	-	-	-	-	-	-	-	
	22	22	COTTER PIN	-	-	-	-	-	-	-	
	23	23	CAP	-	-	-	-	-	-	-	
	24	24	TEST LEVER	-	-	-	-	-	-	-	
	25	25	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	26	26	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	-
	27	27	CAP SCREW	-	-	-	-	-	-	-	
	28	28	RD. HD. RIVET	-	-	-	-	-	-	-	
	29	29	COTTER PIN	-	-	-	-	-	-	-	

GENERAL NOTES: 1. ANY PART DENOTED WITH A DASH IS STANDARD MATERIAL. 2. MAXIMUM SET PRESSURES FOR S1 THRU S3 ARE THE SAME AS THE CARBON STEEL VALVES ON THE SELECTION TABLES OF THE CATALOG. 3. HIGH TEMP. ALLOY NICKEL PLATED SPRING REQUIRED FROM 451°F TO 800°F. 4. FOR TEMPERATURES BELOW -75°F, MAXIMUM PRESSURES ARE SHOWN ON THE SELECTION TABLES.

**TELEDYNE FARRIS ENGINEERING**  
 PALISADES PARK, NEW JERSEY  
 DRAWING NO. 17548-F REV. E, SHEET 1 OF 2

CUSTOMER GLITSCH PACKAGE PLANT  
 PURCHASE ORDER NO. 19385  
 FACTORY ORDER NO. C309870  
 BW6

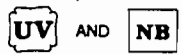


**BILL OF MATERIALS**

ITEM	PART NAME	MATERIALS
1	26EA10 TO 26EA26	SA-216 GRADE WCB, CARB. ST.
	26EA32 TO 26EA36	SA-217 GRADE WCB, ALLOY ST.
2	26EA10 TO 26EA26	SA-216 GRADE WCB, CARB. ST.
	26EA32 TO 26EA36	SA-217 GRADE WCB, ALLOY ST.
3	CAP, PLAIN SCREWED	ASTM A108 GR. 1117, CARB. ST.
4	DISC	PRECIPITATION HARDENED ST. ST.
5	NOZZLE	ASTM A479 TYPE 316 ST. ST. OR A351 GR. CF8M ST. ST.
6	DISC HOLDER	AISI 309 ST. ST.
7	BLOW DOWN RING	AISI 316 ST. ST.
8	SLEEVE GUIDE	AISI 316 ST. ST.
9	STEM	ASTM A562, TYPE 416 ST. ST.
10	SPRING ADJUSTING SCREW	ASTM A302, TYPE 416 ST. ST.
11	JAM NUT (SPR.ADJ. SCREW)	AISI 316 ST. ST.
12	LOCK SCREW (B.D.R.)	AISI 318 ST. ST.
13	LOCK SCREW STUD	AISI 318 ST. ST.
14	STEM RETAINER	PRECIPITATION-HARDENED ST. ST.
15	SPRING BUTTON	ASTM A108 GR. 1117, CARB. ST., PLTD.
18	BODY STUD	ASTM A193 GR. B7, ALLOY ST.
17	HEX. NUT (BODY)	ASTM A194 GR. 2H, ALLOY ST.
18	26EA10 TO 26EA18	CARB. ST., RUST-PROOFED
	26EA20 TO 26EA36	HIGH TEMP. ALLOY RUST-PROOFED
19	CAP GASKET	SOFT IRON OR STEEL
20	BODY GASKET	SOFT IRON OR STEEL
21	BONNET GASKET	SOFT IRON OR STEEL
22	LOCK SCREW GASKET	SOFT IRON OR STEEL
23	HEX. NUT (B.D.R.L.S.)	STAINLESS STEEL
24	LOCK SCREW (D.H.)	STAINLESS STEEL
25	PIPE PLUG (BONNET) 1/2 NPT.	STEEL
26	PIPE PLUG (BODY) 1/2 NPT.	STEEL
27	WIRE SEAL	ST. ST. WIRE/LEAD SEAL
28	NAME PLATE (NOT SHOWN)	STAINLESS STEEL

COMPLIES WITH ASME BOILER & PRESSURE VESSEL CODE: SECTION VIII, DIV. 1 MARKED

FARRIS IT#3



REQUIRING TEST LEVER FOR STEAM, AIR AND HOT WATER SERVICE PER AUXILIARY DWG. 12438-F. OTHER CODES MAY APPLY, SUBJECT TO VERIFICATION BY THE FACTORY. UNLESS OTHERWISE SPECIFIED, ALL VALVES ARE FURNISHED WITH PLAIN SCREWED CAP, ALL FLANGES ARE FURNISHED WITH SERRATED FINISH.

VALVE SIZE	ANSI FLANGE RATING		TYPE NUMBER	DIMENSIONS					APPROX. WGT. LBS.
	INLET RF/RJ	OUTLET RF		CONVENTIONAL	A ALL CAP CONSTRUCTION	B	C	E	
1E2	150	150	26EA10	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26EA20	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	300	150	26EA11	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26EA21	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	300	150	26EA32	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26EA12	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
1-1/2E2	600	150	26EA22	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26EA33	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
	600	150	26EA13	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
			26EA23	18-3/8	4-1/2	4-1/8	1/2	1-3/16	42
1-1/2 E 2-1/2	900	300	26EA34	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
			26EA24	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
	1500	300	26EA14	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
			26EA35	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50
2500	300	26EA15	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50	
		26EA25	22-5/8	5-1/2	4-1/8	11/16	1-15/16	50	
1-1/2 E 2-1/2	2500	300	26EA36	22-3/4	6-1/2	5-1/2	11/16	2-7/16	80
			26EA18	22-3/4	6-1/2	5-1/2	11/16	2-7/16	80
			26EA26	22-3/4	6-1/2	5-1/2	11/16	2-7/16	80

**TAG NUMBERS AND SPECIFICATIONS**

26EA21-140/S2 1 E 2  
 SET PR 150 PSIG BP 0 PSIG  
 DTP 150 PSIG CDTP 155 PSIG  
 SN: 207219-A10  
 ME TAG; RV-059, RV-052  
 SEE DWG; 12438-F REV.H FOR CAP CONSTRUCTIONS  
 AND DWG; 17548-F REV.E FOR S2 CONSTRUCTIONS.

2600 SERIES, SAFETY-RELIEF VALVE, SERIAL A10



DRAWING NO.16962-F, REV. D

CUSTOMER	GLITSCH PACKAGE PLTS	E 0.196 SQ. IN.
PURCHASE ORDER NO.	19385	
FACTORY ORDER NO.	C309870	

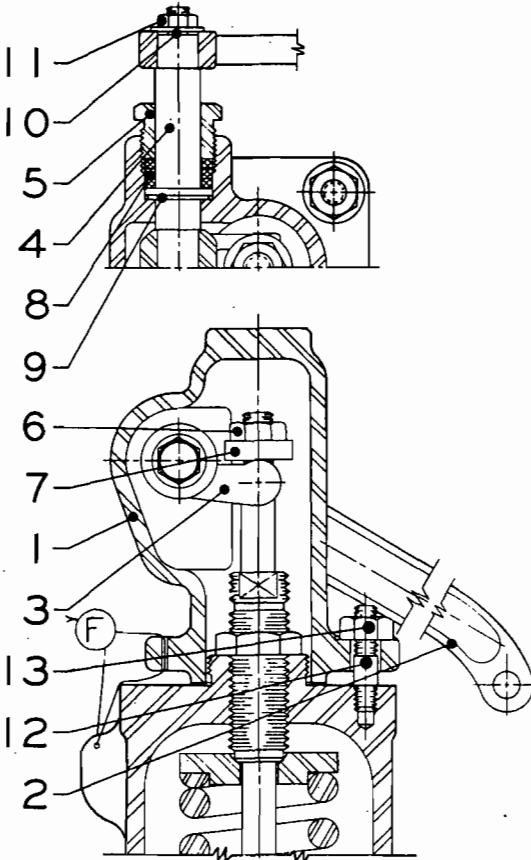
2600 SERIES, SAFETY-RELIEF VALVE, SERIAL A10, A11  
 2600L SERIES, RELIEF VALVE, SERIAL A14, A15  
**TELEDYNE FARRIS ENGINEERING**  
 PALMSIDE PARK, NEW JERSEY

DRAWING NO. 12438-F REV. H

ITEM	PART NAME	MATERIAL
1	CAP	ASTM A216 GR. WCB CARB. ST.
2	TEST LEVER	ASTM A47 GR. 32510 MALL. IRON
3	CAM	ASTM A47 GR. 32510 MALL. IRON
4	CAM SHAFT	AISI 416 ST. ST.
5	GLAND	AISI 416 ST. ST.
6	STEM JAM NUT	AISI 303 ST. ST.
7	STEM TEST NUT	AISI 416 ST. ST.
8	PACKING RING	GRAPHITE
9	RETAINING RING	PRECIPITATION-HARDENED ST. ST.
10	PLAIN WASHER	STEEL
11	HEX. JAM NUT (LEVER)	STEEL
12	CAP STUD	ASTM A193 GR. B7 ALLOY ST.
13	HEX. NUT (CAP)	ASTM A194 GR. 2H ALLOY ST.

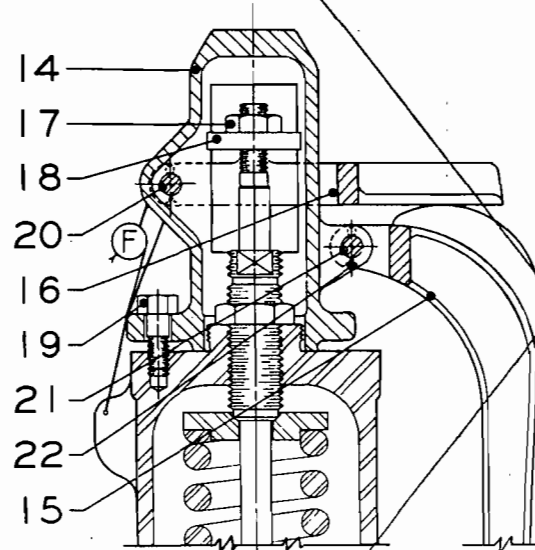
ME TAG; RV-059, RV-052

CAP CONSTRUCTIONS



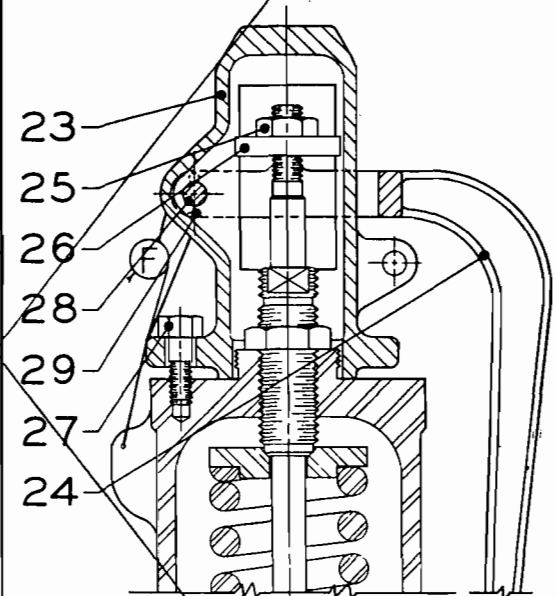
**PACKED LEVER**  
 2600/2600L SERIES, ALL SIZES

ITEM	PART NAME	MATERIAL
14	CAP	ASTM A47 GR. 32510 MALL. IRON
15	TEST LEVER	ASTM A47 GR. 32510 MALL. IRON
16	TEST LEVER FORK	ASTM A47 GR. 32510 MALL. IRON
17	STEM JAM NUT	AISI 303 ST. ST.
18	STEM TEST NUT	AISI 416 ST. ST.
19	CAP SCREW	STEEL, PLTD.
20	RD. HD. RIVET (FORK)	STEEL
21	RD. HD. RIVET (LEVER)	STEEL
22	COTTER PIN	STEEL, PLTD.



**OPEN LEVER  
 (DOUBLE ACTING LEVER)**  
 2600/2600L SERIES, SIZES 1x2 THRU 6x10  
 EXCEPT TYPES 26(A) A10, A11, A20, A21,  
 A60, A61, A70, A71, A80, A81.  
 SIZE 8x10, ALL TYPES

ITEM	PART NAME	MATERIAL
23	CAP	ASTM A47 GR. 32510 MALL. IRON
24	TEST LEVER	ASTM A47 GR. 32510 MALL. IRON
25	STEM JAM NUT	AISI 303 ST. ST.
26	STEM TEST NUT	AISI 416 ST. ST.
27	CAP SCREW	STEEL, PLTD.
28	RD. HD. RIVET	STEEL
29	COTTER PIN	STEEL, PLTD.



**OPEN LEVER  
 (SINGLE ACTING LEVER)**  
 2600/2600L SERIES, TYPES 26(A) A10, A11, A20, A21  
 2600 SERIES, A60, A61, A70, A71, A80, A81  
 ALL SIZES EXCEPT 8x10

CUSTOMER GLITSCH PACKAGE PLTS  
 INQUIRY NO. 19385  
 ORDER NO. C309870  
 CERTIFIED FOR INSTALLATION

FARRIS; IT#3  
ME TAG; RV-059, RV-052

**2600 SERIES, SERIALS A10/A11**

STANDARD MATERIAL FOR CORROSIVE SERVICE - 316 ST. ST.  
CONVENTIONAL (A10) AND BALANSEAL (A11) VALVE CONSTRUCTION  
PLAIN SCREWED CAP, PACKED LEVER AND OPEN LEVER CONSTRUCTION

CAP CONSTRUCTION	ITEM No.		PART NAME	S1		S2		S3		S4	
				NOZZLE & DISC		INTERNAL PARTS EXC. SPR. ASS'Y.		COMPLETE VALVE EXC. SPR. ASS'Y.		COMPLETE VALVE	
				-20°F TO +800°F		-20°F TO +800°F		-20°F TO +800°F		-450°F TO +450°F (note 4)	
				A10	A11	A10	A11	A10	A11	A10	A11
PLAIN SCREWED CAP	1	1	BODY	-	-	-	-	SA-351 GR. CF8M	SA-351 GR. CF8M	SA-351 GR. CF8M	SA-351 GR. CF8M
	2	2	BONNET	-	-	-	-	SA-351 GR. CF8M	SA-351 GR. CF8M	SA-351 GR. CF8M	SA-351 GR. CF8M
	3	3	CAP, PLAIN SCREWED	-	-	-	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M
	4	4	DISC	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	-	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M	A479 TYPE 316 ST. ST. OR A351 GR. CF8M
	5	5	NOZZLE	-	-	-	-	-	-	-	-
	6	6	DISC HOLDER	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	7	7	BLOWDOWN RING	-	-	-	-	-	-	-	-
	8	8	SLEEVE GUIDE	-	-	-	-	-	-	-	-
	9	9	STEM	-	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.
	10	10	SPRING ADJUSTING SCREW	-	-	A479 TYPE 316 ST. ST.	-	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.
	11	11	JAM NUT (SPR. ADJ. SCR.)	-	-	-	-	-	-	-	-
	12	12	LOCK SCREW (B.D.R.)	-	-	-	-	-	-	-	-
	13	13	LOCK SCREW STUD	-	-	-	-	-	-	-	-
	14	14	STEM RETAINER	A479 TYPE 316 ST. ST.	-	-	-	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.	A479 TYPE 316 ST. ST.
	15	15	BELLOWS	NONE	-	NONE	-	NONE	-	NONE	-
	16	16	BELLOWS GASKET	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER	NONE	TEFLON COATED CERAMIC FIBER
	17	17	SPRING BUTTON	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	18	18	BODY STUD	-	-	-	-	ASTM A193 GR. B8T	ASTM A193 GR. B8T	ASTM A193 GR. B8T	ASTM A193 GR. B8T
	19	19	HEX. NUT (BODY)	-	-	-	-	ASTM A194 GR. 8T	ASTM A194 GR. 8T	ASTM A194 GR. 8T	ASTM A194 GR. 8T
	20	20	SPRING	-	-	CARB. ST. OR HI. TEMP. ALLOY NI. PLTD.	-	CARB. ST. OR HI. TEMP. ALLOY NICKLE PLTD.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	21	21	CAP GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	22	22	BODY GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	23	23	BONNET GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	24	24	LOCK SCREW GASKET	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	25	25	HEX. NUT (B.D.R.L.S.)	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	26	26	LOCK SCREW (D.H.)	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
25	25	PIPE PLUG (BONNET) 1/2 NPT	-	NONE	-	NONE	AISI 316 ST. ST.	NONE	AISI 316 ST. ST.	NONE	
26	27	PIPE PLUG (BODY) 1/2 NPT	-	-	-	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	
PACKED LEVER	1	1	CAP	-	-	-	-	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M
	2	2	TEST LEVER	-	-	-	-	-	-	-	-
	3	3	CAM	-	-	ASTM A351 GR. CF8M	-	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M	ASTM A351 GR. CF8M
	4	4	CAM SHAFT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	5	5	GLAND	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	6	6	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	7	7	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	8	8	PACKING RING	-	-	-	-	-	-	-	-
	9	9	RETAINING RING	-	-	NONE	-	NONE	NONE	NONE	NONE
	10	10	PLAIN WASHER	-	-	-	-	-	-	-	-
	11	11	HEX. JAM NUT (LEVER)	-	-	-	-	-	-	-	-
	12	12	CAP STUD	-	-	-	-	ASTM A193 GR. B8T	ASTM A193 GR. B8T	ASTM A193 GR. B8T	ASTM A193 GR. B8T
	13	13	HEX. NUT (CAP)	-	-	-	-	ASTM A194 GR. 8T	ASTM A194 GR. 8T	ASTM A194 GR. 8T	ASTM A194 GR. 8T
OPEN LEVER (DOUBLE ACTING LEVER)	14	14	CAP	-	-	-	-	-	-	-	-
	15	15	TEST LEVER	-	-	-	-	-	-	-	-
	16	16	TEST LEVER (FORK)	-	-	-	-	-	-	-	-
	17	17	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	18	18	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.
	19	19	CAP SCREW	-	-	-	-	-	-	-	-
OPEN LEVER (SINGLE ACTING LEVER)	20	20	RD. HD. RIVET (FORK)	-	-	-	-	-	-	-	-
	21	21	RD. HD. RIVET (LEVER)	-	-	-	-	-	-	-	-
	22	22	COTTER PIN	-	-	-	-	-	-	-	-
	23	23	CAP	-	-	-	-	-	-	-	-
	24	24	TEST LEVER	-	-	-	-	-	-	-	-
25	25	STEM JAM NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	
26	26	STEM TEST NUT	-	-	AISI 316 ST. ST.	-	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	AISI 316 ST. ST.	
27	27	CAP SCREW	-	-	-	-	-	-	-	-	
28	28	RD. HD. RIVET	-	-	-	-	-	-	-	-	
29	29	COTTER PIN	-	-	-	-	-	-	-	-	

GENERAL NOTES: 1. ANY PART DENOTED WITH A DASH IS STANDARD MATERIAL. 2. MAXIMUM SET PRESSURES FOR S1 THRU S3 ARE THE SAME AS THE CARBON STEEL VALVES ON THE SELECTION TABLES OF THE CATALOG. 3. HIGH TEMP. ALLOY NICKEL PLATED SPRING REQUIRED FROM 451°F TO 800°F. 4. FOR TEMPERATURES BELOW -75°F, MAXIMUM PRESSURES ARE SHOWN ON THE SELECTION TABLES.

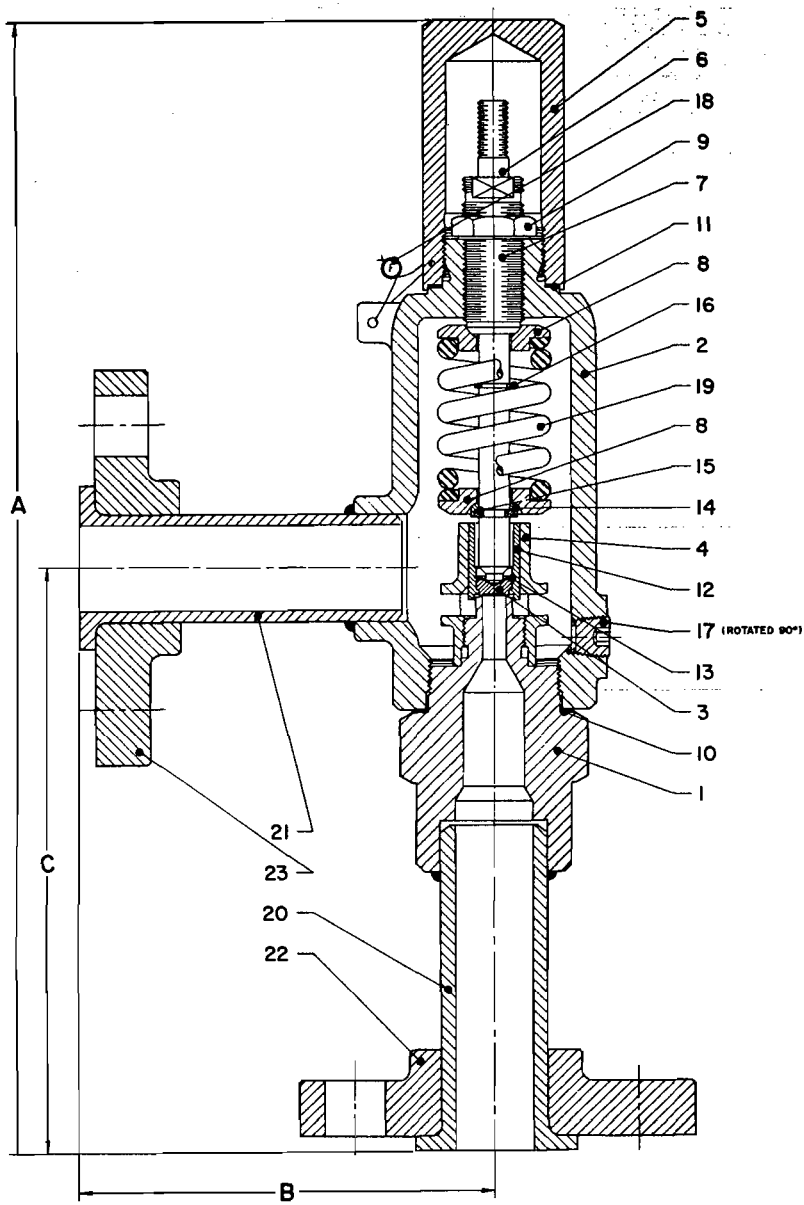
**TELEDYNE FARRIS ENGINEERING**  
PAUSADES PARK, NEW JERSEY

DRAWING NO. 17548-F REV. E, SHEET 1 OF 2

CUSTOMER GLITSCH PACKAGE PLTS

PURCHASE ORDER NO. 19385

FACTORY ORDER NO. C309870



BILL OF MATERIALS		
ITEM	PART NAME	MATERIAL
1	BODY	SA-351, GR. CF8M, 316 ST. ST.
2	BONNET	SA-316, GR. WCB, CARB. ST.
3	DISC	ASTM A479, TYPE 316 ST. ST.
4	GUIDE	ASTM A351, GR. CF8M, 316 ST. ST.
5	CAP, PLAIN SCREWED	ASTM A108, GR. 1117, CARB. ST.
6	STEM	ASTM A479, TYPE 316 ST. ST.
7	SPRING ADJUSTING SCREW	ASTM A502, TYPE 303 ST. ST.
8	SPRING BUTTON	ASTM A108, GR. 1117, CARB. ST., PLTD.
9	JAM NUT (SPR. ADJ. SCREW)	ASTM A502, TYPE 303 ST. ST.
10	BODY GASKET	SOFT IRON OR STEEL
11	CAP GASKET	SOFT IRON OR STEEL
12	DISC HOLDER	ASTM A479, TYPE 316 ST. ST.
13	DISC RETAINING RING	PRECIPITATION HARDENED ST. ST.
14	COMBINATION RING	AISI 316 ST. ST.
15	SPLIT RING	AISI 316 ST. ST.
16	LIFT STOP RING	18-8 ST. ST.
17	PIPE PLUG, 1/4 NPT	ASTM A105, GR. II, CARB. ST.
18	WIRE SEAL	LEAD
19	SPRING	F274OUL STAINLESS STEEL F274OULT HIGH TEMP. ALLOY, RUST PROOF
20	LAP JOINT STUB END-INLET	SA-403 GR. WP316
21	LAP JOINT STUB END-OUTLET	SA-254 CARBON STEEL
22	LAP JOINT FLANGE-INLET	SA-181 OR SA-105, CARB. ST.
23	LAP JOINT FLANGE-OUTLET	SA-181 OR SA-105, CARB. ST.

FARRIS; IT#4

TAG NUMBERS & SPECIFICATIONS	
F274OUL/S4	3/4 X 1 .06
SET PR 125 PSIG BP 0 PSIG	
DTP 125 PSIG CDTP 125 PSIG	
SN: 207220-KC	
ME TAG; RV-075, RV-076	
SEE DWG; 23634-F REV. B FOR S4 CONSTRUCTIONS.	

COMPLIES WITH ASME BOILER & PRESSURE VESSEL CODE SECTION VIII, PRESSURE VESSELS MARKED (uv) & N.B. REQUIRING TEST LEVER FOR STEAM, AIR & WATER SERVICE OVER 140° F. PER AUXILIARY DRAWING 23354-F.

UNLESS OTHERWISE SPECIFIED ALL VALVES ARE FURNISHED WITH PLAIN SCREWED CAP.

LAP JOINT STUB END RAISED FACE IS FURNISHED AS A MANUFACTURER'S STOCK FINISH, DEFINED AS A MODIFIED SPIRAL SERRATED GASKET SURFACE FINISH.

LAP JOINT FLANGE CONNECTIONS								
TYPE NO	ORIFICE	VALVE SIZE INLET x OUTLET	ANSI FLANGE CLASS		A ALL CAP CONSTRUCTION	B	C	APPROX. WGT. LBS.
			INLET RF OR RJ	OUTLET RF				
F274OUL	.06	1/2 x 1	150*	150*	13-1/4	5-3/16	6-1/4	13
			300*/600*	150*				14
			900*/1500*	300*				22
		3/4 x 1	150*	150*	13-1/4	5-3/16	6-3/16	13
			300*/600*	150*				14
			900*/1500*	300*				22
	1 x 1	150*	150*	14-1/4	5-3/16	7-1/8	14	
		300*/600*	150*				16	
		900*/1500*	300*				23	

F274OUL SERIES, SAFETY-RELIEF VALVE, SERIAL KC  
 FLANGED CONNECTIONS  
**TELEDYNE FARRIS ENGINEERING**  
 PALISADES PARK, NEW JERSEY  
 DRAWING NO. 23559-F, REV. C

CUSTOMER GLITSCH PACKAGE PLTS  
 PURCHASE ORDER NO. 19385  
 FACTORY ORDER NO. C309870



# 2740UL SERIES, KC SERIALS

STANDARD MATERIAL FOR CORROSIVE SERVICE, HASTELLOY C, MONEL & 316 ST. ST.

CAP CON- STRUCTION	ITEM NO.				PART NAME	HASTELLOY C		MONEL		316 ST. ST.	
	SCREWED	SOCKET WELD	WELDING NIPPLES	FLANGED		H2	H4	M2	M4	S4 NOTE 2	
PLAIN SCREWED CAP	1	1	1	1	BODY	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	2	2	2	2	BONNET	---	HASTELLOY C	---	MONEL	SA-351 GR. CFBM ST. ST.	
	3	3	3	3	DISC	HASTELLOY C	HASTELLOY C	MONEL	MONEL	ASTM A479 TYPE 316 ST. ST.	
	4	4	4	4	GUIDE	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	5	5	5	5	CAP, PLAIN SCREWED	---	HASTELLOY C	---	MONEL	ASTM A479 TYPE 316 ST. ST.	
	6	6	6	6	STEM	---	HASTELLOY C	---	MONEL	---	
	7	7	7	7	SPRING ADJUSTING SCREW	---	HASTELLOY C	---	MONEL	ASTM A479 TYPE 316 ST. ST.	
	8	8	8	8	SPRING BUTTON	---	HASTELLOY C	---	MONEL	ASTM A479 TYPE 316 ST. ST.	
	9	9	9	9	JAM NUT	---	HASTELLOY C	---	MONEL	ASTM A479 TYPE 316 ST. ST.	
	10	10	10	10	BODY GASKET	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	11	11	11	11	CAP GASKET	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	12	12	12	12	DISC HOLDER	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	13	13	13	13	DISC RETAINING RING	---	---	---	---	---	
	14	14	14	14	COMBINATION RING	---	HASTELLOY C	---	MONEL	---	
	15	15	15	15	SPLIT RING	---	HASTELLOY C	---	MONEL	---	
	16	16	16	16	LIFT STOP RING	---	---	---	---	---	
	17	17	17	17	PIPE PLUG	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	18	18	18	18	WIRE SEAL	---	---	---	---	---	
	19	19	19	19	SPRING	2740UL	---	HASTELLOY C	---	INCONEL	AISI 316 ST. ST.
	19	19	19	19		2740ULT	---	HI-TEMP ALLOY, PLT	---	INCONEL X	HI-TEMP ALLOY, NICKEL, PLT.
	-	-	20	-	WELDING NIPPLE (INLET)	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	-	-	21	-	WELDING NIPPLE (OUTLET)	---	HASTELLOY C	---	MONEL	SA-312 GR. TP, 316 ST. ST.	
	-	-	20	-	LAP JOINT STUB END (INLET)	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
-	-	21	-	LAP JOINT STUB END (OUTLET)	---	HASTELLOY C	---	MONEL	SA-403, GR. WP 316 ST. ST.		
-	-	22	-	LAP JOINT FLANGE (INLET)	---	HASTELLOY C	---	MONEL	SA-182, GR. F 316 ST. ST.		
-	-	23	-	LAP JOINT FLANGE (OUTLET)	---	HASTELLOY C	---	MONEL	SA-182, GR. F 316 ST. ST.		

FARRIS; ITEM#4 ME TAG; RV-075,076

CAP CON- STRUCTION	ITEM NO.				PART NAME	HASTELLOY C		MONEL		316 ST. ST.
	SCREWED	SOCKET WELD	WELDING NIPPLES	FLANGED		H2	H4	M2	M4	S4 NOTE 2
OPEN LEVER CAP	1				TEST LEVER	---	---	---	---	---
	2				CAP, O.L.	---	---	---	---	---
	3				STEM TEST WASHER	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	4				STEM JAM NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	5				BUTTON HEAD RIVET	---	---	---	---	---
	6				SET SCREW	---	---	---	---	---

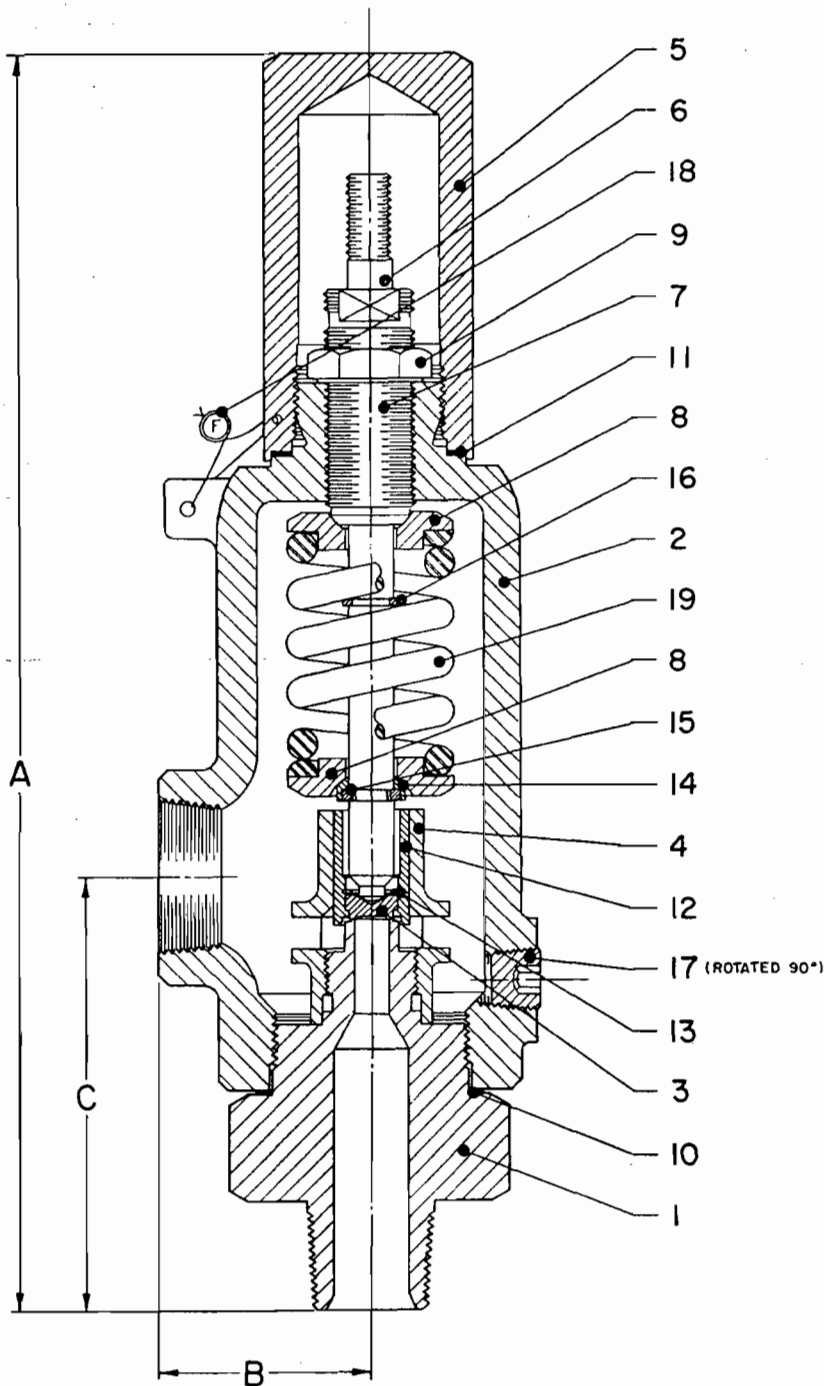
CAP CON- STRUCTION	ITEM NO.				PART NAME	HASTELLOY C		MONEL		316 ST. ST.
	SCREWED	SOCKET WELD	WELDING NIPPLES	FLANGED		H2	H4	M2	M4	S4 NOTE 2
PACKED LEVER CAP	7				TEST LEVER	---	---	---	---	---
	8				CAP, PACKED	---	HASTELLOY C	---	MONEL	ASTM A479 TYPE 316 ST. ST.
	9				STEM TEST WASHER	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	10				STEM JAM NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	11				CAM	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	12				GLAND	---	---	---	MONEL	AISI 316 ST. ST.
	13				GLAND NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	14				PACKING RING	---	---	---	---	---
	15				GLAND NUT GASKET	---	TEFLON COATED CERAMIC FIBER	---	TEFLON COATED CERAMIC FIBER	TEFLON COATED CERAMIC FIBER
	16				GROOV-PIN	---	---	---	---	---

**NOTES:**

1. ANY PART DENOTED WITH A DASH IS STANDARD MATERIAL.
2. ALSO SUITABLE FOR CRYOGENIC SERVICE.

2740UL, SERIALS KC; STANDARD MATERIALS FOR  
H2, H4, M2, M4 & S4  
**TELEDYNE FARRIS ENGINEERING**  
PALISADES PARK, NEW JERSEY  
DRAWING NO. 23634-F, REV. B SHEET 1 OF 2

CUSTOMER GLITSCH PACKAGE PLTS  
PURCHASE ORDER NO. 19385  
FACTORY ORDER NO. C309870



BILL OF MATERIALS			
ITEM	PART NAME	MATERIAL	
1	BODY	SA-351, GR. CF8M, 316 ST. ST.	
2	BONNET	SA-216, GR. WCB, CARR. ST.	
3	DISC	CASTM A479, TYPE 316 ST. ST.	
4	GUIDE	ASTM A351, GR. CF8M, 316 ST. ST.	
5	CAP, PLAIN SCREWED	ASTM A108, GR. 1117, CARR. ST.	
6	STEM	ASTM A479, TYPE 316 ST. ST.	
7	SPRING ADJUSTING SCREW	ASTM A582, TYPE 303 ST. ST.	
8	SPRING BUTTON	ASTM A108, GR. 1117, CARR. ST., PLTD.	
9	JAM NUT (SPR. ADJ. SCREW)	ASTM A582, TYPE 303 ST. ST.	
10	BODY GASKET	SOFT IRON OR STEEL	
11	CAP GASKET	SOFT IRON OR STEEL	
12	DISC HOLDER	ASTM A479, TYPE 316 ST. ST.	
13	DISC RETAINING RING	PRECIPITATION HARDENED ST. ST.	
14	COMBINATION RING	AISI 316 ST. ST.	
15	SPLIT RING	AISI 316 ST. ST.	
16	LIFT STOP RING	18-8 ST. ST.	
17	PIPE PLUG, 1/4 NPT	ASTM A105, GR. II, CARR. ST.	
18	WIRE SEAL	LEAD	
19	SPRING	2740 UL	STAINLESS STEEL
		2740 ULT	HIGH TEMP. ALLOY, RUST PROOFED

FARRIS; IT#5

TAG NUMBERS & SPECIFICATIONS	
2740UL/S4	3/4 X 1 .06
SET PR 150 PSIG BP 0 PSIG	
DTP 150 PSIG CDP 150 PSIG	
SN: 207221-KC	
ME TAG; RV-100	
SEE DWG; 23634-F REV.B FOR S4 CONSTRUCTIONS.	

COMPLIES WITH ASME BOILER & PRESSURE VESSEL CODE SECTION VIII, PRESSURE VESSELS MARKED (uv) & N.B. REQUIRING TEST LEVER FOR STEAM, AIR & WATER SERVICE OVER 140° F. PER AUXILIARY DRAWING 23354-F.

UNLESS OTHERWISE SPECIFIED ALL VALVES ARE FURNISHED WITH PLAIN SCREWED CAP.

SCREWED CONNECTIONS (MNPT INLET x FNPT OUTLET)						
TYPE NO	ORIFICE	VALVE SIZE INLET x OUTLET	A	B	C	APPROX. WGT. LBS.
			ALL CAP CONSTRUCTION			
2740UL	.06	1/2 x 1	10-3/4	1-3/4	3-9/16	7-1/2
		3/4 x 1	10-3/4	1-3/4	3-9/16	7-1/2
		1 x 1	11	1-3/4	3-3/4	7-3/4

2740UL SERIES, SAFETY-RELIEF VALVE, SERIAL KC SCREWED CONNECTIONS

**TELEDYNE FARRIS ENGINEERING**

PALISADES PARK, NEW JERSEY

DRAWING NO. 23338-F, REV. C

CUSTOMER GLITSCH PACKAGE PLTS

PURCHASE ORDER NO. 19385

FACTORY ORDER NO. C309870

# 2740UL SERIES, KC SERIALS

STANDARD MATERIAL FOR CORROSIVE SERVICE, HASTELLOY C, MONEL & 316 ST. ST.

CAP CON- STRUCTION	ITEM NO.				PART NAME	HASTELLOY C		MONEL		316 ST. ST.	
	SCREWED	SOCKET WELD	WELDING NIPPLES	FLANGED		H2	H4	M2	M4	S4 NOTE 2	
PLAIN SCREWED CAP	1	1	1	1	BODY	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	2	2	2	2	BONNET	---	HASTELLOY C	---	MONEL	SA-351 GR. CFBM ST. ST.	
	3	3	3	3	DISC	HASTELLOY C	HASTELLOY C	MONEL	MONEL	ASTMA479 TYPE 316 ST. ST.	
	4	4	4	4	GUIDE	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	5	5	5	5	CAP, PLAIN SCREWED	---	HASTELLOY C	---	MONEL	ASTMA479 TYPE 316 ST. ST.	
	6	6	6	6	STEM	---	HASTELLOY C	---	MONEL	---	
	7	7	7	7	SPRING ADJUSTING SCREW	---	HASTELLOY C	---	MONEL	ASTMA479 TYPE 316 ST. ST.	
	8	8	8	8	SPRING BUTTON	---	HASTELLOY C	---	MONEL	ASTMA479 TYPE 316 ST. ST.	
	9	9	9	9	JAM NUT	---	HASTELLOY C	---	MONEL	ASTMA479 TYPE 316 ST. ST.	
	10	10	10	10	BODY GASKET	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	11	11	11	11	CAP GASKET	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	12	12	12	12	DISC HOLDER	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	13	13	13	13	DISC RETAINING RING	---	---	---	---	---	
	14	14	14	14	COMBINATION RING	---	HASTELLOY C	---	MONEL	---	
	15	15	15	15	SPLIT RING	---	HASTELLOY C	---	MONEL	---	
	16	16	16	16	LIFT STOP RING	---	---	---	---	---	
	17	17	17	17	PIPE PLUG	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.	
	18	18	18	18	WIRE SEAL	---	---	---	---	---	
	19	19	19	19	SPRING	2740UL	---	HASTELLOY C	---	INCONEL	AISI 316 ST. ST.
	19	19	19	19		2740ULT	---	HI-TEMP ALLOY, NPLT	---	INCONEL X	HI-TEMP ALLOY, NICKEL PLT.
	-	-	20	-	WELDING NIPPLE (INLET)	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
	-	-	21	-	WELDING NIPPLE (OUTLET)	---	HASTELLOY C	---	MONEL	SA-312 GR. TP, 316 ST. ST.	
	-	-	20	-	LAP JOINT STUB END (INLET)	HASTELLOY C	HASTELLOY C	MONEL	MONEL	---	
-	-	21	-	LAP JOINT STUB END (OUTLET)	---	HASTELLOY C	---	MONEL	SA-403, GR. WP 316 ST. ST.		
-	-	22	-	LAP JOINT FLANGE (INLET)	---	HASTELLOY C	---	MONEL	SA-182, GR. F 316 ST. ST.		
-	-	23	-	LAP JOINT FLANGE (OUTLET)	---	HASTELLOY C	---	MONEL	SA-182, GR. F 316 ST. ST.		

FARRIS; IT#5 ME TAG; RV-100

OPEN LEVER CAP	1	TEST LEVER	---	---	---	---	---
	2	CAP, O. L.	---	---	---	---	---
	3	STEM TEST WASHER	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	4	STEM JAM NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	5	BUTTON HEAD RIVET	---	---	---	---	---
	6	SET SCREW	---	---	---	---	---

PACKED LEVER CAP	7	TEST LEVER	---	---	---	---	---
	8	CAP, PACKED	---	HASTELLOY C	---	MONEL	ASTMA479 TYPE 316 ST. ST.
	9	STEM TEST WASHER	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	10	STEM JAM NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	11	CAM	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	12	GLAND	---	---	MONEL	---	AISI 316 ST. ST.
	13	GLAND NUT	---	HASTELLOY C	---	MONEL	AISI 316 ST. ST.
	14	PACKING RING	---	---	---	---	---
	15	GLAND NUT GASKET	---	---	TEFLON COATED CERAMIC FIBER	---	TEFLON COATED CERAMIC FIBER
16	GROOV - PIN	---	---	---	---	TEFLON COATED CERAMIC FIBER	

**NOTES:**

1. ANY PART DENOTED WITH A DASH IS STANDARD MATERIAL.
2. ALSO SUITABLE FOR CRYOGENIC SERVICE.

2740UL, SERIALS KC; STANDARD MATERIALS FOR  
H2, H4, M2, M4 & S4  
**TELEDYNE FARRIS ENGINEERING**  
PALISADES PARK, NEW JERSEY  
DRAWING NO. 23634-F, REV. B SHEET 1 OF 2

CUSTOMER GLITSCH PACKAGE PLTS  
PURCHASE ORDER NO. 19385  
FACTORY ORDER NO. C309870

QUALITY CONTROL CERTIFICATION

CUSTOMER: GLITSCH, INC. / PO BOX 3100

PO: 19385

ORDER: C309870

DESC: MBN STANDARD S2

VALVE NO: 926EA21-140S2

LINE ITEM 3 OF 5

QUANTITY: 2

S/N 207219-A10

SET PR 150 PSIG  
CDTP 155 PSIG

BP 0 PSIG  
DTP 150 PSIG  
TEMP 500° F

SERVICE: STEAM-SECT 8

VALVE TEST DATA:

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207219-1-A10 Tag No. RV-059

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 150 PSIG Reseat Pressure 140 PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring 8

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 \_\_\_\_\_ B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

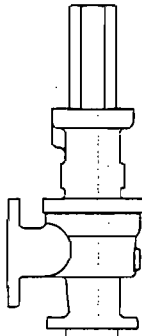
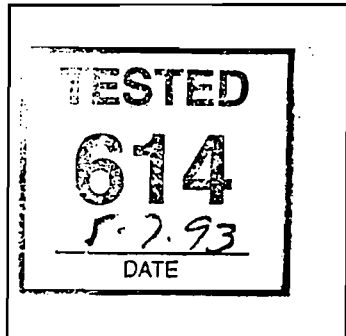
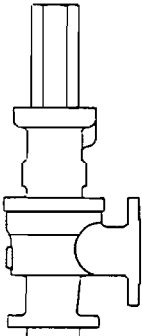
Leak Test Pressure 135 PSIG; Required at 90%  95%  of set pressure;  
But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test 30 PSIG Inlet Test N/A PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
Quality Control Dept.

Date: 5/12/93

TELEDYNE FARRIS ENGINEERING  
QUALITY CONTROL CERTIFICATION

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100

PO: 19385

ORDER: C309870

DESC: MBN STANDARD S2

VALVE NO: 926EA21-140S2

LINE ITEM 3 OF 5

QUANTITY: 2

S/N 207219-A10

SET PR 150 PSIG  
CDTP 155 PSIG

BP 0 PSIG  
DTP 150 PSIG  
TEMP 500° F

SERVICE: STEAM-SECT 8

VALVE TEST DATA:

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207219-2-A10 Tag No. RV-052

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 150 PSIG Reseat Pressure 140 PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring J

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 \_\_\_\_\_ B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

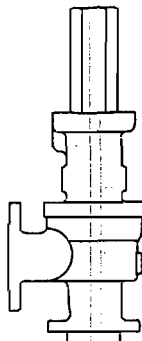
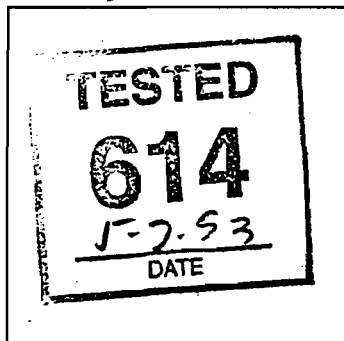
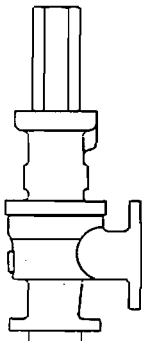
Leak Test Pressure 135 PSIG; Required at 90%  95%  of set pressure;  
But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test 30 PSIG Inlet Test N/A PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
Quality Control Dept.

Date: 5/12/93

**ELEDYNE FARRIS ENGINEERING**  
**QUALITY CONTROL CERTIFICATION**

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100

PO: 19385

ORDER: C309870

DESC: 2740UL/S4 3/4 X 1 .06

VALVE NO: 9KCC03-M20S4

LINE ITEM 5 OF 5

QUANTITY: 1

S/N 207221-KC

SET PR 150 PSIG  
CDTP 150 PSIG

BP 0 PSIG  
DTP 150 PSIG  
TEMP F

SERVICE: LIQUID

**VALVE TEST DATA:**

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207221-KC Tag No. BV-100

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 150 PSIG Reseat Pressure \_\_\_\_\_ PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring \_\_\_\_\_

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 \_\_\_\_\_ B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

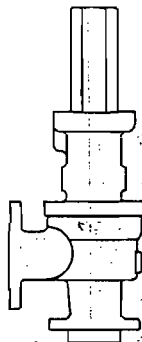
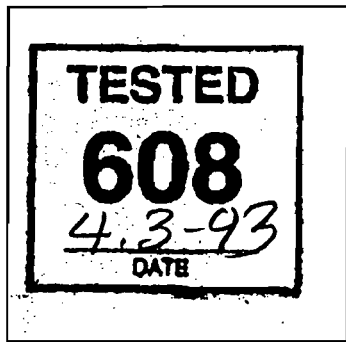
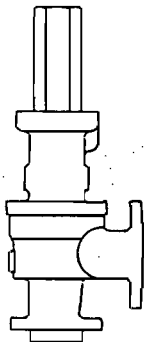
Leak Test Pressure 135 PSIG; Required at 90%  95%  of set pressure;  
But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test N/A PSIG Inlet Test N/A PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
Quality Control Dept.

Date: 4/6/93

**TELEDYNE FARRIS ENGINEERING**  
**QUALITY CONTROL CERTIFICATION**

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100

PO: 19385

ORDER: C309870

DESC: 26DC10-120/S1 1 D 2

VALVE NO: 926DC10-120S1

LINE ITEM 2 OF 5

QUANTITY: 1

S/N 207218-A10

SET PR 150 PSIG  
 CDTP 153 PSIG

BP 0 PSIG  
 DTP 150 PSIG  
 TEMP 300 F

SERVICE: VAPOR

**VALVE TEST DATA:**

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207218-A10 Tag No. RV-139

Performance Test

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 153 PSIG Reseat Pressure \_\_\_\_\_ PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring 2

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 0 B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

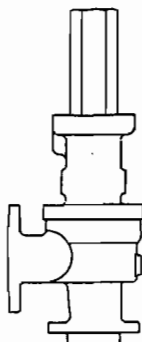
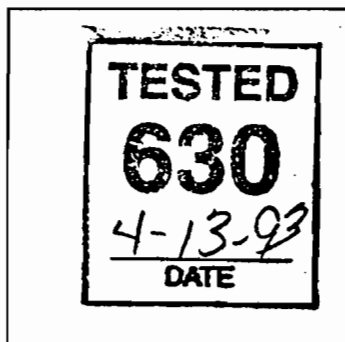
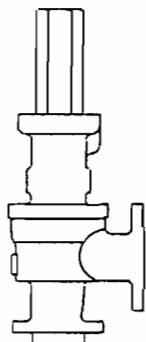
Leak Test Pressure 145 PSIG; Required at 90%  95%  of set pressure;  
 But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test 30 PSIG Inlet Test EXEMPT PER ASME CODE PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
 Quality Control Dept.

Date: 4/14/93

TELEDYNE FARRIS ENGINEERING  
QUALITY CONTROL CERTIFICATION

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100

PO: 19385

ORDER: C309870

DESC: 26JC10-120/S1 2 J 3

VALVE NO: 926JC10-120S1

LINE ITEM 1 OF 5

QUANTITY: 1

S/N 207217-A10

SET PR 25 PSIG  
CDTP 25 PSIG

BP 0 PSIG  
DTP 25 PSIG  
TEMP 300 F

SERVICE: VAPOR

VALVE TEST DATA:

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207217-A10 Tag No. BK-006

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 25 PSIG Reseat Pressure \_\_\_\_\_ PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring ✓

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 0 B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

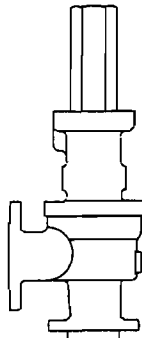
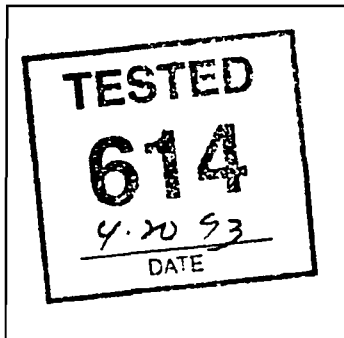
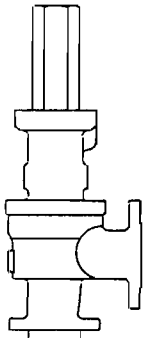
Leak Test Pressure 20 PSIG; Required at 90%  95%  of set pressure;  
But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test 30 PSIG Inlet Test 428 PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
Quality Control Dept.

Date: 4/21/93



**TELEDYNE FARRIS ENGINEERING**  
**QUALITY CONTROL CERTIFICATION**

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100	PO: 19385
ORDER: C309870	DESC: F2740UL/S4 3/4 X 1 .06
VALVE NO: 9KCC030-120S4	LINE ITEM 4 OF 5
QUANTITY: 2	S/N 207220-KC
SET PR 125 PSIG	BP 0 PSIG
CDTP 125 PSIG	DTP 125 PSIG
	TEMP 75' F
SERVICE: LIQUID	

**VALVE TEST DATA:**

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207220-1-KC Tag No. BV-025

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 125 PSIG Reseat Pressure \_\_\_\_\_ PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring \_\_\_\_\_

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 \_\_\_\_\_ B.P.M.  
 Water: Less than 10cc/hr/inch of inlet size.  
 Steam: No audible or visible leakage.

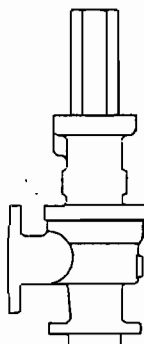
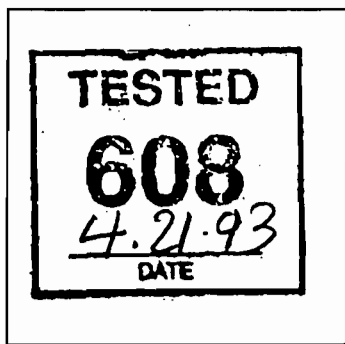
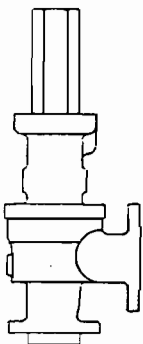
Leak Test Pressure 112 PSIG; Required at 90%  95%  of set pressure;  
 But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test EXEMPT PER ASME CODE \_\_\_\_\_ PSIG Inlet Test EXEMPT PER ASME CODE \_\_\_\_\_ PSIG

Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: *[Signature]*  
 Quality Control Dept.

Date: 4/27/93

**TELEDYNE FARRIS ENGINEERING**  
**QUALITY CONTROL CERTIFICATION**

ES-684

CUSTOMER: GLITSCH, INC. / PO BOX 3100	PO: 19385
ORDER: C309870	DESC: F2740UL/S4 3/4 X 1 .06
VALVE NO: 9KCC030-120S4	LINE ITEM 4 OF 5
QUANTITY: 2	S/N 207220-KC
SET PR 125 PSIG	BP 0 PSIG
CDTP 125 PSIG	DTP 125 PSIG
	TEMP 75 F
SERVICE: LIQUID	

**VALVE TEST DATA:**

Individual Valve Data: (Applicable where quantity is greater than one per line item)

Serial No. 207220-2-KC Tag No. BV-076

Performance Test:

Test Fluid: Air  Nitrogen  Water  Steam  Other

Warning Pressure \_\_\_\_\_ PSIG Pop Pressure 125 PSIG Reseat Pressure \_\_\_\_\_ PSIG

Final Ring Settings, Notches: Upper Ring \_\_\_\_\_ Lower Ring \_\_\_\_\_

Seat Leakage Test:

Test Fluid:  Air, Nitrogen: PER MES-666 & ANSI/API 527 \_\_\_\_\_ B.P.M.

Water: Less than 10cc/hr/inch of inlet size.

Steam: No audible or visible leakage.

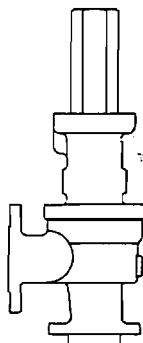
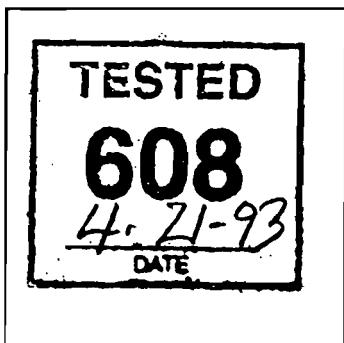
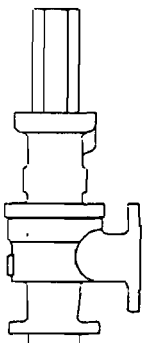
Leak Test Pressure 112 PSIG; Required at 90%  95%  of set pressure;  
 But not less than 5 PSI Differential

Hydrostatic Test:

Test Fluid: Air  Nitrogen  Water  Other

Outlet Test EXEMPT PER ASME CODE PSIG Inlet Test EXEMPT PER ASME CODE PSIG

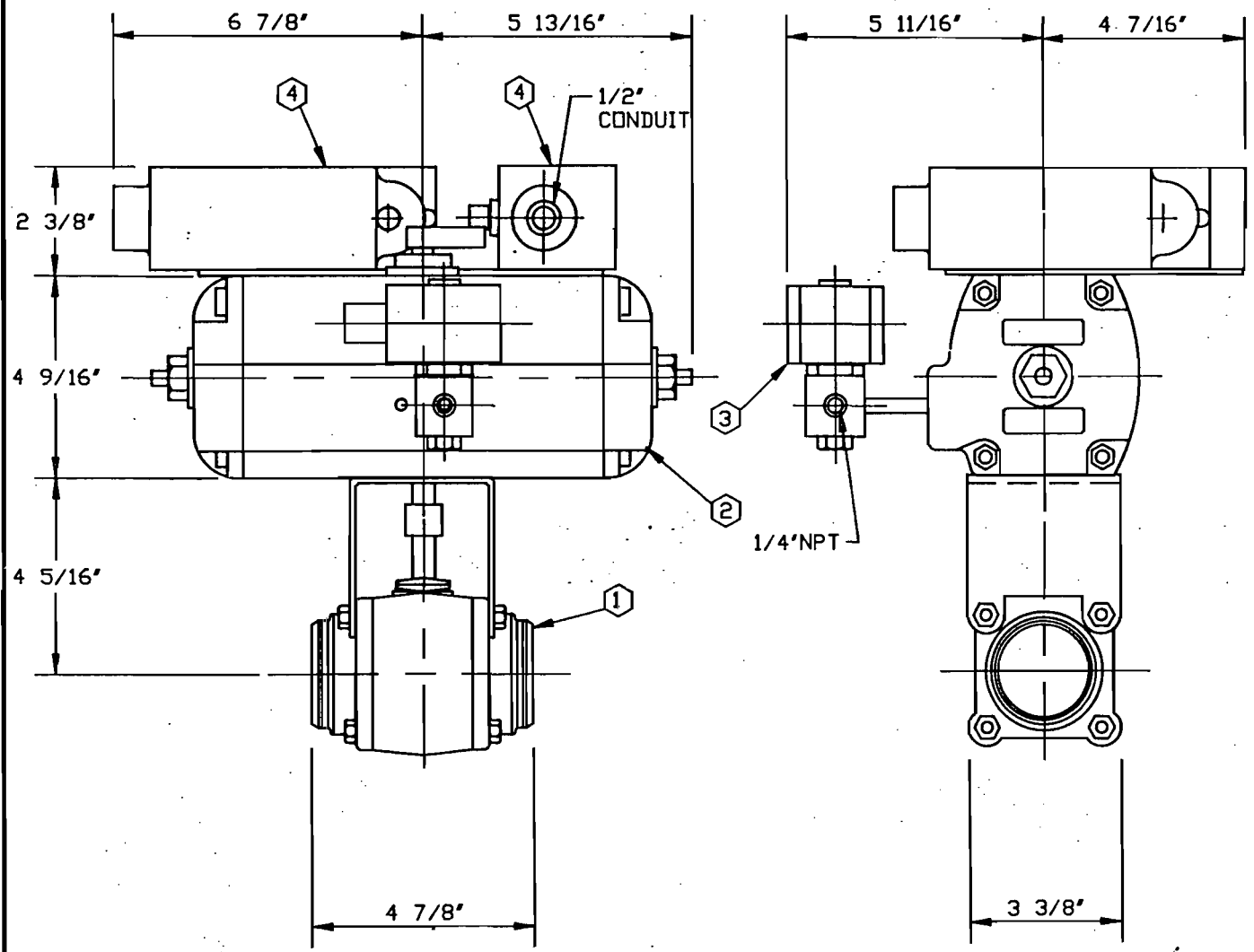
Inlet Test: The primary pressure parts, of the above referenced valve, have been hydrostatically tested in accordance with applicable ASME Code requirements; (PG 73.4.1 AND UG 136)



Approved: [Signature]  
 Quality Control Dept.

Date: 4/27/93

DATE	SYM	REVISION RECORD	APP'D	CHK




TAG NO. ICCF-ABV-1001, ICCF-ABV-2001, ICCF-ABV-3001

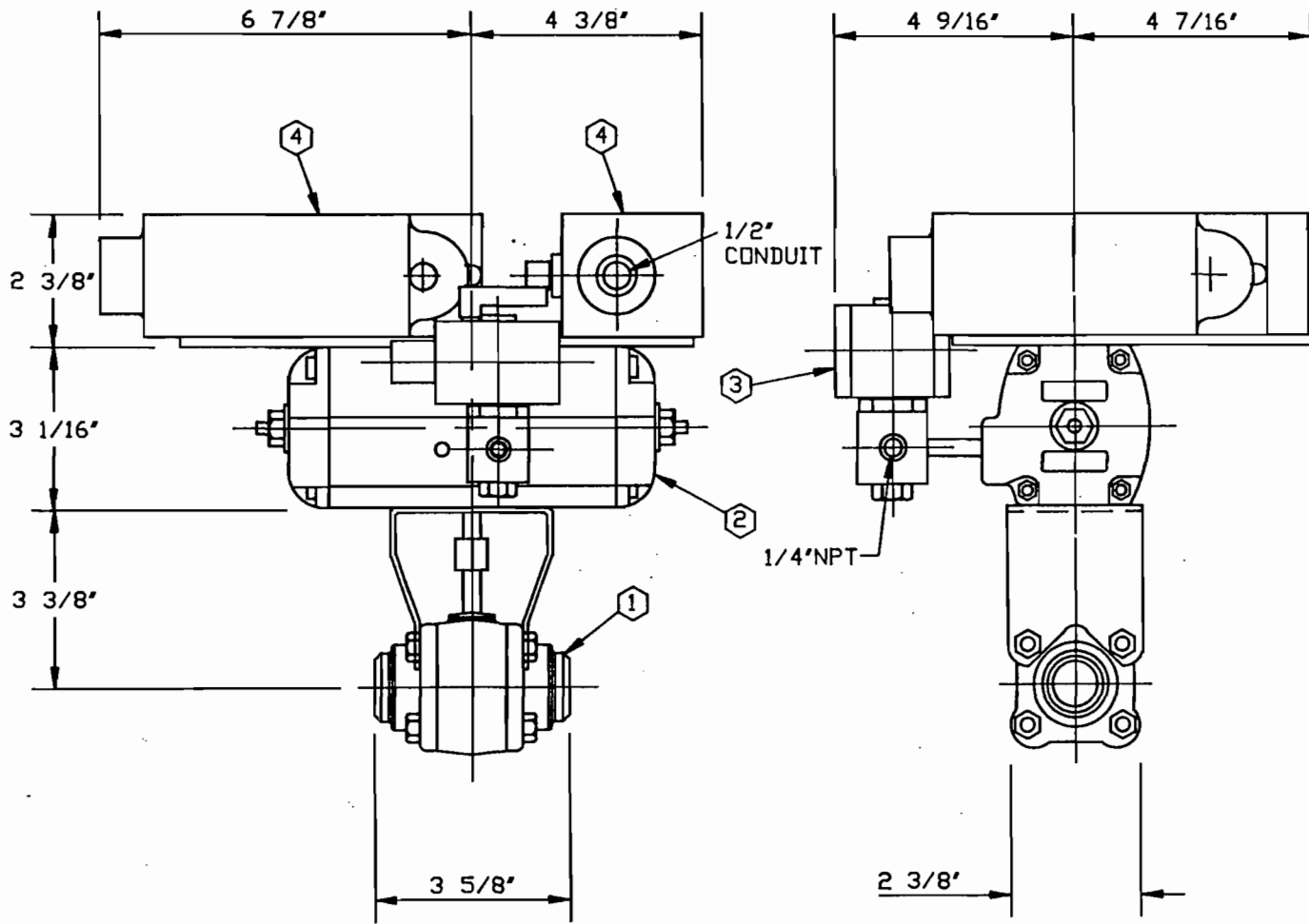
FAIL CLOSED

①	VALVE; WORCESTER 2" 466RTBW1
②	ACTUATOR; AUTOMAX S100SR8
③	SOLENOID VALVE; ASCO EF8320G202
④	LIMIT SWITCH; NAMCO EA700
⑤	
⑥	
⑦	

P.D # 19379

	<b>CONTROLS</b> ENGINEERED SYSTEMS GROUP PAWTUCKET, RHODE ISLAND		
	<b>GLITSCH</b>		
P.D. NO.			
SCALE	NONE	DRAWN BY	C.E.G.
TITLE	SEE ABOVE		
DATE	4/1/93	DRAWING NUMBER	6881-02
REV. NO.			0

DATE	SYM	REVISION RECORD	AUTH	DR	CK



TAG NO. 1CCF-ABV-1009, 1CCF-ABV-2009, 1CCF-ABV-3009

FAIL OPEN

- ① VALVE: WORCESTER 1" 466RTBW1
- ② ACTUATOR: AUTOMAX S63SR8
- ③ SOLENOID VALVE: ASCO EF8320G202
- ④ LIMIT SWITCH: NAMCO EA700

P.O # 19379

## CONTROLS

ENGINEERED SYSTEMS GROUP  
PAWTUCKET, RHODE ISLAND

---

P.O. NO. GLITSCH

---

SCALE NONE      DRAWN BY C.E.G.  
APPROVED BY

---

TITLE SEE ABOVE

---

DATE 4/1/93      DRAWING NUMBER 6881-01      REV. NO. 0

# Installation Operation & Maintenance Instructions

MISER BALL VALVES		
1/4" - 2"	4	
1/4" - 1-1/2"	59	
1/4" - 2"	F4	

## A. INSTALLATION:

1. Standard Miser valves may be installed for flow or vacuum in either direction. Use care to exclude pipe sealants from the valve cavity.
2. For weld, braze or solder valves. (TE, SW, BW, SWO).

- a. Tack weld valve in place.
- b. Remove 3 body bolts, loosen fourth, swing out body, with valve open. Note: F4 valves should not be swung out. Remove fourth bolt and spread pipe ends to clear centering ring. Close valve, remove ball, seats, body seals.

Return body to its original position and temporarily secure it with two body bolts diagonally opposite each other.

- c. Weld valve in, (when gas welding or brazing do not play flame on valve body).
- d. Allow valve to cool, reassemble valve.
- e. Tighten body bolts as follows:

### Carbon Steel Bolts

<u>Bolt Dia</u>	<u>In.-Lbs.</u>	<u>Ft.-Lbs.</u>
1/4"	96-120	8-10
5/16"	156-204	13-17
3/8"	216-264	18-22
7/16"	420-480	35-40

### Stainless Steel Bolts

1/4"	72-94	6-8
5/16"	120-144	10-12
3/8"	192-216	16-18

## 3. CAUTION:

The Teflon body seals (and the Teflon-coated stainless steel "S" gaskets used in the 1/4"-2" Miser Fire Valves) make an excellent seal. However, some points of caution in their use need emphasizing.

- a. No Teflon part (except a seat) is reusable. Upon disassembly of the valve, they should be discarded and replaced with new parts.
- b. Care must be taken to avoid scratching the Teflon or the coating of the "S" gasket during installation.
- c. The body bolts of the valve should be tightened evenly. Tighten one bolt snugly, then the one diagonally across. Repeat for other bolts, bringing them all down tight in sequence.



A BTR Company

33 LOCKE DRIVE, PO BOX 538  
MARLBOROUGH, MA 01752-9906

GLITSCH PACKAGE PLANTS  
P.O. #19379  
TAG #15: 1" - 1CCF-ABV-1009, 2009+  
3009  
2" - 1CCF-ABV-1001, 2001 + 3001

B. OPERATION:

1. The operation consists of turning the handle a quarter-turn clockwise to close and a quarter-turn counter-clockwise to open. When the handle is in line with the pipe, the valve is open.
2. These valves will provide bubble-tight shut-off when used in accordance with Worcester's published pressure/temperature chart.
3. It is not good practice to leave a ball valve partly open without knowledge of the pressure drop and flow at that position.
4. As shipped from the factory, valves contain a silicone-based lubricant. This is for break-in, and may be removed if it is objectionable for a particular application by disassembling and solvent washing.
5. Media which can solidify, crystallize or polymerize should not be allowed to stand in ball valve cavities.
6. Torque Requirements: Torque ratings are subject to variations depending on the length of time between cycles and the media in the system. All figures in the following table are based on laboratory tests with water as the media. They are measured at WOG rated pressure, 70 degrees F, with clean tap water, after 24 hours. Breakaway torque is that force which must be exerted to cause the ball to begin to open.

<u>VALVE SIZE - 4 SERIES</u>	<u>NORMAL BREAKAWAY TORQUE</u>
1/4", 3/8", 1/2"	30 inch pounds
3/4"	45 inch pounds
1"	100 inch pounds
1-1/4"	200 inch pounds
1-1/2"	300 inch pounds
2"	400 inch pounds

C. MAINTENANCE:

Tighten retaining nut (Item C, exploded view), if seepage is noted at stem. Caution: For maximum seal life, proper stem adjustment procedure must be followed.

1. Tighten retaining nut until spring washers are flat, the nut will "bottom".
2. Loosen retaining nut 1/6 turn.
3. Tighten handle nut securely to lock retaining nut in place. On automated valve, 2 retaining nuts are used with a lockwasher in between. Hold the bottom nut securely with a wrench while tightening the top nut to lock the 2 nuts in place.

D. REBUILDING:

"WARNING" - BALL VALVES CAN TRAP FLUIDS IN BALL CAVITY WHEN CLOSED

If the valve has been used to control hazardous media, it must be decontaminated before disassembly. It is recommended that the following steps are taken for safe removal and disassembly:

- Relieve the line pressure.
- Place valve in half-open position and flush the line to remove any hazardous material from valve.
- All persons involved in the removal and disassembly of the valve should wear the proper protective clothing such as face shield, gloves, apron, etc.

1. A standard repair kit (Worcester's recommended spares) may be ordered for the Miser, consisting of seats, body seals, two Belleville washers, 1 stem seal, and 1 thrustbearing. Specify the material of seats and body seals, size and R number (revision number) of valves as stamped on the stop plate or on the actuator bracket.

To order: Valve Size RK 44 Material Revision No.

CAUTION: If the seats and seals installed differ from those removed, the valve nameplate or stop must be replaced or remarked to indicate the altered materials and ratings.

2. To replace seats and seals on Miser valves:

- a. Place valve in open position, remove 3 body nuts and bolts, loosen fourth, swing out center section from between pipe ends with valve open. F4 valves require spreading the pipe ends to clear the body to pipe end centering rings.
- b. With valve in closed position, remove old seats, body seals and ball.
- c. Remove handle nut, lockwasher, handle and stop from stem.
- d. Using handle or a wrench to prevent stem from turning, remove retaining nut and Belleville washers from stem. Remove stem through body cavity.
- e. Remove thrustbearing from body or stem. Check and clean all sealing surfaces.
- f. Place thrustbearing on stem and insert through body cavity.
- g. Place stem seal, follower and Belleville washers in position.

Note: For valves having a graphite stem seal. Care must be taken when installing the graphite stem seal because the parts are easily damaged by squeezing the O.D. of the seals. Handle gently by holding seals on flat surfaces rather than on the O.D. If resistance is encountered when installing seal over the stem, use follower to gently push the stem seal down.

Place retaining nut on stem and using handle to prevent rotation, tighten retaining nut to make snug and firm. Excessive tightening causes higher torque and shorter seal life. Follow Section C - Maintenance - for proper stem adjustment.

- h. Replace stop, handle, lockwasher and handle nut on stem. With stem in closed position, replace ball and seats. With valve in open position, carefully insert body seals and place center section between pipe ends. For F4 valves insert centering rings into pipe ends before installing center section of valve. For valves with metal "S" gasket install with wide flange facing body. (See view A-A.)

Replace body bolts and nuts and tighten per figures in Section A.

The body bolts of the valve should be tightened evenly. Tighten one bolt snugly, then tighten the one diagonally across; repeat for the other bolts, bringing all bolts down tight in sequence.

CAUTION: Do not scratch body seals when replacing valve body.

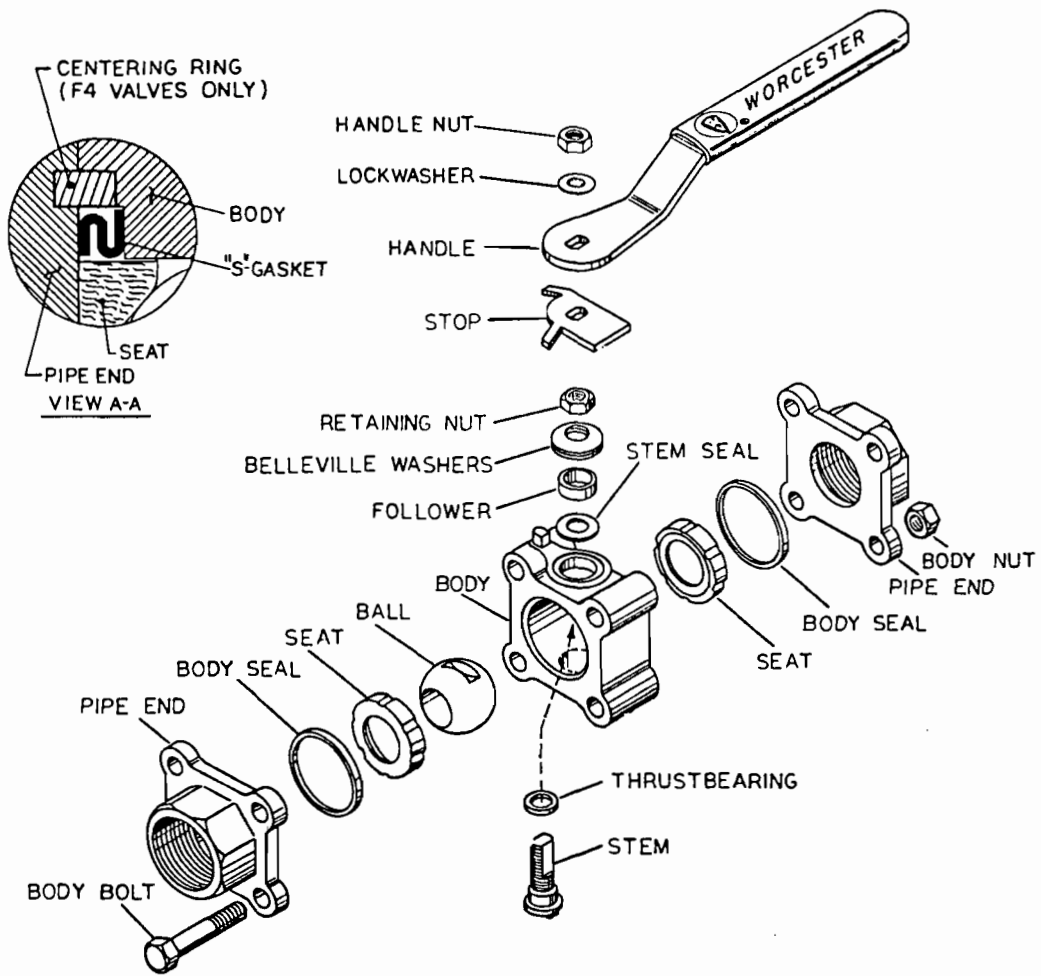
When ordering parts, please provide the following information:

1. Valve Size, Style and Revision Number -  
e.g., 1/2" - 466T SE R-11.
2. Valve Size and Five-Character Code, known as a "P-number", the designation for a non-standard product:  
e.g., 1/2" P-2577 R-5

These are on the valve stop.

The terminology shown in the Parts List is standard. The desired material and valve size and style must be specified when ordering these parts:

e.g., 1/2" 44 Ball 316 S.S.







11444 Deerfield Rd.  
Cincinnati, Ohio 45242  
(513) 489-7800  
FAX (513) 489-5243

# SuperNova S-Series

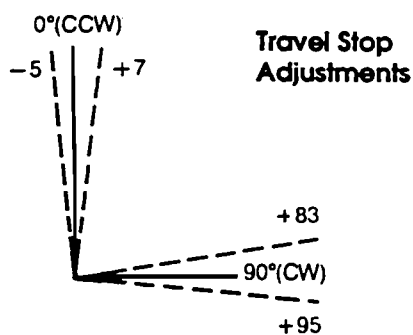
## Installation, Operating & Maintenance Instructions

All actuators are factory lubricated for life, but still should be protected from the elements and stored indoors until ready for use. The ports of the actuator are plugged as supplied from the factory. If actuators are stored for a long period of time prior to installation, the units should be stroked periodically to prevent the seals from taking a set.

Prior to assembly, check the mounting surfaces, the stem adaptor and the bracket to assure proper fit. Manually open and close the valve to insure freeness of operation. Be sure the valve and Automax actuator rotate in the same direction and are in the same position (i.e. valve open, actuator open). Secure the valve with the stem vertical. Bolt the bracket to the valve and place the stem adaptor on the valve stem. Position the actuator over the valve and lower to engage the stem adaptor to the actuator shaft. Continue to lower until the actuator seats on the bracket mounting surface. In order to align the bolt holes, it may be necessary to turn or stroke the actuator a few degrees and/or adjust the actuators travel stops. Bolt the actuator to the bracket.

After consulting the valve manufacturer's recommendations, adjust the travel stop bolts of the actuator for the proper open and closed valve positions. Pneumatically stroke the actuator several times to assure proper operation with no binding of the stem adaptor. If the actuator is equipped with an UltraSwitch or other accessories, adjust them at this time.

To prolong actuator life use only clean, dry plant air. Lubricated air is not required, however it is recommended particularly for high cycle applications. Do not use lubricated air with positioners.



Actuator	Endcap Screw Socket Size	Adjustment Bolt Socket Size	Spring Color Code
S50	4mm	1/8 inch	white
S63	5mm	5/32 inch	lt. green
S85	6mm	3/16 inch	blue
S100	6mm	7/32 inch	red
S115	6mm	7/32 inch	yellow
S125	8mm	1/4 inch	grey
S150	8mm	5/16 inch	dk. green
S175	10mm	5/16 inch	purple
S200	12mm	5/16 inch	orange

### Travel Stop Adjustments (Patent #4,949,936)

#### Both Directions 5° Overtravel 12° Adjustment Each End

The *SuperNova* Series actuators have unique, patented travel stop adjustments in both the clockwise and counterclockwise directions. The 10° total overtravel provides adjustments from -5° to +7° at the 0° Counterclockwise position and from +83° to +95° at the 90° Clockwise position.

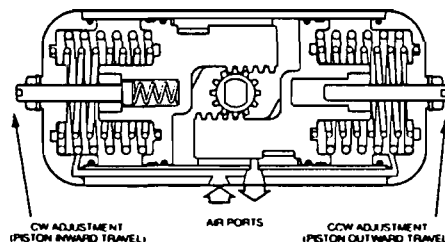
All actuated valving requires accurate travel-stop adjustments at both ends of the stroke to obtain optimum performance and valve seat life. The accumulation of tolerances in the adaption of actuators to valves is such that there must be a range of adjustment for both ends of the stroke to achieve the expected performance.

**Ball and Plug Valves** require precise adjustment at the open (CCW) position to protect the seat from the flow media and the closed (CW) position to assure absolute shut-off.

**Butterfly Valves** require precise adjustment at the closed position to assure full shut-off, to prevent disc overtravel and damage to the seat at the closed position and to assure maximum flow in the open position.

**Tandem Valves**, where two valves are operated in tandem through a single solenoid valve (eg. a 3-Way configuration), absolutely require precise adjustment at both ends of the stroke to assure the seating of both valves.

**Stop Adjustments and Locations**  
View the actuator with the Air Ports facing you.



### Adjustment Bolt Location

Actuator Type	Fail Position	Clockwise (CW)	Counterclockwise (CCW)
Double Acting		Left End Cap	Right End Cap
Spring Return	CW	Left End Cap	Right End Cap
Spring Return*	CCW*	Right End Cap	Left End Cap

\*The pistons are rotated 180° for CCW fail position.

GLITSCH PACKAGE PLANTS  
P.O. # 19379

TAG # 55 11-1CCF-ABV-1009, 2007-3009

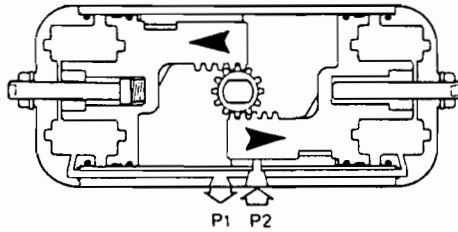
71-1000-0131-1001 2001 & 2001

## Operation

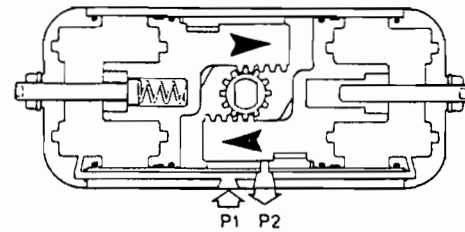
(as viewed from top of actuator)

### Double Acting

Applying air pressure to Port 2 drives the pistons outward, which turns the pinion counterclockwise as the air volume on the outside of the pistons exhausts through Port 1.

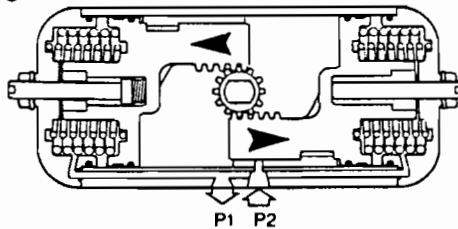


Applying air pressure to Port 1 drives the pistons inward, which turns the pinion clockwise as the air volume on the inside of the pistons exhausts through Port 2.

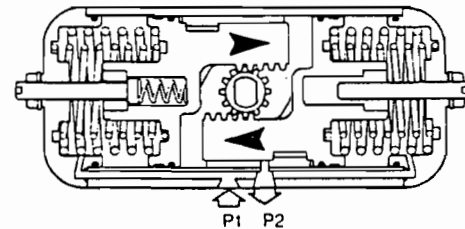


### Spring Return (Fail CW)

Applying air pressure to Port 2 drives the pistons outward, which compresses the springs and turns the pinion counterclockwise as the air volume on the outside of the pistons exhausts through Port 1.

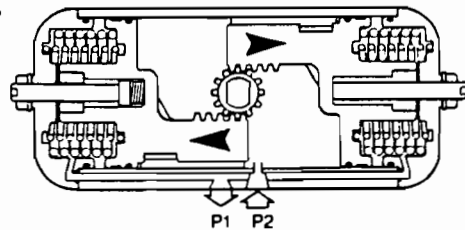


Exhausting the air pressure from Port 2 allows stored energy of the springs to drive pistons inward, turning the pinion clockwise. Air volume on outside of pistons vents through Port 1.

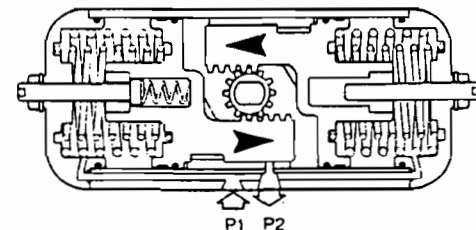


### Spring Return (Fail CCW)

Applying air pressure to Port 2 drives the pistons outward, which compresses the springs and turns the pinion clockwise as the air volume on the outside of the pistons exhausts through Port 1.



Exhausting the air pressure from Port 2 allows stored energy of the springs to drive pistons inward, turning the pinion counterclockwise. Air volume on outside of pistons vents through Port 1.



## Changing Pinion Orientation

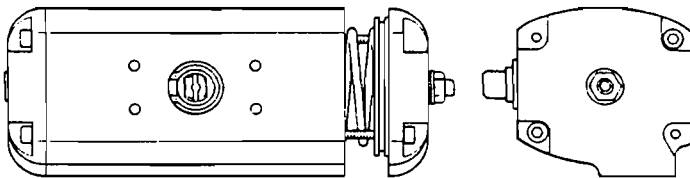
**Note: Steps 4 & 8 are not required for DA actuator.**

1. Disconnect all air and electrical supplies from actuator.
2. Remove all accessories from actuator and dismount actuator from valve.
3. Position actuator with air supply ports facing you.
4. Follow step 6 under disassembly procedure to unload spring pressure from right endcap (18) only.
5. Remove the Pinion Snap Ring (5) and Pinion Washer (4).
6. Tap Pinion (3) lightly with plastic mallet to remove.  
**CAUTION: Failure to follow step 4 will result in permanent damage to SR actuator.**
7. Reverse Steps 5 & 6 with new Pinion (3) orientation.
8. Assemble right endcap (18) in reverse order of disassembly. Grease endcap screw (21) threads with multi-purpose "polymer" fortified grease, such as Dubols Chemical MPG-2, before assembly.

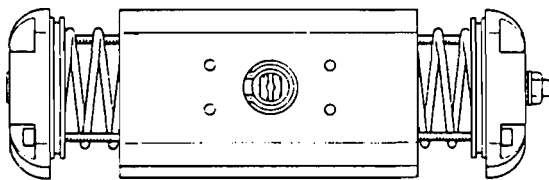
### Maintenance Instructions

#### Disassembly Procedures

1. Disconnect all air and electrical supplies from actuator.
2. Remove all accessories from actuator and dismount actuator from valve.
3. Position actuator with air supply ports facing you. Apply air pressure to Port 2 to release spring pressure from the Stop Bolt (9).
4. Remove the Stop Bolt Retaining Nut (14), Washer (15), and O-ring (16) on the Left Endcap (19) and turn the Stop Bolt (9) clockwise into the Body (1) until it is flush with the Endcap (19).
5. Exhaust air from Port 2, the Stop Bolt (9) should now turn freely. Continue turning Stop Bolt (9) clockwise until it is disengaged from the Endcap.
6. **SR Actuator:**  
**CAUTION: Follow step 4 to relieve force on inward travel stop before proceeding.** To remove SR Endcap, first completely remove two diagonal Endcap Screws (21) from one Endcap. The two remaining Endcap Screws should be removed evenly. As the Screws are removed, the springs will push the Endcap out. Repeat for opposite side. **The springs will be totally unloaded before the screws are completely unthreaded.** Remove the springs (23,24,25.)



Actuator with springs partially disarmed (right side)



Actuator with springs totally disarmed

**DA Actuator:** Remove the 8 Endcap Screws (21). Step 7 will push the Endcaps (18,19) from the Body (1).

7. Rotate Pinion (3) counterclockwise (DA & SR-FCW) or clockwise (DR & SR-FCCW) to drive the Pistons (2) off the end of the rack. Pull the Left Piston (2) from the body (1) by pulling on the Stop Bolt (9).
8. Remove the Right Piston (2) by pushing out through Inside of Body (1).
9. Remove the Pinion Snap Ring (5) and Pinion Washer (4).
10. Tap Pinion (3) lightly with plastic mallet to remove.

#### Reassembly Procedures

1. Inspect all parts for wear and replace any worn parts as needed. Replace all O-rings.
2. Clean all components and lightly grease cylinder bore, pinion and seals with a multi-purpose "polymer" fortified grease such as DuBols Chemicals MPG-2. Lubricate endcap screw (21) threads with similar grease
3. Reverse the disassembly procedures to reassemble.
4. The standard Pinion (3) orientation is with the drive pocket parallel with the Body (1) in the CW position.
5. When fitting the Pistons (2) ensure the teeth engage the Pinion (3) at the same time by measuring in from the edge of the body (1) the same distance from each end. Note: the orientation of the pistons will determine the operation of the actuator. Refer to the diagrams under "Operation" for correct piston position.
6. Test the actuator for smooth operation and air leakage at service pressure before reinstalling.

#### Changing Number of Springs

1. Follow the Disassembly Procedures through step 6.
2. Determine nested spring combination of Inner, middle and outer springs. Consult catalog torque charts, distributor or factory. Insert appropriate springs into cylinder. Springs must be properly seated against piston and endcap to assure that springs do not bind.
3. Re-assemble the actuator.

Spring chart S63-S200

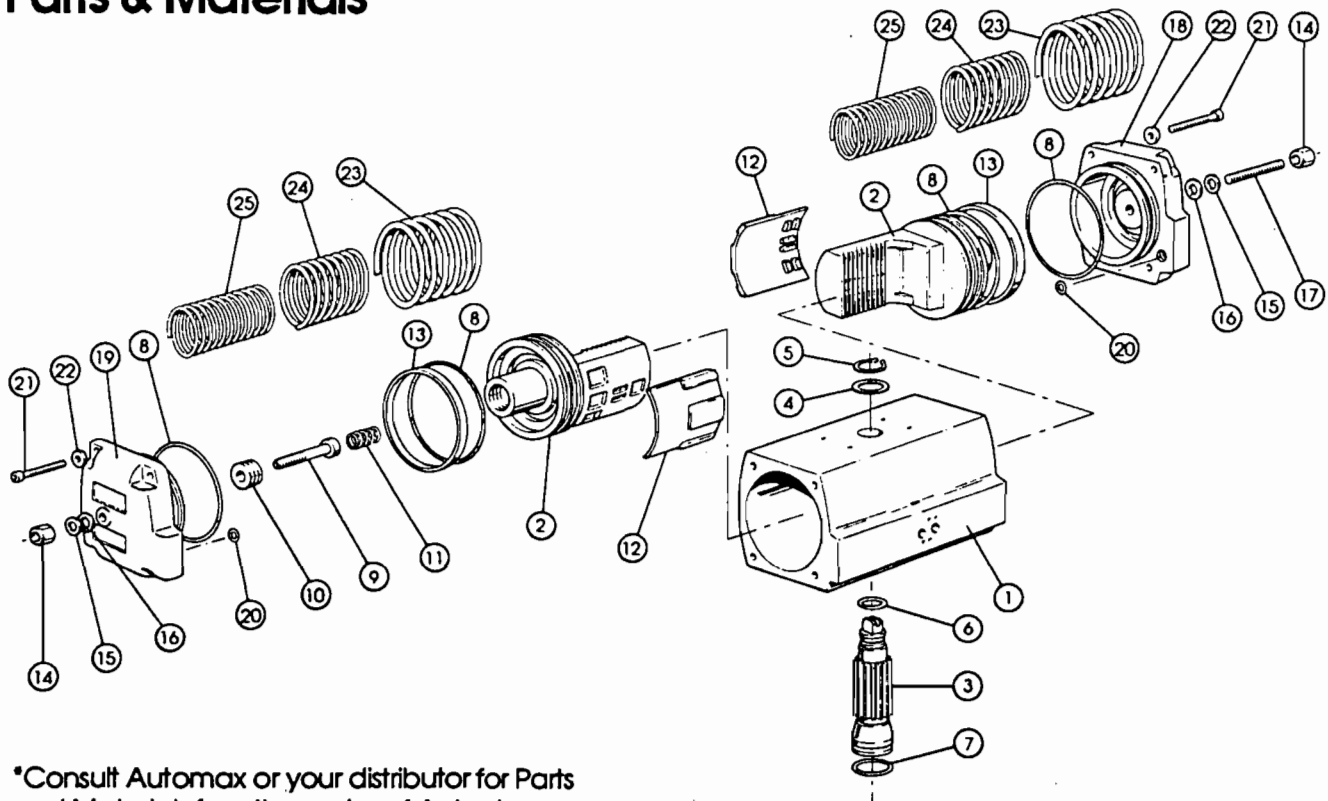
Spring Group	Spring Combination <sup>ⓐ</sup>		
	#1 Spring (inner)	#2 Spring (middle)	#3 Spring (outer)
4		2	
5		1	1
6			2
7		2	1
8		1	2
9	1	1	2
10		2	2
11	1	2	2
12	2	2	2

Spring chart S50<sup>ⓑ</sup>

Spring Group	Spring Combination <sup>ⓐ</sup>		
	#1 Spring (inner)	#2 Spring (outer)	#3 Spring (outer)
4	1	1	
5		2	
6	2	1	
7	1	2	
8	2	2	
9	2		2

**Note** <sup>ⓐ</sup>#1 Spring has one color code dot  
<sup>ⓑ</sup>#2 Spring has two color code dots  
<sup>ⓐ</sup>#3 Spring has three color code dots  
<sup>ⓑ</sup>S50 has maximum of 2 springs per endcap

### Parts & Materials



\*Consult Automax or your distributor for Parts and Materials for other series of Actuators.

Item No.	Part Description	Materials	Quantity	
			DA	SR
1	Body	Hard Anodized Aluminum	1	1
2	Pistons	Die Cast Aluminum	2	2
3	Pinion	Nickel Plated Steel	1	1
4	Pinion Washer $\emptyset$	Nylon	1	1
5	Pinion Snap Ring $\emptyset$	Steel/Plated	1	1
6	Upper Pinion O Ring $\emptyset$	Nitrile Rubber	1	1
7	Lower Pinion O Ring $\emptyset$	Nitrile Rubber	1	1
8	Piston and End Cap O Ring $\emptyset$	Nitrile Rubber	4	4
9	Inward Travel Stop Bolt	Steel/Plated	1	1
10	Inward Travel Retaining Nut	Steel/Plated	1	1
11	Inward Travel Spring	Steel/Plated	1	1
12	Piston Guide	Nylon and Molybdenum Disulfide	2	2
13	Piston Guide Band	Nylon and Molybdenum Disulfide	2	2
14	Stop Bolt Retaining Nut	Stainless Steel	2	2
15	Stop Bolt Washer	Stainless Steel	2	2
16	Stop Bolt O Ring $\emptyset$	Nitrile Rubber	2	2
17	Stop Bolt	Steel/Plated	1	1
18	Right End Cap	Die Cast Aluminum/Electrostatic Poly	1	1
19	Left End Cap	Die Cast Aluminum/Electrostatic Poly	1	1
20	End Cap Supply O Ring $\emptyset$	Nitrile Rubber	2	2
21	End Cap Screw	Stainless Steel	8	8
22	End Cap Screw Washer	Stainless Steel	8	8
23	Outer Spring	Spring Steel Coated	0	2 max. $\emptyset$
24	Middle Spring	Spring Steel Coated	0	2 max. $\emptyset$
25	Inner Spring	Spring Steel Coated	0	2 max. $\emptyset$

### Seal Kits

Buna Seal Kit Number	S (Actuator Model No.) SKB
Viton Seal Kit Number	S (Actuator Model No.) SKV

Seal kits consist of all sealing parts, snap ring and washer.

### Pressure Rating

150 psig maximum

### Temperature Ratings

Standard	Nitrile	-20°F to +175°F
High Temp	Viton	0°F to +300°F
Low Temp	Silicon-based	-55°F to +175°F

Note:  $\emptyset$  Parts included in a Seal Kit  
 $\emptyset$  See Spring chart for required spring combination

# INSTALLATION & MAINTENANCE INSTRUCTIONS

**ASCO**  
BULLETIN  
8320

3-WAY SOLENOID VALVES — NORMALLY OPEN,  
NORMALLY CLOSED, AND UNIVERSAL OPERATION  
1/4" NPT — BRASS AND STAINLESS STEEL CONSTRUCTION

Form No. V5688R2

## DESCRIPTION

Bulletin 8320 valves are small 3-way solenoid valves with all three connections located in the body. Valve bodies are made of brass or stainless steel.

Standard valves have a Type 1, General Purpose Solenoid Enclosure. Valves may also be provided with an explosion-proof solenoid enclosure designed to meet Enclosure Type 3-Raintight, Type 7 (C & D)-Explosion-Proof Class I, Groups C & D and Type 9 (E, F, & G)-Dust Ignition-Proof Class II, Groups E, F, & G, and have a temperature range code of TC3. Installation and maintenance instructions for the explosion-proof solenoid enclosure are on Form No. V5380.

## OPERATION

**Normally Open (Pressure at 3)**

Applies pressure when solenoid is de-energized; exhausts pressure when solenoid is energized. When solenoid is de-energized, flow is from Port "3" to Port "1." Port "2" is closed. When solenoid is energized, flow is from Port "1" to "2." Port "3" is closed.

**Normally Closed (Pressure at 2)**

Applies pressure when solenoid is energized; exhausts pressure when solenoid is de-energized. When solenoid is de-energized, flow is from Port "1" to Port "3." Port "2" is closed. When solenoid is energized, flow is from Port "2" to Port "1." Port "3" is closed.

**Universal (Pressure at 1, 2, or 3)**

For normally closed or normally open operation, selection or diversion of pressure can be applied to Ports "1", "2", or "3."

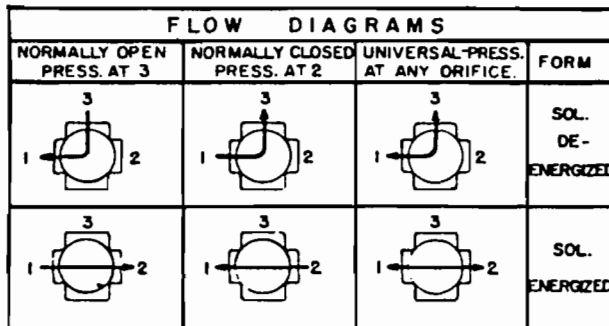
## Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number prefix and watt rating on nameplate to determine the maximum temperatures. See example below chart.

Construction AC or DC	Catalog Number Prefix	Watts	Maximum Ambient Temp. °F	Maximum Fluid Temp. °F
AC	None, DA, or S	10.5	77	200
	DF, FT, or SF	10.5	122	200
	HT	10.5	140	200
DC	None, DP, or SP	16.7*	77	200
	None, FT, or HT	11.2*	77	150

\* Catalog Nos. 8320A 170, 8320A 180, and 8320A 190 are limited to 140 °F fluid temperature.

EXAMPLES: For Catalog No. HT8320A 201, AC construction with a watt rating of 10.5, the maximum ambient temperature is 140°F with a maximum fluid temperature of 200°F. For Catalog No. 8320A 204, AC construction with a watt rating of 10.5, the maximum ambient temperature is 77°F with a maximum fluid temperature of 200°F.



## Manual Operator (Optional)

Manual operator allows manual operation when desired or during an electrical power outage. Two types of manual operators are available - push type (Suffix MO) and screw type (Suffix MS). To operate valve manually with push type operator, push stem at base of valve body as far upward as possible. Valve will now be in the same position as when the solenoid is energized. Removing pressure from stem will release manual operator to original position. To operate valve with a screw type manual operator, rotate manual operator stem at base of valve body clockwise until it hits a stop. Valve will now be in the same position as when the solenoid is energized. Rotate manual operator stem fully counterclockwise before operating valve electrically.

## INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service.

## Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

## Mounting

For mounting dimensions of body boss (brass) or mounting brackets (optional on brass construction), refer to Figures 1, 2, and 3.

## Piping

Connect piping to valve according to markings on valve body. Refer to flow diagrams provided. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

**IMPORTANT:** To protect the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Bulletins 8600, 8601, and 8602 for strainers.

## Wiring

Wiring must comply with local codes and the National Electrical Code. Solenoid housings are provided with a 7/8" diameter hole to accommodate 1/2" conduit. On some constructions, a green grounding wire is provided. Use rigid metallic conduit to ground all enclosures not provided with a green grounding wire. To facilitate wiring, the enclosure may be rotated 360° by removing the retaining cap or clip. **WARNING:** When metal retaining clip disengages, it will spring upward. Rotate enclosure to desired position. Then replace retaining cap or clip before operating.

**NOTE:** Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid, including the solenoid base sub-assembly and core assembly.

ITSCH PACKAGE PLANTS

P.O. # 19379

TAG #S: 1" - 1CCF-ABV-1009, 2009+

3009

2" - 1CCF-ABV-1001, 2001 + 3001

**ASCO Valves**

Automatic Switch Co. 50-60 Hanover Road, Florham Park, New Jersey 07932

## Solenoid Temperature

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched by hand only for an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

## MAINTENANCE

**NOTE:** It is not necessary to remove the valve from the pipeline for repairs. **WARNING:** Turn off electrical power supply and depressurize valve before making repairs.

### Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise, or leakage will indicate that cleaning is required. Clean valve strainer or filter when cleaning the valve.

### Preventive Maintenance

1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While in service, the valve should be operated at least once a month to insure proper opening and closing.
3. Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace worn or damaged parts. However, for best results, replace all parts as supplied with an ASCO Rebuild Kit.

### Causes Of Improper Operation

1. **Faulty Control Circuits:** Check the electrical system by energizing the solenoid. A metallic "click" signifies that the solenoid is operating. Absence of the "click" indicates loss of power supply. Check for loose or blown fuses, open circuited or grounded coil, broken lead wires or splice connections.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coil as necessary. Check supply voltage; it must be the same as specified on nameplate.
3. **Low Voltage:** Check voltage across the coil lead. Voltage must be at least 85% of nameplate rating.
6. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve (see Maintenance) and clean all parts. Replace worn or damaged parts. However, for best results, replace all parts as supplied with an ASCO Rebuild Kit.

### Coil Replacement (Refer to Figures 4 and 5)

**WARNING:** Turn off electrical power supply.

1. Disconnect coil lead wires.
2. Remove retaining cap or clip, nameplate and housing. **WARNING:** When metal retaining clip disengages, it will spring upward.
3. Remove spring washer, insulating washer, coil, insulating washer, ground wire terminal (if present) from solenoid base sub-assembly. Insulating washers are omitted when a molded coil is used.
4. Reassemble in reverse order of disassembly. Use exploded view provided for identification and placement of parts.

**CAUTION:** The solenoid must be fully reassembled because the housing and internal parts complete the magnetic circuit. Be sure to replace insulating washer at each end of the non-molded coil.

### Valve Disassembly (Refer to Figures 4 and 5)

**WARNING:** Depressurize valve and turn off electrical power supply.

1. Disassemble valve in an orderly fashion. Use exploded views for identification and placement of parts.
2. If necessary, disconnect coil lead wires, grounding wire (if present), and rigid conduit from solenoid housing.
3. Remove retaining cap or clip and slip the entire solenoid enclosure off the solenoid base sub-assembly. **WARNING:** When metal retaining clip disengages, it will spring upward.
4. Unscrew solenoid base sub-assembly from valve body.
5. Remove core assembly, core spring, core guide (AC construction only), and solenoid base gasket.
6. Unscrew end cap (or manual operator assembly) and remove end cap gasket, disc holder spring, and disc holder sub-assembly.
7. All parts are now accessible to clean or replace. Replace worn or damaged parts. However, for best results, replace all parts as supplied with an ASCO Rebuild kit.

### Valve Reassembly

1. Reassemble in reverse order of disassembly. Use exploded views for identification and placement of parts.
2. Lubricate all gaskets with DOW CORNING® 111 Compound lubricant or an equivalent high-grade silicone grease. For stainless steel valve constructions, apply a small amount of LOCTITE® PST® pipe sealant (ASCO No. 208-832-11) to male threads of end cap (or manual operator assembly). Pipe sealant supplied in ASCO Rebuild Kits.

3. Replace disc holder sub-assembly, disc holder spring, disc holder gasket, and end cap (or manual operator assembly). For brass construction, torque end cap to  $175 \pm 25$  inch-pounds ( $19.8 \pm 2.8$  newton-meters). For stainless steel, torque end cap to  $90 \pm 10$  inch-pounds ( $10.2 \pm 1.1$  newton-meters).
4. Replace solenoid base gasket, core assembly, core spring, core guide (on AC construction only), and solenoid base sub-assembly. Torque solenoid base sub-assembly to  $175 \pm 25$  inch-pounds ( $19.8 \pm 2.8$  newton-meters).
5. Replace solenoid enclosure and retaining cap or clip.
6. Restore line pressure and electrical power supply to valve.
7. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic "click" signifies the solenoid is operating.

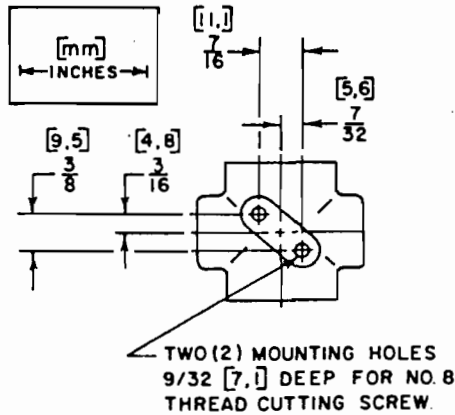


Figure 1. Brass Valve Body Mounting

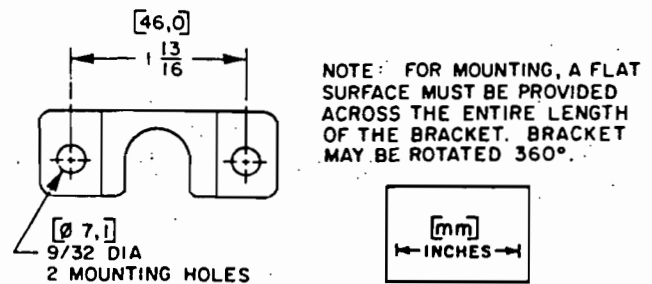


Figure 2. Mounting Bracket for Stainless Steel

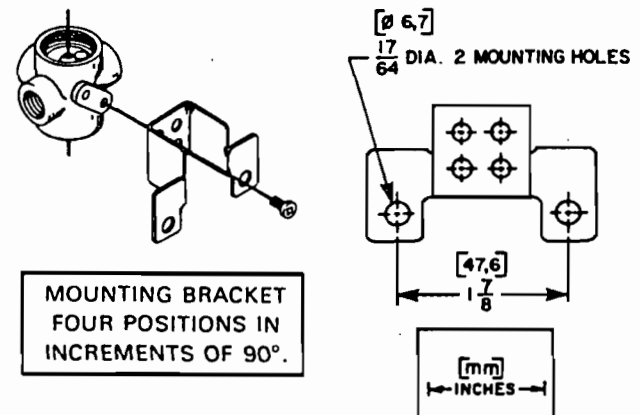


Figure 3. Optional Mounting Bracket for Brass

**ORDERING INFORMATION  
FOR ASCO REBUILD KITS AND COILS**

Parts marked with an asterisk (\*) in the exploded view are supplied in Rebuild Kits.

- When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate.+
  - When Ordering Coils for ASCO valves, order the number stamped on your coil.+
- + If the number of the Rebuild Kit or the Coil is not visible, order them and specify your valve's Catalog Number, Serial Number, Voltage, and Frequency.

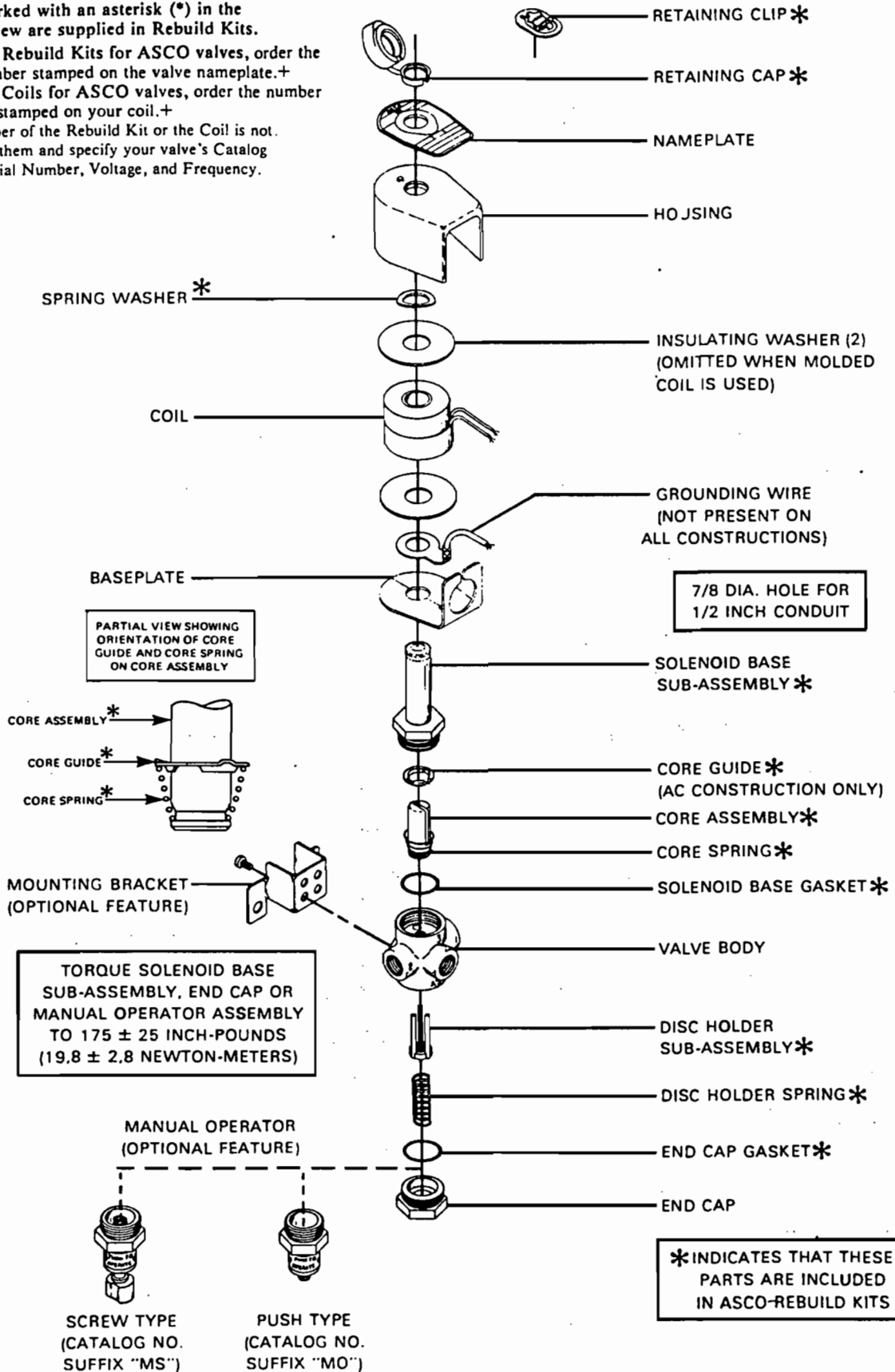


Figure 4. Bulletin 8320, Brass Construction  
With General Purpose Solenoid Enclosure Shown  
For Explosion-Proof Solenoid Enclosure, See Form No.V5380.

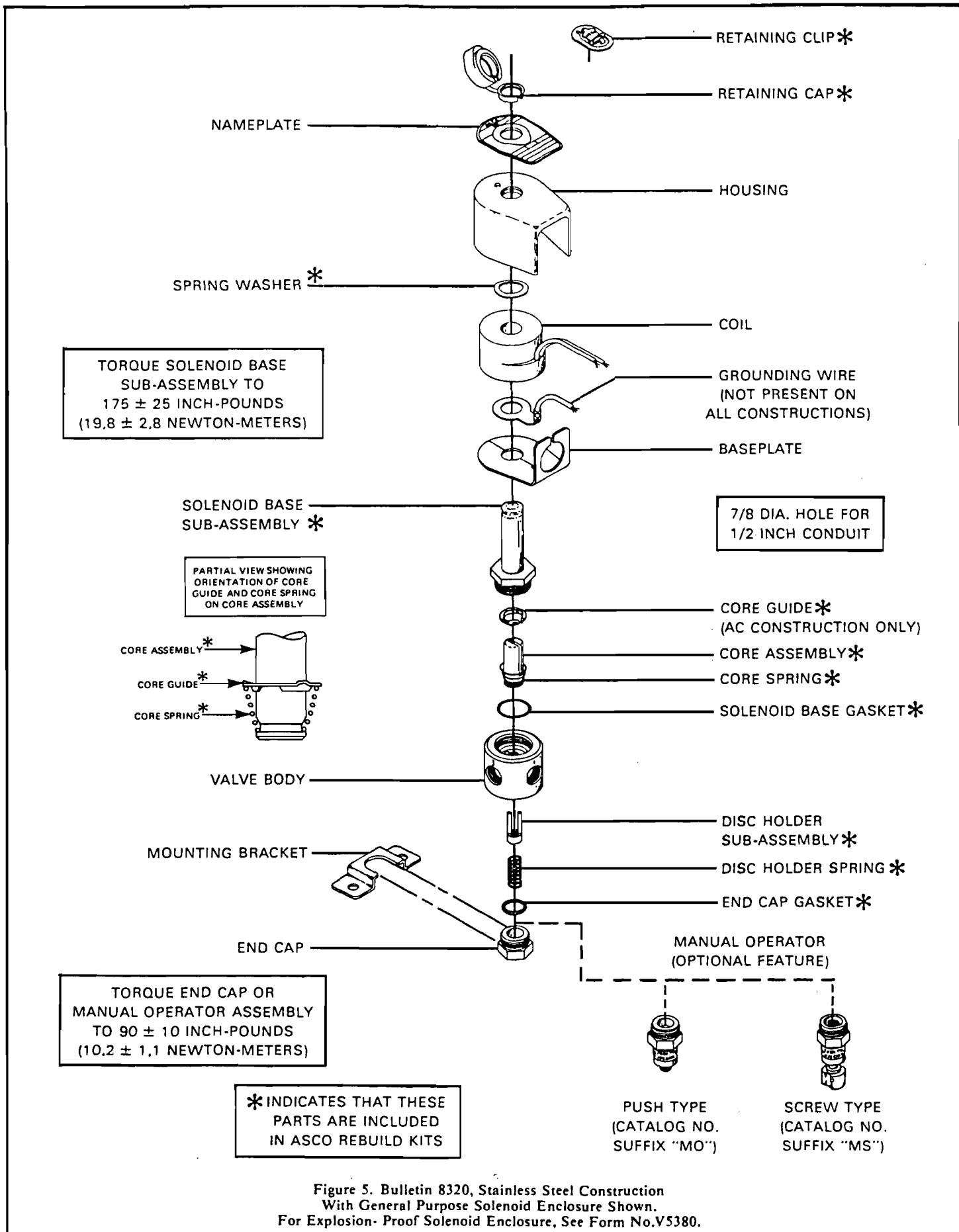


Figure 5. Bulletin 8320, Stainless Steel Construction  
 With General Purpose Solenoid Enclosure Shown.  
 For Explosion-Proof Solenoid Enclosure, See Form No.V5380.



**ASCO Valves**

Automatic Switch Co. 50-60 Hanover Road, Florham Park, New Jersey 07932

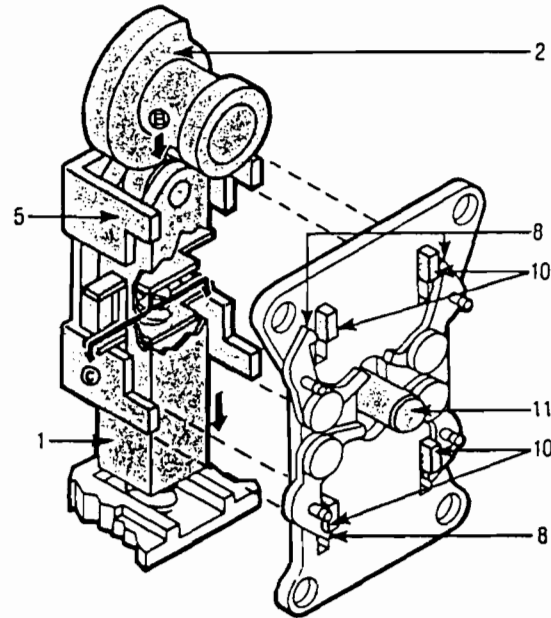
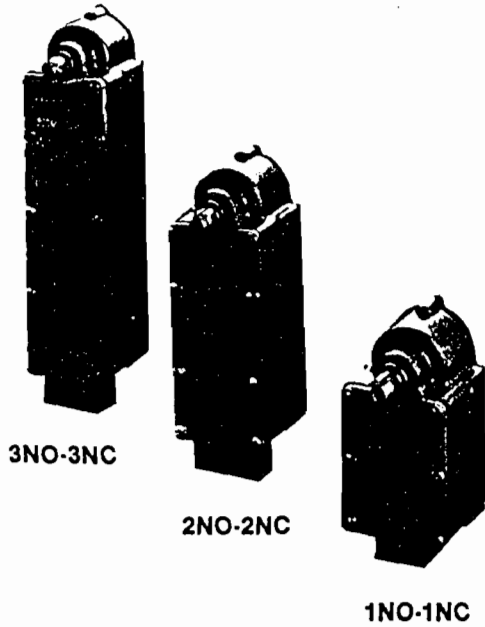
Form No. V5688R2

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Snap-Lock Mechanism



WIDE RANGE OF OPERATION ... MODULAR CONSTRUCTION ... PRACTICAL FLEXIBILITY

In every respect these Snap-Lock Limit Switches are the "ultimate" of the industry. The scope of Models is tailored to meet today's rugged requirements ... there is a Model of size and type to meet virtually all demands.

Besides covering all functional requirements this line is designed to meet practically every condition of installation. These Snap-Lock Switches provide reliable "machine-life" service and have the stamina to operate under unusual conditions ... at the same time giving millions of consistently fast, accurate contacts.

Here are a few of the outstanding features built into the switch for maximum performance.

- Generous overtravel and by-pass.
- Flexibility of motion, clockwise and counter-clockwise.
- Light operating torque.
- Fast contact action.
- Form Z contact arrangement.

OPTIONS AVAILABLE

- Precious metal contacts.
- High temperature (0°C to +150°C) components and lubricants. Aluminum housing.
- Low temperature (-40°C to +90°C) components and lubricants.

Parts Nomenclature

1. Cam Follower	6. Floating Arms	10. Ears, Shuttle
2. Cam	7. Compression Spring	11. Operating Pin
3. Return Spring		12. Movable Contacts
4. Fixed Base	8. Latches	13. Stationary Contacts
5. Shuttle	9. Latch Plate	14. Contact Block
		15. Contact Spring

The Snap-Lock Mechanism is responsible for quickly and positively snapping the contacts open and closed and then locking them in either position. Here's how it works:

As the lever arm is moved the Cam (2) starts to rotate, this causes the cam follower to move in direction B. The Shuttle (5) is locked in place by Latches (8) which are engaged with the lower fingers (10) of the shuttle. This in turn causes the Floating Arm (6) to compress Spring (7) with resultant force in direction C. Operating Pin (11), an integral part of Cam Follower (1), moves downward as the cam continues to rotate; first releasing the upper Latches (8), they remain open and resting against the shuttle fingers, secondly the Operating Pin engages the lower latches. At a predetermined point the latches are forced open and disengage the shuttle fingers. At this point force C goes into action and snaps Shuttle (5) to the down position, contact transfer now takes place.

In most cases these switches are operated by some type of auxiliary lever (1). Namco Controls supplies a series of these, see Product Information Sheets Series EL. Most

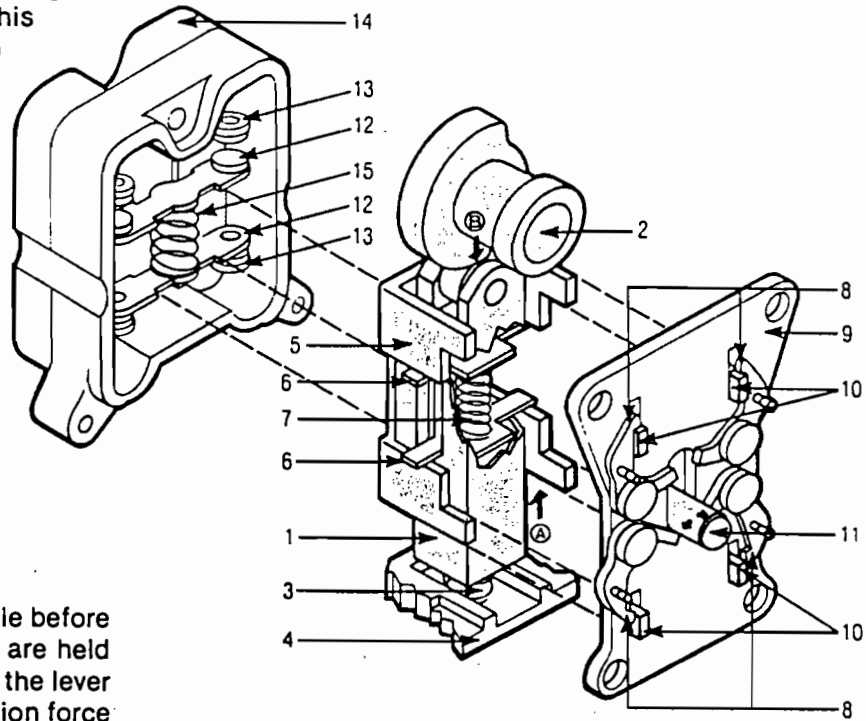
GLITSCH PACKAGE PLANTS  
 P.O. #19379  
 TAG #15: 1" - 1CCF-ABV-1009, 2009+  
 3009  
 2" - 1CCF-ABV-1001, 2001 + 3001

BEST AVAILABLE COPY

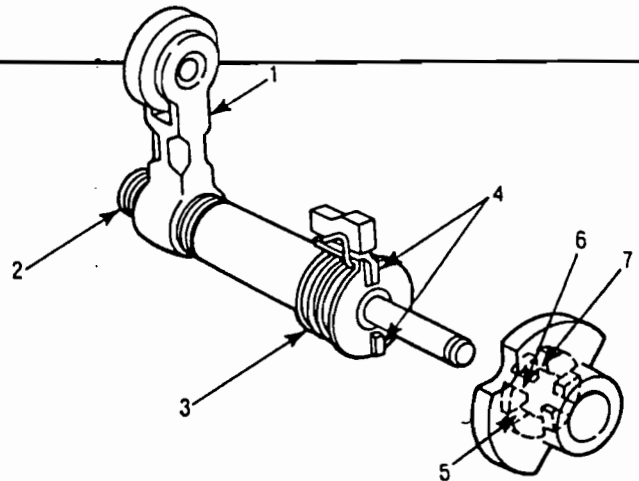
The Cam Follower is at the extreme end of its travel, Return Spring (3) has been compressed with resulting force in direction A. The Cam Follower is held in this position by the cam rise. Shuttle (5) is locked into position by the upper Latches (8)

To put the positive Snap-Lock mechanism into use in our switch, we added a pair of movable contact carriers (12) and two pairs of Stationary Contacts (13). The movable contact carriers are connected to the Shuttle (5) by means of a molded plastic carrier (not shown here for clarity). Thus the movable contact carriers are moved from one set of stationary contacts to the other as the shuttle moves. The movable contact carriers are free to "float" and "self-align" with the Stationary Contacts for positive wiping action. The Stationary Contacts (13) are an integral part of the molded plastic Contact Block (14).

In the sketch the lower contacts are closed a little before the Shuttle (5) reaches the locked position and are held firmly together by the Contact Spring (15). When the lever arm allows the cam to return to its original position force A takes over and the process is simply reversed with the lower contacts being snapped "open" and the upper contacts then snapped "closed" and positively locked.



Namco Controls supplied levers have serrated holes that match the switch operating shafts. The levers are locked in place by simply turning in the screw (2) in the end of the switch operating shaft with an Allen wrench. (3/16") When the switch is operated by a force against the lever, clockwise or counterclockwise return torque is supplied by the self-contained torsion spring (3). This motion is transmitted to the cam by two clutch projections (4) that engage the cam slots (either 5, 6 or 7).



### Specifications

1. Enclosure is water, oil and dust tight.
2. Enclosure meets NEMA Type 1, 4 and 13 requirements.
3. Contacts made of silver alloy. Contact shifting mechanism is locked in position by the latches until switch lever is actuated.
4. Standard Temperature Range: -20°C to +90°C
5. Operating lever is adjustable to any required position.
6. Operating Lever Angles (travel either clockwise or counterclockwise) maximum degrees of trip travel, reset travel, as well as total lever travel, are determined by the cam selected.

7. Operating Torques — Trip Torque varies from 15 to 33 in. lbs. depending on switch size and cam selected.		
8. Underwriters' Laboratories, Inc. Listed. File No. E12967. (Except neutral position module)		
9. Current ratings:		
Voltage		For Neutral Position Only
125V-A.C.	20.0 Amps*	10.0 Amps*
250V-A.C.	15.0 Amps*	7.5 Amps*
480V-A.C.	10.0 Amps*	5.0 Amps*
600V-A.C.	5.0 Amps*	2.5 Amps*
125V-D.C.	5.0 Amps	2.5 Amps
250V-D.C.	1.5 Amps	.75 Amps
*75-100% Power Factor.		

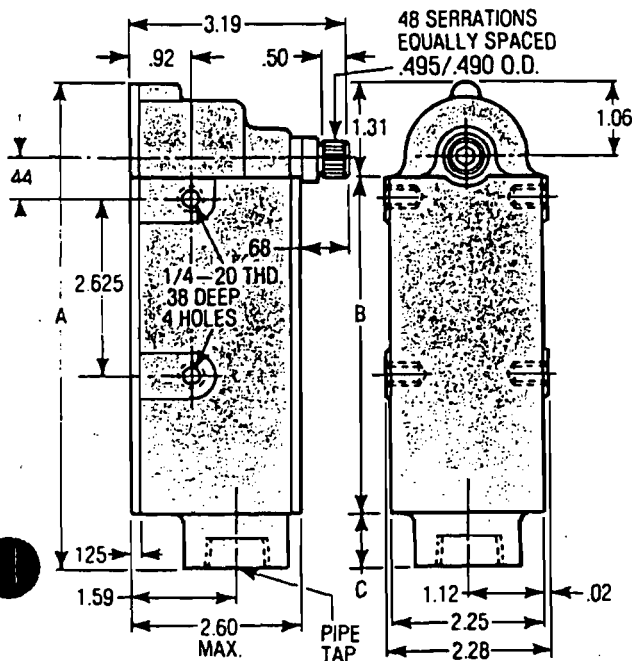
For Marine or Off-Shore Requirements, See EA780, EA790 Series, Pages 57-58.  
 For Hazardous Location Requirements, See EA800 Series, Pages 59 through 64.

### Mounting Styles and Dimensions

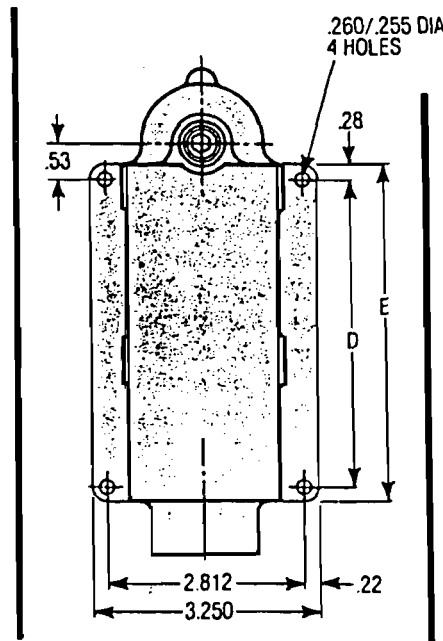
Series EA700 Snap-Lock Limit Switches are designed for flexibility in mounting arrangements. Basic design permits mounting for either side or back. Shown here are the (1) STANDARD for side mounting; (2) W (wide for back mounting); (3) L (long for back mounting). Style W or L mounting styles for back mounting, are available at no extra cost.

CONTACT SEQUENCE	STANDARD SWITCH			MOUNTING STYLE				
	PIPE TAP SIZE	A	B	C	WIDE		LONG	
					D	E	F	G
1NO-1NC	1/2-14 NPT	4.94	3.00	.62	2.44	3.00	4.22	4.84
2NO-2NC	1-11½ NPT	7.06	4.94	.81	4.38	4.94	6.41	7.06
3NO-3NC	1-11½ NPT	9.62	7.50	.81	6.94	7.50	8.97	9.62

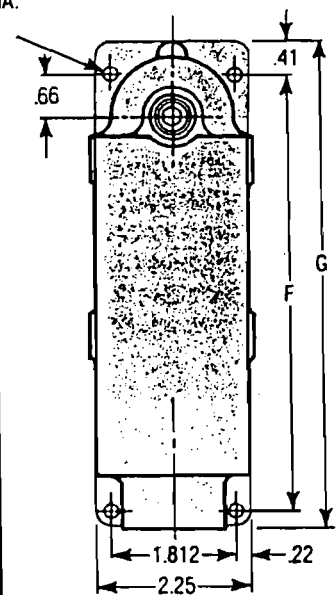
Standard Mounting



W Mounting



L Mounting



## AUTOMAX SUPERNOVA SPARE PARTS



ACTUATOR MODEL FOR S & N SERIES	SEAL KITS**		FLOW PATH INDICATOR		PHAROS INDICATOR WITH MOUNTING KIT	
	NITRILE (...SKB)	VITON (...SKV)	PART NUMBER	PRICE	PART NUMBER	PRICE
→ SN50	\$ 44	\$ 102	ME2257	\$ 7	607273	\$ 68
→ SN63	59	120	ME2259	7	607273	68
→ SN85	66	135	ME2283	7	607274	68
→ SN100	75	147	ME2284	7	607275	68
SN115	85	163	ME2287	9	607276	68
SN125	95	177	ME2288	9	607276	68
SN150	113	237	ME2289	9	607277	75
SN175	135	284	ME2290	9	607277	75
SN200	154	328	ME2291	9	607278	75
N250*	286	577	N/A	N/A	N/A	N/A
N300*	367	783	N/A	N/A	N/A	N/A

NOTE: 'SN' prefix indicates that seal kit is suitable for both 'S' and 'N' series SuperNova double-acting and spring-return. Items contained in the seal kit are detailed in IOM B00043-1

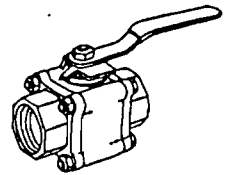
\*For N series units only.

\*\* To order seal kits, specify base model number followed by the three letter suffix shown in parenthesis.

EXAMPLE: Part number for S150 nitrile seal kit is SN150SKB

ACTUATOR MODEL	OUTER SPRING (SNSP...-23)	MIDDLE SPRING (SNSP...-24)	INNER SPRING (SNSP...-25)	PINION		EXTRA LONG OUTWARD TRAVEL STOP BOLT	
				PART NUMBER	PRICE	PART NUMBER	PRICE
S50	\$ 23	\$ 23	\$ 23	SNSP50-3	\$ 51	1072911	\$ 15
S63	23	23	23	SNSP63-3	57	1072912	17
S85	25	25	25	SNSP85-3	70	1072913	19
S100	36	36	36	SNSP100-3	75	1072914	21
S115	48	48	48	SNSP115-3	122	1072915	26
S125	56	56	56	SNSP125-3	146	1072916	33
S150	86	86	86	SNSP150-3	168	1072917	41
S175	119	119	119	SNSP175-3	249	1072918	57
S200	199	199	199	SNSP200-3	308	1072919	64

Effective December 1, 1992



# REPAIR KITS 1/4 - 2 INCH SERIES 44 MISER BALL VALVES

SCHEDULE B

SIZE	STYLE	COMPLETE REPAIR KITS*					
		B,N,TB, T,TV,TE	RT,RE,YB, YV,YE,U	PV,PE	TM**	RM**	PM**
1/4"	RK44	\$21.50	\$26.50	\$51.00	\$32.00	\$36.50	\$61.00
3/8"	RK44	21.50	26.50	51.00	32.00	36.50	61.00
1/2"	RK44	21.50	26.50	51.00	32.00	36.50	61.00
3/4"	RK44	25.00	33.50	59.00	35.50	43.50	68.50
1"	RK44	34.00	44.00	74.00	45.50	56.00	86.00
1 1/4"	RK44	44.00	56.50	88.00	56.00	68.00	99.00
1 1/2"	RK44	52.50	65.50	102.00	65.50	78.50	115.00
2"	RK44	62.00	77.50	116.50	75.00	90.00	130.00

\*A Repair Kit consists of:

- 2 Seats
- 2 Body Seals
- 1 Stem Seal
- 1 Thrust Bearing
- 2 Bellevilles
- Instruction Sheet

NOTE: To obtain Repair Kit with S.S. bellevilles, add prefix "6" to order style and add \$1.00 to trade price. Example: 1/4" 6 RK 44 T B

To order a Valve Repair Kit specify:

1/4	RK44	T	B
Size	Series	Seat Material	Seal Material

\*\*1/4" - 1" valves with carbon or stainless steel bodies and R1, R14, or R17 on nameplate cannot accept "S" gasket M body seals. All other seals may be used.

GLITSCH PACKAGE PLANTS

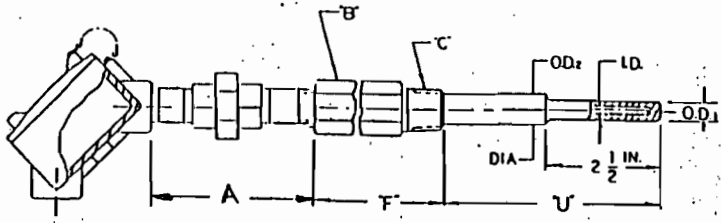
P.O.# 19379

TAG #1'S: 1" - 1CCF-ABV-1009, 2009+3009

2" - 1CCF-ABV-1001, 2001+3001

B/CD51746

Revisions				
Ltr	Description	Date	Chk.	Engr



**THERMOCOUPLE**

CONST.: DUPLEX  
 SPRINGLOAD: YES  
 CALIB.: 15A-E  
 LIMITS OF ERROR: STANDARD  
 GAGE SIZE: 1B  
 INSULATION: MAP  
 SHEATH MAT'L.: 316 S/STL  
 SIZE OD: 1/4  
 MEAS. JUNCT.: GRO  
 LENGTH: TO SUTASSY

**HEAD**

TYPE: EXPLOSION PROOF  
 MAT'L.: ALUMINUM  
 COND. SIZE NPT: 1/2 TUBE: 1/2  
 RIPPLE SIZE NPT: 1/2, SCH. 40  
 MAT'L.: 304 S/STL  
 UNION SIZE NPT: 1/2, 150#  
 MAT'L.: 304 S/STL  
 GROUND SCREW: NO  
 "A" LENGTH: 4

**WELL**

CONST.: DRILLED BAR STOCK  
 MAT'L.: 316 S/STL  
 SIZE OD1 = .500, OD2 = .88, ID = .260  
 RMS FINISH: 63  
 PROCESS MTG. "C": 1" NPT  
 HEX. DIM. "B": 1 3/8  
 INTERNAL CONN.: 1/2 NPT  
 TAG. 1" X 2" MAT'L.: S/STL.  
 EACH TAG TO CONTAIN THE  
 APPROPRIATE TAG N°

M<sup>c</sup>ABEE CONSTRUCTORS

CUSTOMER P/O N° 19371  
 TE JOB N° E10072

ITEM N°	QTY	"F"	"U"	TE CODE N°	TAG N°
1	3	2.5	4.5	ARY 1/2-1/2-4(304 S/STL)ADSLI4EGR-142 R2.5-4.5	ICCF-TE-106 ICCF-TE-108 ICCF-TE-109

CERTIFIED CORRECT  
 THERMO ELECTRIC CO.  
 SADDLE BROOK, N.J.  
 MAY 20 1993  
 BY: *[Signature]*

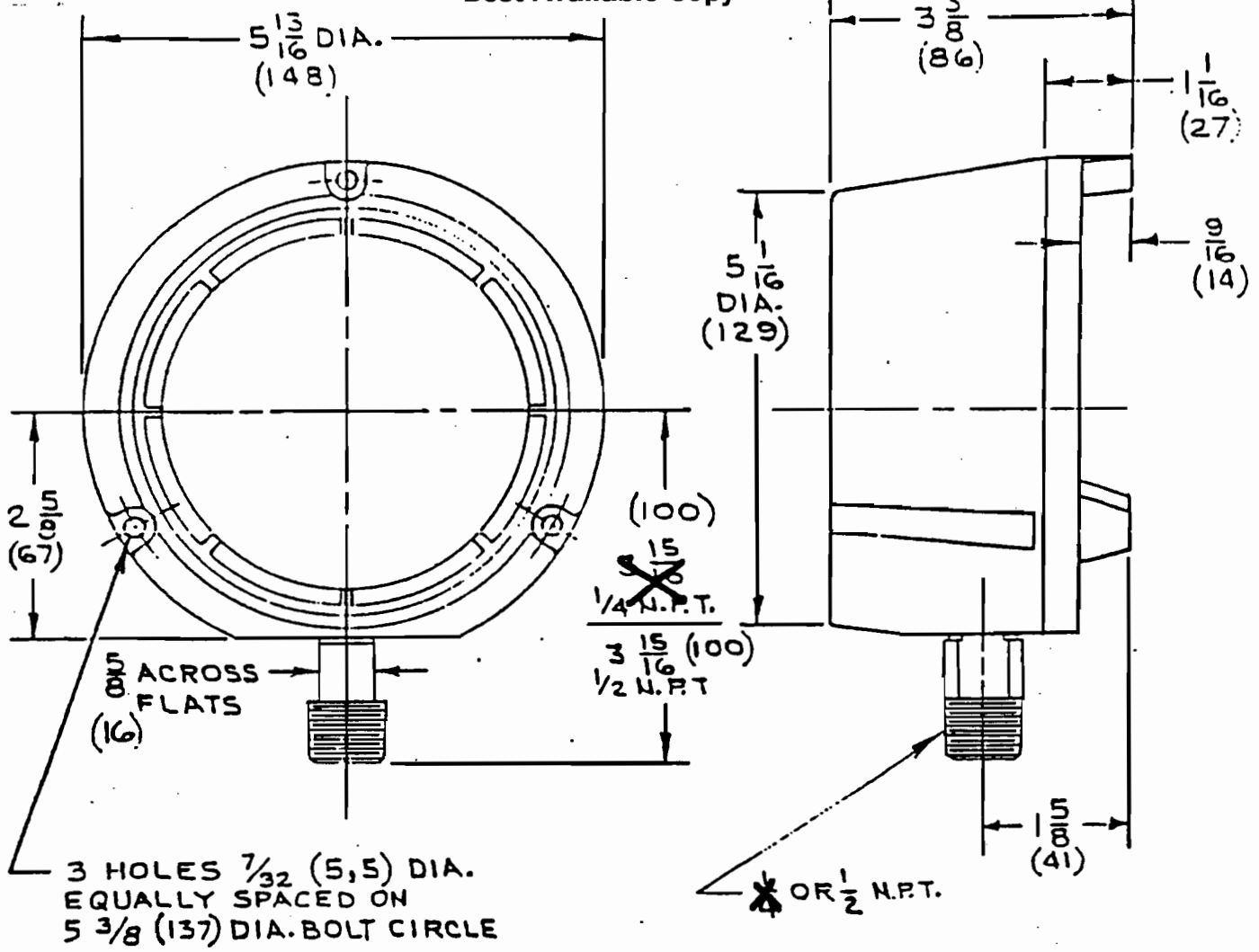
DO NOT SCALE THIS DRAWING  
 Tolerances (unless otherwise noted)  
 Decimals .x = ± .015 .xx = ± .010 .xxx = ± .005  
 Fractional ± 1/64  
 Break corners and edges .010 max  
 All dimensions in inches unless otherwise specified

Dwg Made & Approved By	Draftsman	Checker	Engineer
Initial	<i>[Signature]</i>		<i>[Signature]</i>
Date	5-5-93		5-10-93
<b>THERMO ELECTRIC</b> Saddle Brook, New Jersey 07662			

INDUSTRIAL T/C  
 ASSY  
 B/CD51746  
 Rev.

BRUNING 40-105 32987-3

Best Available Copy



3 HOLES  $7/32$  (5.5) DIA.  
EQUALLY SPACED ON  
 $5 \frac{3}{8}$  (137) DIA. BOLT CIRCLE

TAG #  
 ICCF-PI-110, 112, 104,  
 115, 116, 125,  
 1004, 1008, 2004,  
 2008, 3004, 3008.

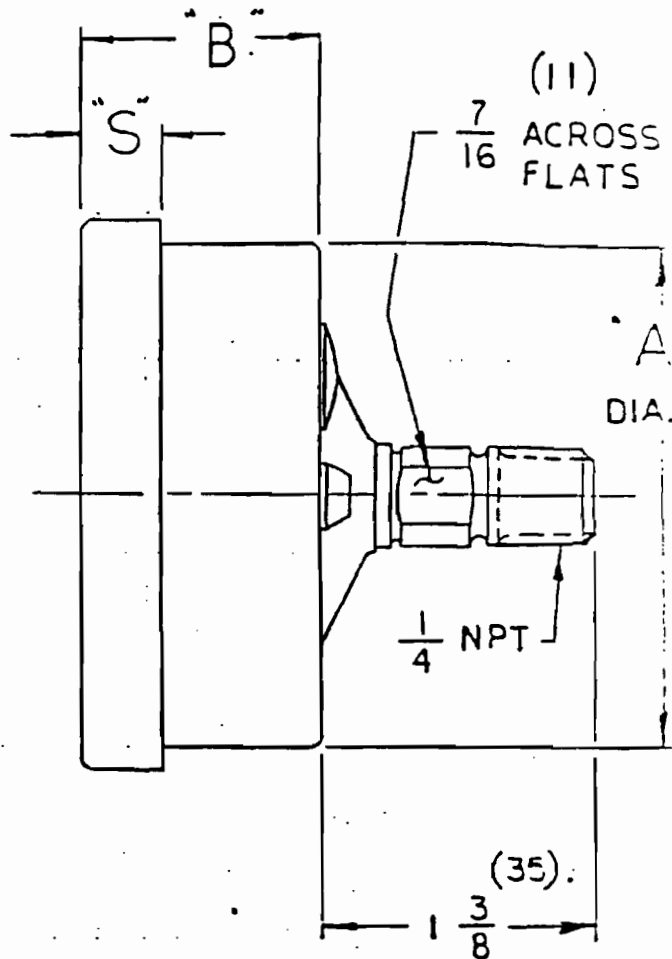
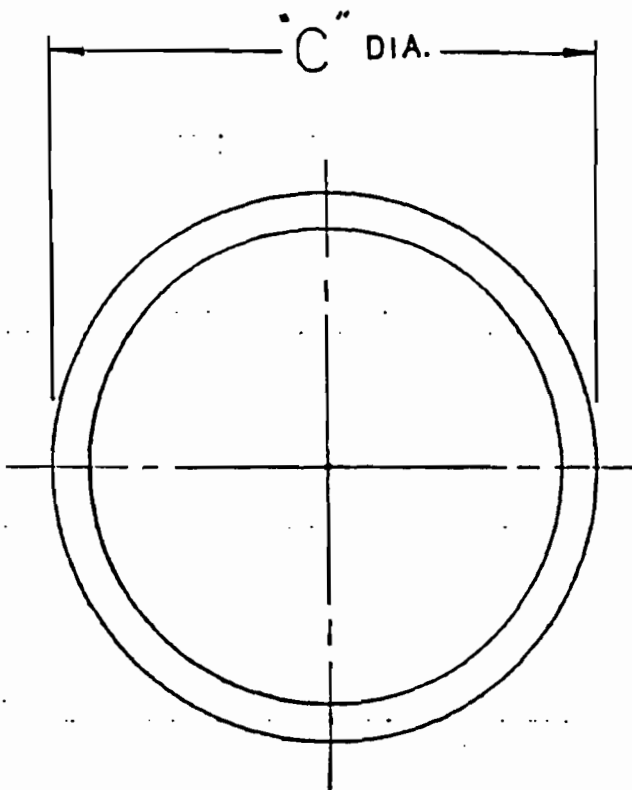
NOTE -1  
 $4 \frac{1}{2}$ -1279\_S XSG  
~~OR~~  $1/2$  NPT LOWER CONN PHENOL  
 TURRET CASE WALL MOUNTED DURAGAUGE.

DIMENSIONS IN ( )  
 ARE MILLIMETERS.

REVISION  
 DATE  
 5/20/97  
 3/15  
 3/15

THIS PRINT CERTIFIED CORRECT FOR	
CUSTOMERS NAME <b>GLITCH, INC.</b>	
CUSTOMERS ORDER NO. <b>19380</b>	JOB NO. <b>65-7877</b>
CERTIFIED By <b>Jeanne Husted</b> DATE <b>December 3, 1992</b>	

GENERAL DIMENSIONS SEE NOTE -1			
<b>DRESSER</b>			
INDUSTRIAL VALVE & INSTRUMENT DIVISION STRATFORD, CONNECTICUT 06487			
DRAWN CHK'D. APPD. <i>KAL</i>	DATE <b>4-22-76</b>	DATE OF ISSUE	REV. <b>D</b>
	RELEASED <b>4 23 76</b>	<b>70A917</b>	



DIMENSIONS IN ( ) ARE MILLIMETERS

GAUGE SIZE		A	B	C	S
25	INCH	$2 \frac{21}{32}$	$1 \frac{5}{32}$	$2 \frac{7}{8}$	$\frac{3}{8}$
	MM	67	29	73	10
35	INCH	$3 \frac{19}{32}$	$1 \frac{7}{32}$	$3 \frac{31}{32}$	$\frac{15}{32}$
	MM	91	31	101	12

TAG #

- ICCF-PI-127
- ICCF-PI-1019
- ICCF-PI-2019
- ICCF-PI-3019

FORM NO. 250-7848D  
 REV. 1  
 DATE 4/16/84  
 RELEASED  
 ALL RIGHTS RESERVED  
 ALL RIGHTS RESERVED

THIS PRINT CERTIFIED CORRECT FOR

CUSTOMERS NAME  
**GLITCH INC.**

CUSTOMERS ORDER NO. **19380**

JOB NO. **65-7877**

**GENERAL DIMENSIONS**

~~25-1009SW-02E~~ & ~~25-1009SW-02B x 5G~~

~~35-1009SW-02E~~ & ~~35-1009SW-02B~~

Industrial Valve and Instrument Division **DRESSER** STRATFORD CONNECTICUT 06497

CERTIFIED **Jeanne Husted** DATE **August 13, 1991**

DRAWN <b>RKI</b>	DATE <b>4-16-84</b>	DATE OF ISSUE	REV <b>A</b>
CHK'D. <b>KAL</b>	RELEASED <b>4/30/84</b>	<b>70A1980</b>	
APP'D. <b>Lith</b>			



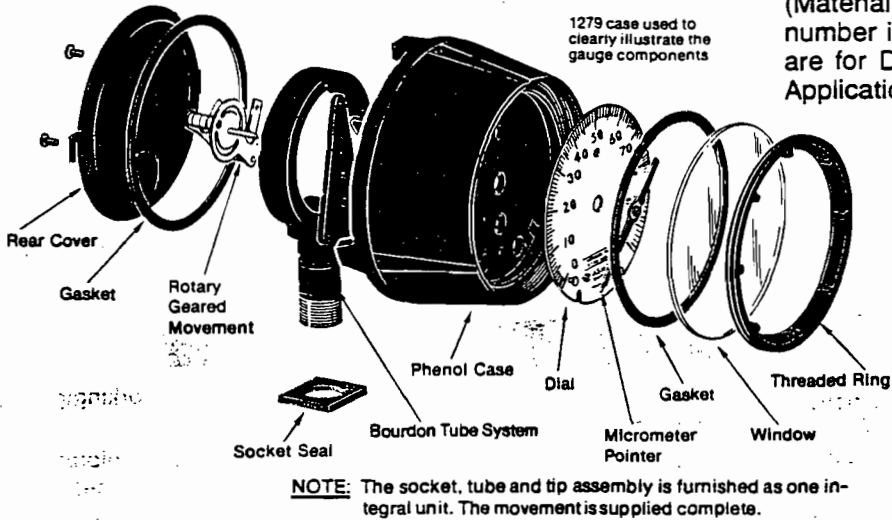
# NAMES OF GAUGE PARTS AND RING DESIGNS

# ENGINEERING DATA

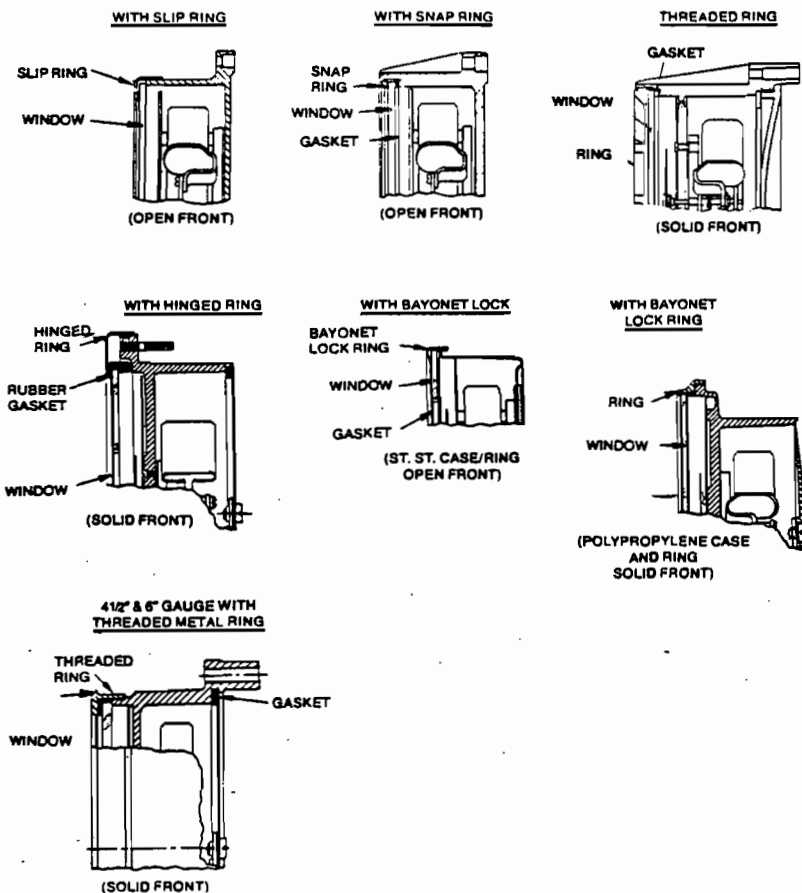
The drawing below shows a typical solid front lower connection Duragauge with all of the parts designated by their standard names. The use of these names will facilitate the ordering of parts and eliminate any misunderstanding in describing gauge construction.

When ordering parts — specify as much of the following data as possible:

**Size (Dial Diameter)** — **Case Material** (Stainless Steel, Polypropylene, Aluminum or Phenol) — **Case Type** (Open Front or Solid Front) — **Ring Design** (Slip, Internal Threaded, External Threaded, Bayonet, Snap or Hinged) — **Connection Location** (Lower or Back) — **Connection Size** ( $\frac{1}{4}$ " or  $\frac{1}{2}$ ") — **Bourdon Tube/Socket** (Material Indicated on Dial) — **Dial Range**. Specify type number if possible; otherwise, mention whether parts are for Duragauge, General Service Gauge, Special Application Gauge, Receiver Gauge or Test Gauge.

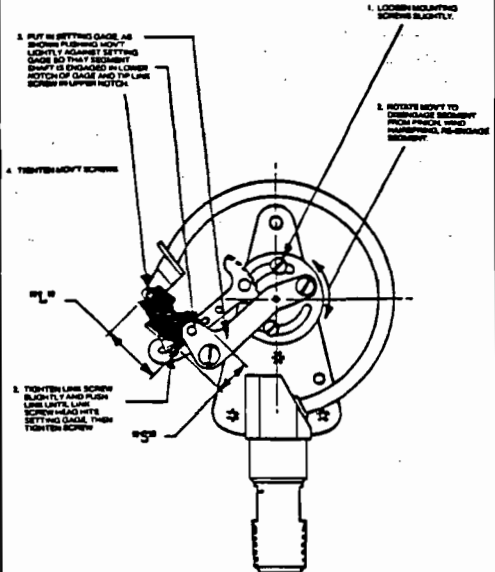


## TYPICAL CONSTRUCTION DETAILS



## CALIBRATION PROCEDURE

### 1. Preliminary Gauge Calibration Setting — (SOLID FRONT GAUGE SHOWN)



### 2. Calibration —

- At zero pressure (or at full vacuum for compound or vacuum gauges), assemble pointer to pinion shaft in the horizontal position.
- Apply pressure equal to full range and adjust the slide in the segment slot until the pointer has rotated 270 degrees (vertical position).
- Reduce pressure to zero and reset pointer if necessary to horizontal position. If pointer adjustment was required, repeat step (b) above.
- Apply pressure equal to mid-scale and drive pointer firmly onto pinion.
- Recheck calibration at the lower and upper ends of the scale.

**3. Linearity Adjustment —** Although the procedure outlined above should produce a correctly calibrated gauge, linearity adjustment may be required. If the pointer reads correctly at the bottom of the scale and low at the top of the scale, rotate the movement to increase the angle between the link and the segment. If the pointer reads high, rotate the movement in the opposite direction.



INSTRUMENT DIVISION  
DRESSER INDUSTRIES INC.  
STRATFORD, CONNECTICUT 06497

## ASHCROFT® PRESSURE GAUGE INSTALLATION INSTRUCTIONS

**GAUGES ARE INSTRUMENTS. HANDLE THEM CAREFULLY**

### SELECTION

**Pressure Ranges**—Select a gauge with a full scale pressure range of approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Failure to select a gauge range within this criteria may ultimately result in fatigue failure of the Bourdon tube component.

### INSTALLATION

Always use a wrench on the flats of the gauge socket to screw the gauge in place. When a fitting is being screwed to the gauge, hold a wrench on the socket flats instead of twisting against the gauge socket screws which are intended to hold the gauge mechanism in the case.

When gauges are mounted on a wall or panel, make sure they are connected free from piping strains. Also see that the mounting surface is flat, or insert washers under the flange of the gauge case to obtain three-point suspension. Preferably, the last length of piping leading up to the gauge should be flexible tubing. This will insure that the gauge is free from strain.

Install gauges where they will be free from the effects of mechanical vibration as this will wear out any gauge quickly. Try to mount the gauge on a wall nearby and connect the gauge to the machine which vibrates badly by means of flexible line assembly.

Protect gauges from frequent pressure pulsations by using throttle screws in the socket of the gauge, needle valves, pulsation dampeners, or pressure snubbers.

When any gauge is used for steam pressures, a siphon filled with water must be installed between the gauge and the line. When the system is subject to occasional vacuum, provide a leg of piping which cannot be emptied by the vacuum effect. A drain cock or plug should be installed at the bottom of this leg to enable occasional cleaning out of the sediment. The head effect of this piping leg should be compensated for by resetting the pointer of the gauge.

### OPERATING CONDITIONS

The operating conditions to which a gauge will be subjected must be considered. If the gauge will be subjected to severe vibration or pressure pulsations, liquid filling the gauge may be necessary to obtain normal product life. Other than discoloration of the dial and hardening of the gasketing that will occur as ambient temperatures exceed 150° F, metal case Duragauges (that are not liquid filled) can withstand continuous ambient temperatures as high as 350° F. Phenol and polypropylene case gauges can withstand ambient temperatures up to 250° F. Accuracy will be affected by approximately 1.5% per 100° F. Gauges with welded joints will withstand 750° F (450° F with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. For temperature limits on other gauges see General Service Bulletin GS1, Special Service SG1 and Test Gauge Bulletin TG-1.

### PROPER USE

Apply pressure slowly. Do not open the gauge cock or valve too quickly—this imparts a severe strain on the Bourdon tube which may rupture it, or result in shortened life. When the service itself is subject to sudden pressure applications, use a needle valve, or the Ashcroft Gauge Saver.

Avoid over-pressure. See that the apparatus is provided with a relief valve and that the range of the gauge is higher than the set pressure of the relief valve.

Sudden pressure release has the same detrimental effect and should be compensated for in the same manner as for pressure applications mentioned above. On hydraulic presses, Catalog Number 1056 or 1009DH Gauges with slotted link should be specified. See Special Service bulletin SG-1.

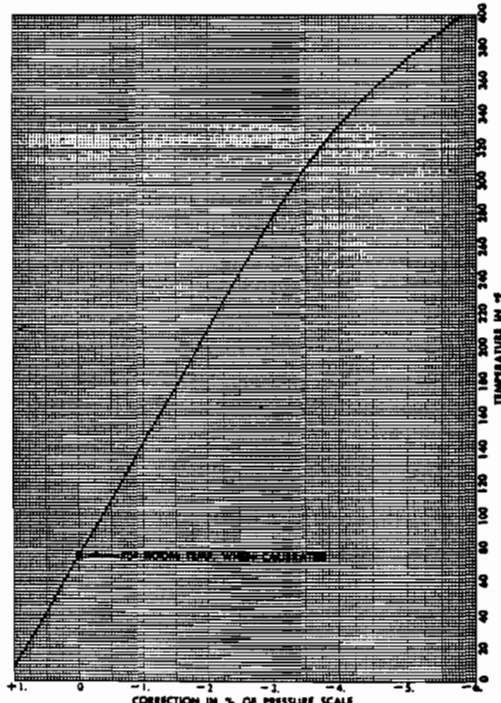
### MAINTENANCE

Replace broken glasses and thus keep dirt out of the working bearings and teeth of the movement mechanism.

Never oil gauge movements or linkages except with high grade instrument oil. Regular oil attracts dirt and becomes gummy, thus causing the gauge to act sluggish and inaccurate.

### HEAT AFFECTS GAUGE ACCURACY

Approximate error or change in calibration of a Bourdon tube type Pressure Gauge caused by changes in temperature.



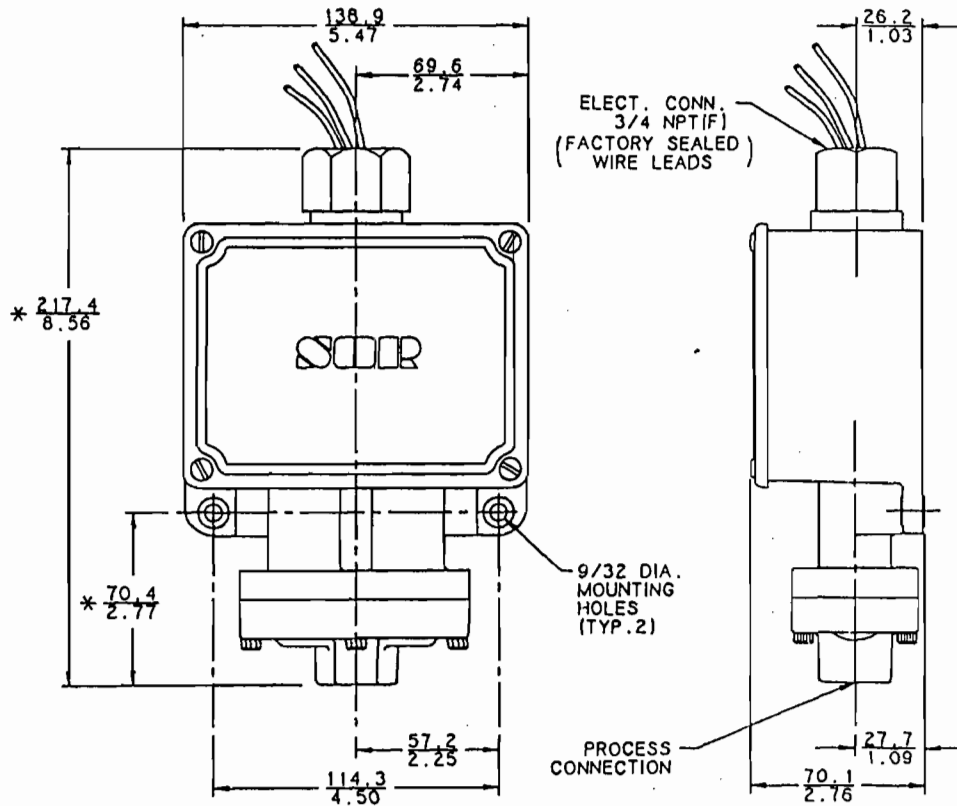
Example: Gauge working at 500 p.s.i. pressure and at 280° F. temperature would have a -3% correction and would read 3% or 15 p.s.i. fast.

MODEL  
6V3-AG3-M9-C2A-PCTT  
5V3-AG3-M9-C2A-PCTT

S.O.NO. 187280

PC=OVERRANGE 2000 PSI PROOF 2500 PSI

Form - 466



\* ADD  $\frac{0.1}{0.25}$  FOR ALL NON-ALUMINUM PORTS.

REVISION HISTORY				
REV.	EO NUMBER	BY	DATE	CHKD
A	EO-3052	J.WIG	5-13-91	MLS

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<p>TOLERANCES UNLESS OTHERWISE SPECIFIED:          FINISHES: 1. PER DRAWING; 2. USE ANGLES;          MACHINE FINISH</p> <p>COMPLIANCE FOR ALL DIMENSIONS:          TOLERANCE GRADE:          ALL DIMENSIONS IN INCHES          FALLET'S AND ANALOGS FROM USA</p>	DRAWN BY J.WIG DATE 5/13/91
	CHECKED BY DATE MLS 5-13-91
	DATE 5/13/91
DRILLED HOLE TOLERANCES	
0.13 TO 0.175    .001    0.175 TO 0.338    .002	0.338 TO 0.500    .003    0.500 TO 0.750    .004
0.75 TO 1.00    .004    1.00 TO 2.000    .005	2.000 TO 3.000    .006    3.000 TO 4.000    .007

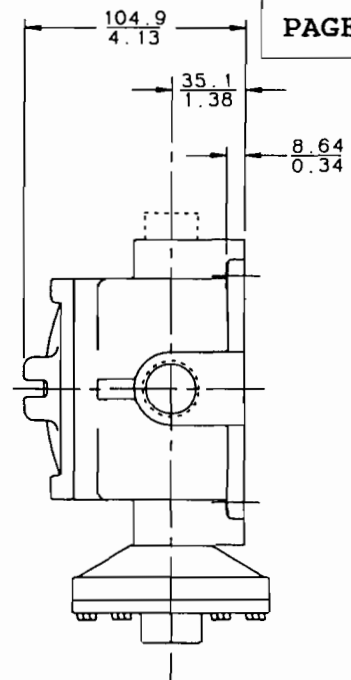
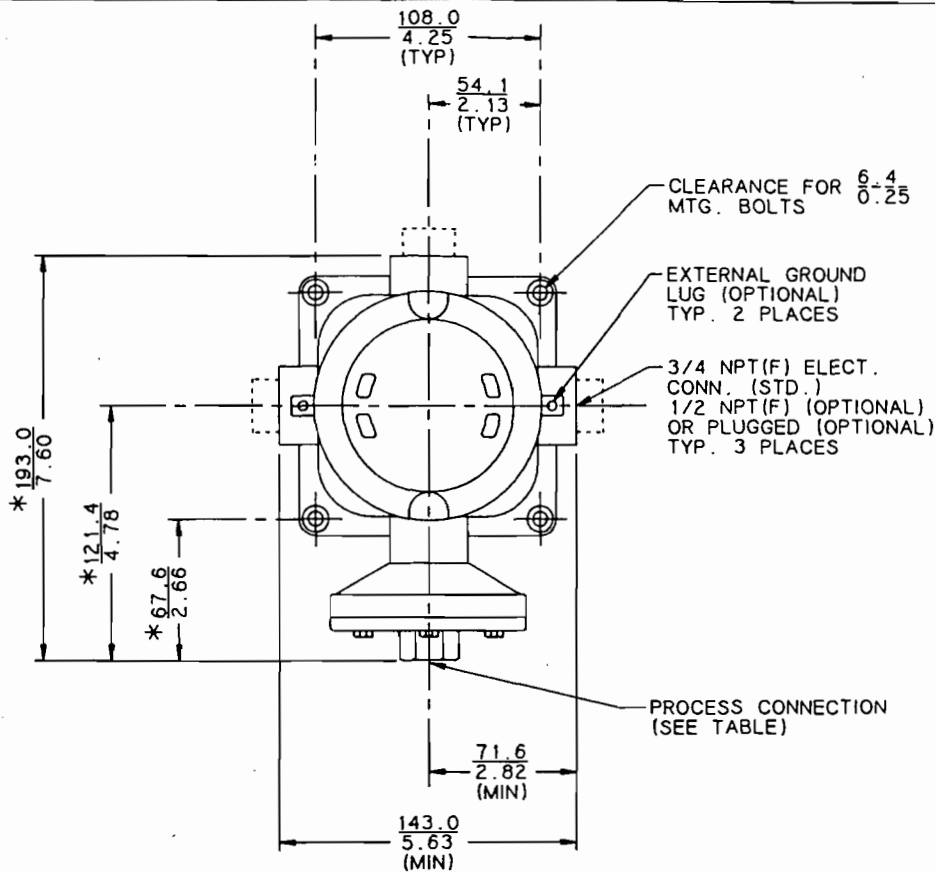
**SDR** 14885 W. 105th LANE, ANNE ARBOR MI 48106  
 PHONE 313/888-7630 FAX 313/888-7630  
 CIRCLE 5 ON CARD

DIM. DWG. V3 DUAL HI-LO FOR GENERAL INSTRUCTIONS

**NOTE**  
 THIS DRAWING USED ON THE FOLLOWING:  
 FORM NO. 281 (ADJ. DEAD BAND CATALOG)

FROM LINEAR = $\frac{\text{mm}}{\text{IN}}$	FORM-466 3	REV A B
--	---------------	---------------

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Process Connection	*Length
1/4" NPT(F) 1/2" NPT(F)	Shown
1" NPT(F)	Add 5.6 0.22
2" NPT(F)	Add 25.4 1.00

Linear =  $\frac{\text{mm}}{\text{in.}}$

Model Number

**52SC-KK117-M9-C2A-PBPCTT**

Descriptions

SC = EXPLOSION PROOF/WEATHERTIGHT HOUSING, CLASS 1, GRPS. C&D, DIV. 1&2, 3/4 IN. CONDUIT, ALUMINUM  
 KK = 1 DPDT 15 AMPS 250VAC, \*5 AMPS 30VDC, DEAD BAND FIXED  
 M9 = 316L SS DIAPHRAGM/EPR O-RING  
 C2A = 1/2 IN. NPT (F) 316SS PORT  
 PB = CARBON STL BODY/ STAINLESS STEEL ADJUST NUT  
 PC = HIGHER OVERRANGE/PROOF PRESSURES  
 TT = 316SS TAG PERMANENTLY ATTACHED  
 52-117 = RANGE 40-0-40 IN WC  
 OVRNG 250 PSI  
 PROOF 400 PSI

Tag Numbers

1CCF-PSL111

Set Point

FIELD SET

+/-

Certification for

MCABEE CONSTRUCTION

Purchase Order

19741

Submittal Revision

SOR Order Number

187280

Certified by

JOEL BRADLEY

Date

4/21/93

Type

SC - 12, 52

Drawing No.

090-184

Rev.

D



14685 West 105th Street  
 Lenexa, Kansas 66215 USA  
 Fax 913-888-0767  
 Tel. 913-888-2630

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Linear =  $\frac{\text{mm}}{\text{in.}}$

Model Number

**6V3-AG3-M9-C2A-PCTT**

Descriptions

V3 = EXPLOSION PROOF/WEATHERTIGHT HOUSING, ALUMINUM, 3/4 IN. NPT (F) CONDUIT WITH WIRE LEADS  
 AG = 2 SPDT 11 AMPS 250VAC, 5 AMPS 30VDC, DEAD BAND ADJUSTABLE, HERMETICALLY SEALED/EXPLOSION PROOF WEATHERTIGHT SWITCH HOUSING, CLASS 1, GRPS. A,B,C,D, DIV. 1&2, U.L. LISTED/CSA CERTIFIED.  
 M9 = 316L SS DIAPHRAGM/EPR O-RING  
 C2A = 1/2 IN. NPT (F) 316SS PORT  
 PC = HIGHER OVERRANGE/PROOF PRESSURES  
 TT = 316SS TAG PERMANENTLY ATTACHED  
 6-3 =        RANGE        20-100 PSI  
           OVRNG        2000 PSI  
           PROOF        2500 PSI

Tag Numbers

1CCF-PSL1005,  
 1CCF-PSL2005,  
 1CCF-PSL3005

Set Point

FIELD SET

+/-

Certification for

MCABEE CONSTRUCTION

Purchase Order

19741

SOR Order Number

187280

Submittal Revision

Certified by

Date

*Joel Bradley*  
 JOEL BRADLEY

4/21/93

Type  
 6V3



14685 West 105th Street  
 Lenexa, Kansas 66215 USA  
 Fax 913-888-0767  
 Tel. 913-888-2630

Drawing No.  
 FORM 466

Rev.  
 A

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Linear =  $\frac{mm}{in.}$

Model Number

**5V3-AG3-M9-C2A-PCTT**

Descriptions

**V3 = EXPLOSION PROOF/WEATHERTIGHT HOUSING, ALUMINUM, 3/4 IN. NPT (F) CONDUIT WITH WIRE LEADS**  
**AG = 2 SPDT 11 AMPS 250VAC, 5 AMPS 30VDC, DEAD BAND ADJUSTABLE, HERMETICALLY SEALED/EXPLOSION PROOF WEATHERTIGHT SWITCH HOUSING, CLASS 1, GRPS. A,B,C,D, DIV. 1&2, U.L. LISTED/CSA CERTIFIED.**  
**M9 = 316L SS DIAPHRAGM/EPR O-RING**  
**C2A = 1/2 IN. NPT (F) 316SS PORT**  
**PC = HIGHER OVERRANGE/PROOF PRESSURES**  
**TT = 316SS TAG PERMANENTLY ATTACHED**  
**5-3 =**  
     **RANGE       80-240 PSI**  
     **OVERRNG    2000 PSI**  
     **PROOF       2500 PSI**

Tag Numbers

**1CCF-PSL112**

Set Point

**FIELD SET**

+/-

Certification for

**MCABEE CONSTRUCTION**

Purchase Order

**19741**

SOR Order Number

**187280**

Submittal Revision

Certified by

Date

**JOEL BRADLEY**

**4/21/93**



14685 West 105th Street  
 Lenexa, Kansas 66215 USA  
 Fax 913-888-0767  
 Tel. 913-888-2630

Type  
**5V3**

Drawing No.  
**FORM 466**

Rev.  
**A**



# Pressure Switches for Process Applications

## General Instructions

Form #496

These instructions supersede SOR Forms #119 and 338.

### GENERAL

These instructions provide information for Mounting, Process Connection, Electrical Connection, and Calibration of SOR general purpose, weathertight and conventional explosion proof pressure switches. The Static“O”Ring type pressure switch with optional wetted parts is suitable for a wide variety of process applications. See Catalog #216 for details. This type is not recommended for high-pressure fluid power applications where high-shock pressure and high cycle rates are expected.

**Note:** SOR products do not normally require periodic service. SOR discourages field modifications, changeout of wetted parts or repair. It is recommended that products be returned to SOR for inspection and necessary repair work. Contact the factory for a return authorization number. Any field work should be performed by qualified instrument repairmen using factory authorized procedures.

*Continued on back*

### ELECTRICAL CONNECTION

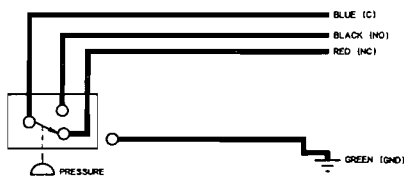
**CAUTION:** Electrical power **must** be disconnected from conventional explosion proof models in a hazardous location before the cover is removed. Failure to do so could result in severe personal injury or substantial plant damage.

Storing excess wire or making wire lead splices inside the pressure switch housing will interfere with pressure switch operation.

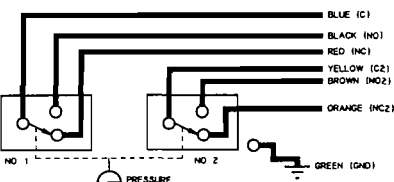
Housing Type	Conduit Connection	Contact Termination	Contact Identification
Open Bracket	None	Screw Terminals	Stamped on insulation
		Wire leads	Color coded and marked
All others	3/4 NPT(F) unless optional adapter is specified	Screw terminals	Stamped on insulation
		Wire leads	Color coded and marked
		Terminal strip	Stamped on insulation

#### Wire Lead Color Code

##### SPDT



##### DPDT (2-SPDT)



#### Vacuum Switch

##### Wiring Schematics for Switching Elements in Compound Vacuum-Pressure Switches

When operating in vacuum range, i.e. when set point is calibrated to vacuum, use wiring schematic Figure 1.

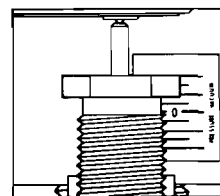
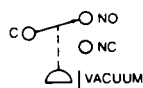


Figure 1

When operating in positive pressure range, i.e. when set point is calibrated to positive gauge pressure, use wiring schematic Figure 2.

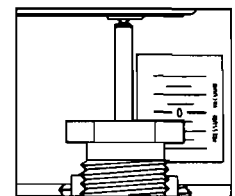
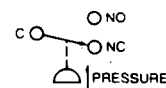


Figure 2

## MOUNTING

1. Secure housing mounting pad to a bulkhead, panel rack or pipe stanchion with two suitable 1/4" bolts.

*IMPORTANT: When mounting to irregular or uneven surface, install rubber washers (provided) on bolts between housing and mounting surface to prevent deformation of housing, which could change relative positions of internal parts and affect calibration or render the device inoperative.*

2. Line mounting by either process connection or electrical conduit connection is **not** recommended.
3. Suggested mounting orientation is electrical conduit connection at 6 o'clock to prevent condensate from collecting in the housing enclosure. However, the device can be mounted in any position.

## PROCESS CONNECTION

Securely connect process line to pressure port using two wrenches: one to hold hex flats on pressure port, the other to tighten process pipe or tube fitting.

*IMPORTANT: Be certain process connection is tightened and positioned so bending and torsional forces imposed on pressure switch are minimal. Use care not to loosen pressure port from body or body from housing.*

## CALIBRATION

**CAUTION:** Switching Element has been precisely positioned in the housing and overtravel adjusted at the factory for optimum performance. Any inadvertent movement or replacement in the field will degrade performance and could render the device inoperative, unless factory authorized procedures are followed.

### Fixed Dead Band Models

Use 3/4" open-end wrench to turn hex adjusting nut clockwise to increase set point; counterclockwise to decrease Set Point. Approximate set point can be obtained by sighting across top of adjusting nut to calibration scale on interior wall of housing. If precise set point calibration is required, it will be necessary to use a regulated pressure source, a suitable continuity tester, and a 1/4% test gauge.

### Adjustable Dead Band Models

Use the fixed dead band procedure (above) to calibrate the desired **decreasing** pressure set point. The **increasing** pressure set point can be adjusted by turning the white thumbwheel on the electrical switching element. Setting A yields the smallest possible dead band. Setting F yields the widest possible dead band. Settings above E may degrade repeatability.

See SOR Catalog #216 for reference dimension drawings. For certified dimension drawings, contact the factory.



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Represented by

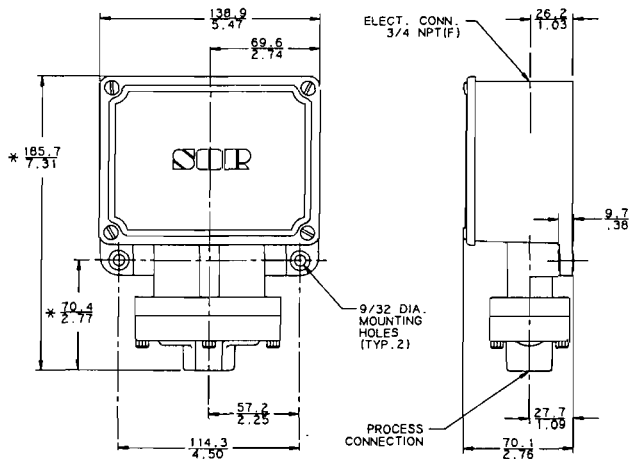


# SOR Dual Hi-Lo Pressure Switch

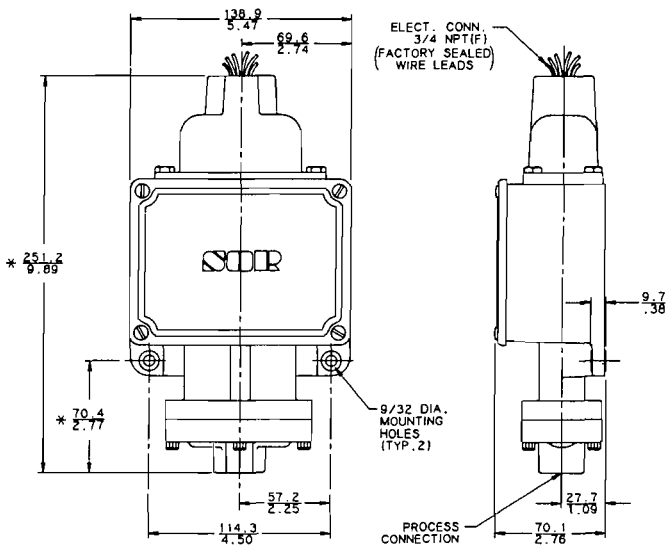
## General Instructions

Form #248

### Dimensions



**V1 Weathertight**



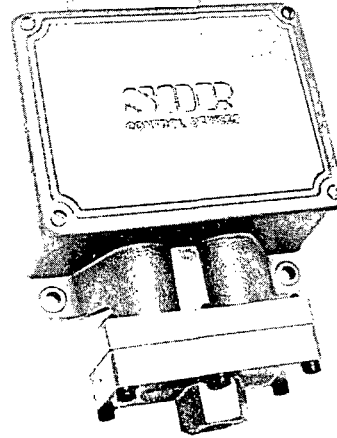
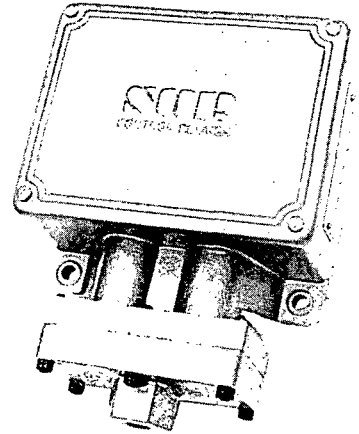
**V2 Explosion Proof, Hermetically Sealed**

\*Add  $\frac{6.4}{0.25}$  for all non-aluminum pots

Dimensions are for reference only. Contact the factory for certified drawings for a particular model number.

LINEAR =  $\frac{MM}{IN}$

**V1**  
Weathertight  
Housing



**V2**  
Weathertight  
Explosion Proof  
Hermetically Sealed

### GENERAL

This instruction provides information for Mounting, Process and Electrical Connections, and Field Calibration of SOR Dual Hi-Lo Series Pressure Switches.

The pressure sensing elements are a pair of force-balanced, piston-actuated assemblies sealed by flexible diaphragms and o-rings that are static. The only wetted parts in this arrangement are the single pressure port, two sensing assembly diaphragms and o-rings.

Media pressure on the area of the pistons counteracts the force of the range spring (adjustable by the adjusting nuts), which moves the piston shafts only a few thousandths of an inch to directly actuate the electrical snap-action switching elements.

### MOUNTING

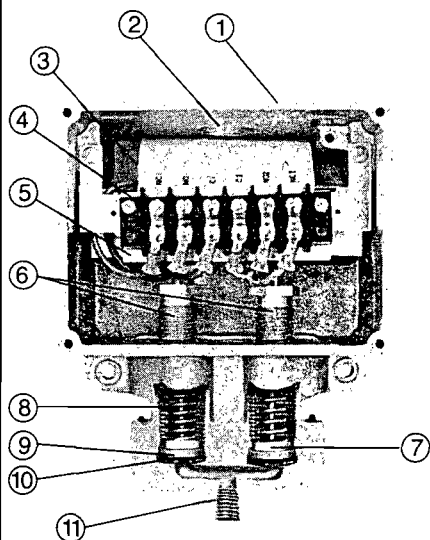
Dual Hi-Lo Pressure Switches may be secured to bulkheads, panels or pipe stanchions with suitable bolts. When mounting the pressure switch to an irregular or uneven flat surface, install the rubber washers on the mounting bolts between the housing and the mounting surface.

**CAUTION: Failure to place these washers between the housing and the mounting surface may result in torsional forces on the housing that could cause false trips or render the pressure switch inoperative.**

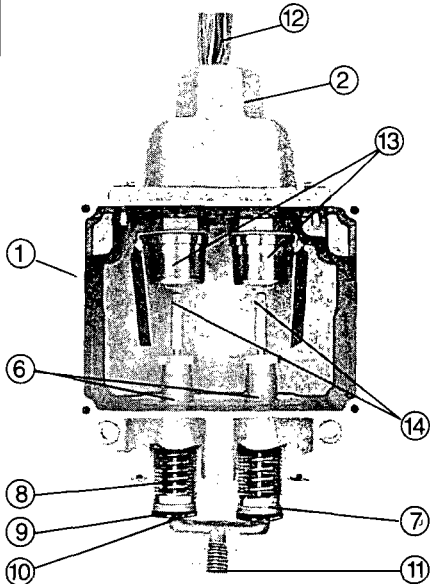
Line-mounting by either the process connection or the electrical conduit connection is **not** recommended.

### PROCESS CONNECTION

Securely connect the process line to the pressure port using two wrenches; one to hold the hexagonal flats on the pressure port, the other to tighten the process pipe or tube fitting.



V1 Weathertight



V2 Explosion Proof

- 1 Housing
- 2 Conduit Connection
- 3 Switching Element(s) (not visible)
- 4 Terminal Block
- 5 Overtravel Adjustment (not visible)  
See Caution Note.
- 6 Set Point Adjusting Nut
- 7 Piston Assembly
- 8 Pressure Range Spring
- 9 Diaphragm
- 10 O-Ring
- 11 Pressure Port
- 12 Free Leads
- 13 Hermetically Sealed Switching Elements
- 14 Overtravel Adjustment (**not** for fine adjustment of Set Point) See CAUTION Note.

**IMPORTANT:** Ensure that the process connection is tightened and positioned so that bending and torsional forces imposed on the pressure switch are minimal. **Do not** loosen the pressure port from the body, because leakage could result or the pressure switch could be rendered inoperative.

### ELECTRICAL CONNECTION

#### V1 – Weathertight

**Common**      **Normally Open**      **Normally Closed**  
**SPDT:** Screw terminal block with marked insulation. Left and right positions:

No. 1 (Left side)	..... C1	..... NO1	..... NC1
No. 2 (Right side)	..... C2	..... NO2	..... NC2

**2-SPDT (DPDT):** Left and right positions.

Nos. 1 & 2 (Left Side)	..... C1	..... NO1	..... NC1
	..... C2	..... NO2	..... NC2
Nos. 3 & 4 (Right Side)	..... C3	..... NO3	..... NC3
	..... C4	..... NO4	..... NC4

**V2 – Explosion proof** 18" 18 AWG color coded and marked wire leads with 3/4" NPT(F) conduit connection.

**Common**      **Normally Open**      **Normally Closed**

#### SPDT

No. 1 (Left side)	..... C1 - Blue	..... NO1 - Black	..... NC1 - Red
No. 2 (Right side)	..... C2 - Blue	..... NO2 - Black	..... NC2 - Red

#### 2-SPDT (DPDT):

Nos. 1 & 2 (Left side)	..... C1 - Blue	..... NO1 - Black	..... NC1 - Red
	..... C2 - Yellow	..... NO2 - Brown	..... NC2 - Orange
Nos. 3 & 4 (Right Side)	..... C3 - Blue	..... NO3 - Black	..... NC3 - Red
	..... C4 - Yellow	..... NO4 - Brown	..... NC4 - Orange

GR - Ground (earth) green wire connected to each hermetically sealed switching element capsule.

**NOTE:** Transpose NO and NC on vacuum switches when set points are in the vacuum range.

**CAUTION:** Overtravel has been preset at the factory, i.e. the switching element assembly has been precisely positioned in the housing for optimum performance. It normally should not be changed in the field. Should adjustment be necessary, factory approved procedures must be closely followed. Any inadvertent movement or replacement in the field will degrade performance, void the warranty and could render the device inoperative.

### CALIBRATION

- a. Remove the housing cover.
- b. To increase the set point at which the No. 1 (left side) switching element(s) actuates, turn the hex adjusting nut clockwise with a 3/4-inch open-end wrench.
- c. Sight across the flat top of the adjusting nut to the calibration scale at the bottom of the housing for an approximate set point. Use a 1/4% external pressure gauge to more precisely calibrate the pressure switch.
- d. Repeat steps b and c for the No. 2 (right side) set point. There is no interaction, so it is not critical whether the left or right side is set first.
- e. Replace the housing cover. The pressure switch can be placed in service.



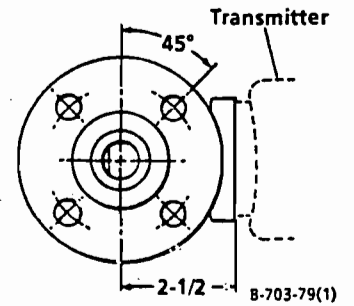
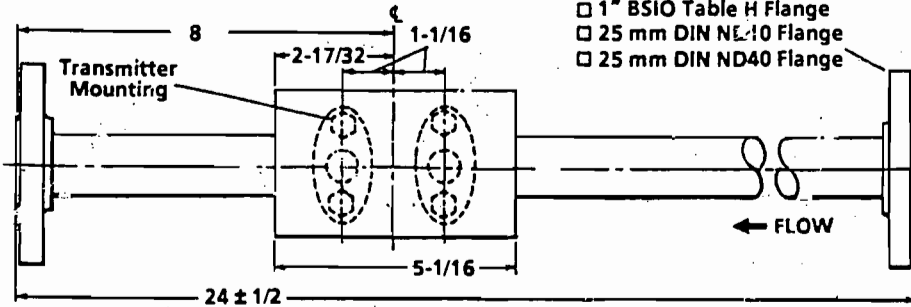
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\*Can be any digit.

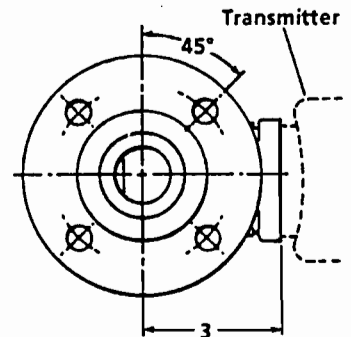
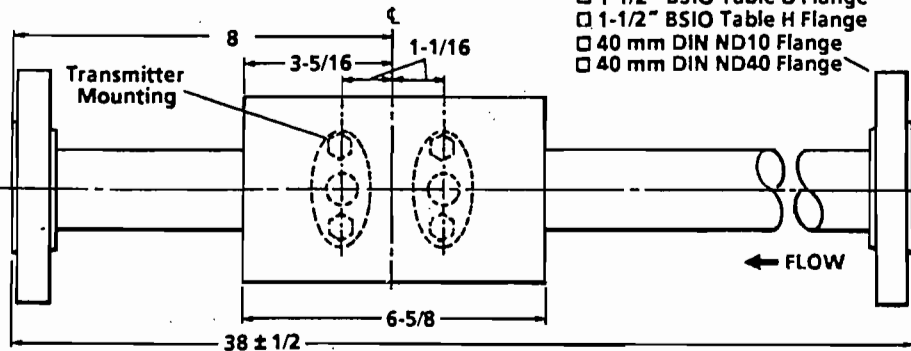
1337LZ2\_\_0\_\_

- 1" Class 150 ANSI Raised Face Flange
- 1" Class 300 ANSI Raised Face Flange
- 1" BSIO Table D Flange
- 1" BSIO Table H Flange
- 25 mm DIN ND10 Flange
- 25 mm DIN ND40 Flange



1337LZ3\_\_0\_\_

- 1-1/2" Class 150 ANSI Raised Face Flange
- 1-1/2" Class 300 ANSI Raised Face Flange
- 1-1/2" BSIO Table D Flange
- 1-1/2" BSIO Table H Flange
- 40 mm DIN ND10 Flange
- 40 mm DIN ND40 Flange



Note: Integral Wedge Flow Element mounts in place of adapters shown on Transmitter drawing

INCHES	mm
1/2	12.70
1-1/16	26.99
2-1/2	63.50
2-17/32	64.29
3	76.20
3-5/16	84.14
5-1/16	128.59
6-5/8	168.28
8	203.20
24-1/2	622.30
38	966.20

For Transmitter dimensions refer to transmitter drawing



Only items checked  apply. All dimensions in inches. Not for construction unless certified.

Cat. No. 1337LZ32100

Cust. No. 53442S ABB Kent-Taylor No. 930401385

Also Refer to Dwgs.

Certified by M. Fleischman

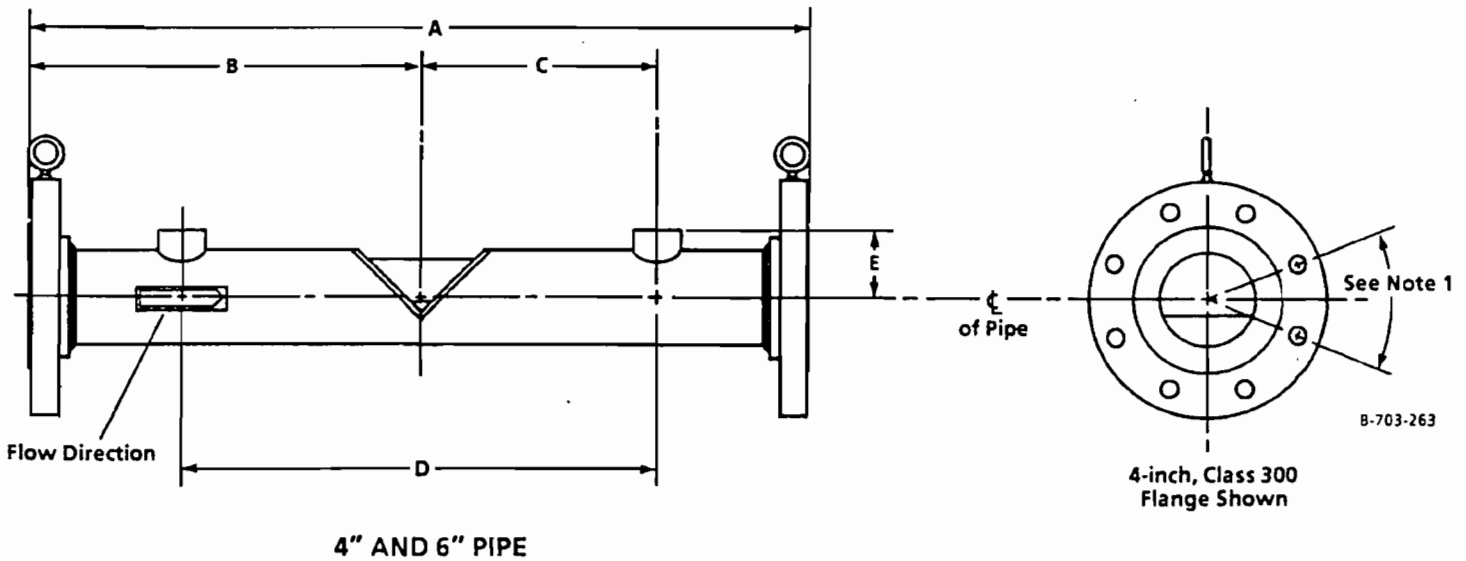
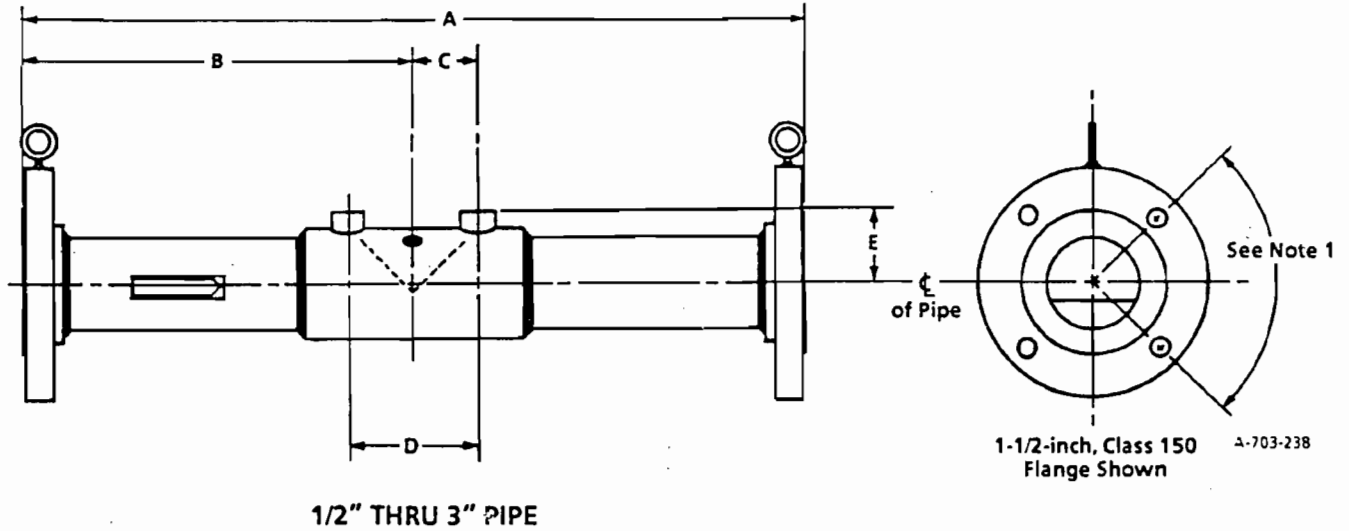
Date 5-5-93

<b>ABB Kent-Taylor</b>	
<b>MOUNTING DIMENSIONS</b>	
<b>WEDGE Flow Element for 302T-304T,306T Pneumatic Transmitters</b>	
<b>MD-L-1337-1</b>	<b>Issue 3</b>

\*Can be any digit.

Flange Ratings

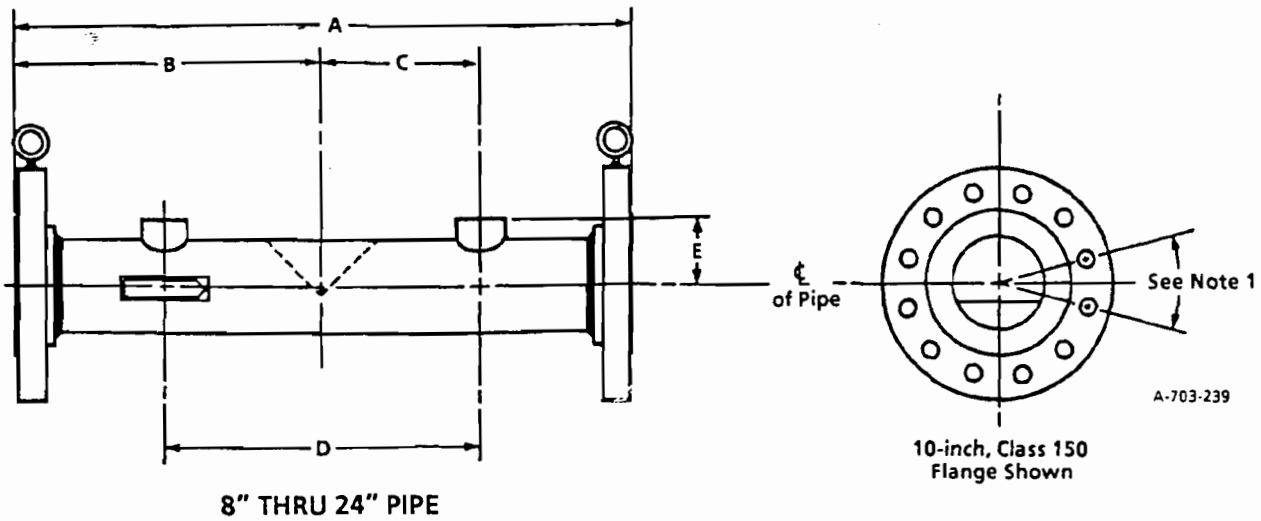
- Class 150 ANSI Raised Face Flange
- Class 300 ANSI Raised Face Flange
- Class 600 ANSI Raised Face Flange
- DIN ND 10 Flange
- DIN ND 40 Flange



Only items checked  apply. All dimensions in inches.  
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Cat. No. 1610LF15052A0211-2000  
 Cust. No. 53442S ABB Kent-Taylor No. 930401385  
 Also Refer to Dwgs.  
 Certified by M. Heischman Date 5-5-93

<b>ABB Kent-Taylor</b>
<b>MOUNTING DIMENSIONS</b>
<b>Flanged WEDGE Flow Element with 1/2-inch Pressure Connection</b>
MD-L-1610-3 Issue 3 Sheet 1 of 2



8" THRU 24" PIPE

10-inch, Class 150  
Flange Shown

A-703-239

INCHES	mm	INCHES	mm	INCHES	mm
0.50	12.70	7.43	188.72	14.87	377.70
0.75	19.05	7.76	197.10	15.00	381.00
0.96	24.38	7.94	201.68	15.50	393.70
1.00	25.40	8.00	203.20	16.00	406.40
1.50	38.10	8.75	222.25	16.50	419.10
1.59	40.39	8.76	222.50	16.76	425.70
1.89	48.01	8.94	227.08	17.50	444.50
1.90	48.28	9.62	244.35	18.00	457.20
2.00	50.80	9.76	247.90	19.00	482.60
2.12	53.85	9.94	252.48	20.00	508.00
2.69	68.33	10.00	254.00	21.00	533.40
2.72	69.09	10.62	269.76	22.00	558.80
3.00	72.20	10.76	273.30	24.00	609.60
3.19	81.04	10.94	277.88	25.00	635.00
4.00	101.60	11.00	279.40	26.00	660.40
4.25	107.95	11.78	298.70	27.50	705.98
4.81	122.17	12.00	304.80	28.00	711.20
5.25	133.35	12.12	307.85	30.00	762.00
5.31	134.87	12.50	317.50	31.00	787.40
6.00	152.40	13.00	330.20	33.00	838.20
6.06	153.92	13.12	333.25	35.00	889.00
6.31	160.74	13.75	349.25	36.00	914.40
6.56	166.62	13.78	349.50	38.00	965.20
6.88	174.75	14.00	355.60	42.00	1066.80
7.25	184.15	14.50	368.30	48.00	1219.20
7.31	185.67				

Note:

1. Flange bolt holes are equidistant from center of pipe.

Catalog Number	Pipe Size	Code C	Dimensions					Weight (lbs)		
			A	B	C	D	E	Class 150	Class 300	Class 600
1610LF05	1/2	C05	9.62	4.81	0.875	1.75	1.11	9	9	9
1610LF01	1	C01	10.62	5.31	1.12	2.25	1.34	13	15	16
1610LF15	1-1/2	C15	12.12	6.06	1.50	3.00	1.64	17	23	25
1610LF02	2	C02	13.12	6.56	1.90	3.80	2.12	25	29	33
1610LF03	3	C03	14.87	7.43	2.72	5.44	2.69	43	53	58
1610LF04	4	C04	20.00	10.00	5.00	10.00	3.19	65	83	109
1610LF06	6	C06	23.00	11.50	6.00	12.00	4.25	94	134	198
1610LF08	8	C08	26.00	13.00	7.25	14.50	5.25	120	178	274
1610LF10	10	C10	30.00	15.00	8.75	17.50	6.31	186	266	442
1610LF12	12	C12	31.00	15.50	10.00	20.00	7.31	260	374	
1610LF14	14	C14	33.00	16.50	11.00	22.00	7.94	327	497	
1610LF16	16	C16	35.00	17.50	12.50	25.00	8.94	410	624	
1610LF18	18	C18	38.00	19.00	13.75	27.50	9.94	478	770	
1610LF20	20	C20	42.00	21.00	15.50	31.00	10.94	595	953	
1610LF24	24	C24	48.00	24.00	18.00	36.00	12.94	828	1172	



Only items checked  apply. All dimensions in inches.  
Not for construction unless certified.

# Instructions for 1600L Series WEDGE™ Flow Elements

IB-4H115  
Issue 2  
Dec 1991

- 1610L Model A with NPT Instrument Connections
- 1615L Model A WAG WEDGE
- 1620L Model A Dual WEDGE Plate
- 1630L Model A with Remote Seal Instrument Connections

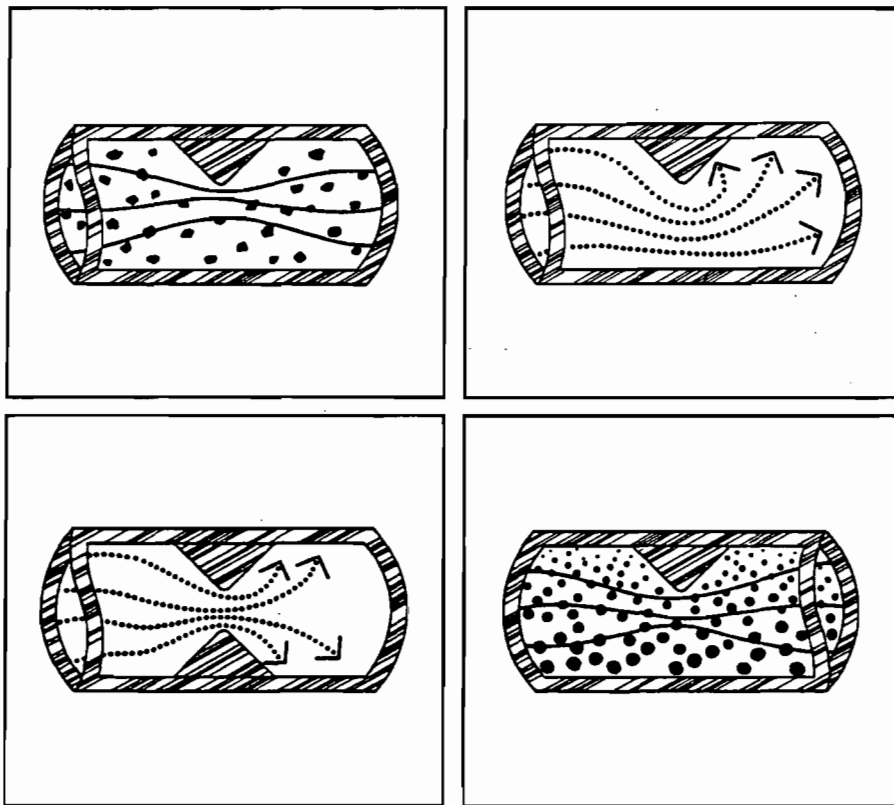


ABB Kent-Taylor

PID, INC.  
(Our Name Spells Control)

P.O. Box 230  
AUGUSTA, ME 04332  
(207) 623-8101

**ABB**  
ASEA BROWN BOVERI

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### Use of **DANGER**, **WARNING**, **CAUTION** and **NOTE**

This publication includes **DANGER**, **WARNING**, **CAUTION** and **NOTE** information where appropriate to point out safety related or other important information.

**DANGER** - Hazards which will result in severe personal injury or death.

**WARNING** - Hazards which could result in personal injury.

**CAUTION** - Hazards which could result in equipment or property damage.

**NOTE** - Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING** and **CAUTION** notices.

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Monel is a trademark of Huntington Alloy, Inc., The International Nickel Company, Inc.

Prepared by:

TECHNICAL COMMUNICATIONS DEPARTMENT

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**ABB Kent-Taylor**

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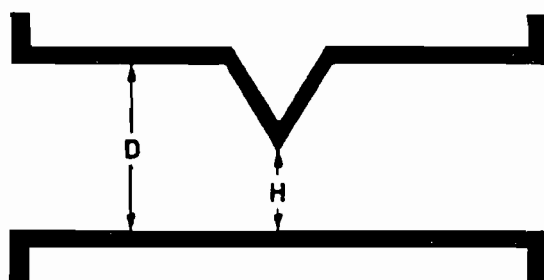
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## SECTION 1 INTRODUCTION

### 1.1 DESCRIPTION

#### 1.1.1 General

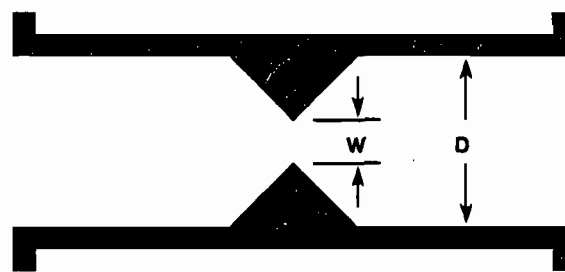
WEDGE™ Flow Elements utilize V-shaped restrictions to produce a square root relationship between differential pressure and volumetric flow. Elements are designed for either clean or dirty service and are offered in various materials, pipe sizes, and pressure ratings. Various connections on the WEDGE provide for either a pneumatic or electronic differential pressure transmitters or other differential pressure sensing devices. Calibrated elements are optional and are supplied with a factory calibration report, including calculations for the user's process when such data is supplied. Refer to 3.2 Accuracy and 3.3 Flow Equations.



S-703-280

#### 1610L, 1615L and 1630L WEDGE Flow Element

The area of unrestricted flow of the 1610L, 1615L and 1630L is determined by 1 of 4 different Height/Diameter ratios thus defining the differential range produced with respect to the fluid flow range. This H/D ratio equals the height of the opening under restriction divided by the internal pipe diameter.



S-703-264

#### 1620L Dual WEDGE Plate Flow Element

The area of unrestricted flow of the 1620L is determined by the selection of 1 of 3 different Width/Diameter ratios thus defining the differential range produced with respect to the fluid flow range. The W/D equates to the width of the opening between restrictions divided by the internal pipe diameter.

*Figure 1-1. Cross Section View of WEDGE Flow Element, H/D and W/D Ratios*

#### 1.1.2 Model 1610L – Clean Service

The 1610L WEDGE Flow Element offers in-line mounting in either a flanged or wafer style body with internal NPT taps for the connection of transmitter impulse lines. This model is well suited for gas and steam applications as well as clean liquids that may be dead ended in conventional static lead lines. The wafer style is offered in 316 SST with 1/2-inch through 4-inch pipe sizes; while the flanged version may be ordered in carbon steel, 316 SST, Hastelloy C and Monel with 1/2-inch through 24-inch sizes. Flange ratings up to ANSI 600# are available for both styles. Refer to Specification Sheet 4-50 for physical and performance specifications and ordering information.

## INTRODUCTION

---

### 1.1.3 Model 1615L – Water and Gas Service

---

The 1615L WEDGE Flow Element is designed to meet the strict demands found in water and gas injection applications. A single WAG WEDGE replaces two primary elements found on a typical injection skid and provides accurate measurement of water, carbon dioxide and static pressure. Offered in a wafer style 316 SST body, the 1615L is available in four pipe sizes ranging from ½ inch to 2 inches with an internal bore matching Schedule 40 pipe dimensions. All 1615L elements can be inserted between Class 150, 300, 600 or 1500 flanges with mounting hardware suitable to process line pressure. Minimum straight piping is recommended upstream and downstream of the element for optimum performance. Standard internal NPT taps are provided for connection to transmitter impulse lines. Refer to Specification Sheet 4-55 for physical and performance specifications and ordering information.

### 1.1.4 Model 1620L – Dual WEDGE Plate

---

Dual WEDGE elements are designed for clean service applications for any fluid that may be dead ended in conventional static lead lines. A wafer style 316 SST body is available in pipe sizes ranging from 1 inch to 4 inches with schedule 40 internal bore. Female pipe threads on either side of the restrictions allow for a connection to transmitter impulse lines. The Dual WEDGE may be inserted between Class 150, 300, 600 and 1500 flanges with mounting hardware suitable to process line pressure. Refer to Specification Sheet 4-56 for physical and performance specifications and ordering information.

### 1.1.5 Model 1630L – Dirty Service

---

The 1630L WEDGE Flow element is offered in a flanged body style and is designed for use with remote seal pressure transmitters. Application of this model is recommended for use on difficult to measure slurries and fluids with high solid content that are prone to plugging or have high erosion factors. In addition, the Model 1630L may also be used where it is necessary to contain hazardous materials within the process piping or where process temperatures exceed the limits of a conventional direct-connect transmitter. Sizes range from ½ inch through 24 inches (with materials and larger sizes offered as optional). Remote seal connections are offered in both the standard 3-inch wafer seal design or a chemical tee type seal design. Selection of either seal design is typically based on process conditions. The 3-inch wafer is generally suited for fluids with a high solid content and abrasive properties since the seal is raised up and eliminates erosive effects of the process on the diaphragm surface. The chemical tee type is more suited for processes that tend to plug since the diaphragm face is flush with the pipe ID, and allows free passage of materials without buildup in the seal area. Refer to Specification Sheet 4-51 for physical and performance specifications and ordering information.

## 1.2 DATA PLATE SERIAL NUMBER

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The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number contains a series of single and multiple character codes which provide specific information concerning the various size and structural options. Inquires regarding product installed in the field should reference the stamped serial number.

### 1.3 TECHNICAL CHARACTERISTICS

#### ACCURACY

Refer to Tables 1-1 and 1-2.

#### MAXIMUM WORKING PRESSURE

Flanged Element	Maximum working pressure is that of flange rating per ANSI B16.5, except forms with chemical tee transmitter connections that may not exceed 300 psi or flange rating, whichever is less.
Wafer Element	1440 psi at 100°F (37.8°C) or rating of mating flange, whichever is less.
Dual WEDGE Element	3600 psi at 100°F (37.8°C) or rating of mating flange whichever is less.

#### MAXIMUM WORKING TEMPERATURE

Dependent upon mating ANSI flange rating.

#### WEIGHT

Refer to Tables 1-3 through 1-5.

**Table 1-1. Accuracy, 1610L, 1615L, and 1630L**

Pipe Size in Inches	WEDGE Ratio H/D	Accuracy in % of Flow Span	
		Water Calibrated in ABB Kent-Taylor Flow Lab	Uncalibrated
1/2, 1, 1 1/2	0.2, 0.3, 0.4, 0.5	± 0.5% (± 0.75")	± 3%
2, 3, 4	0.2, 0.3, 0.4, 0.5	± 0.5%	± 3%
6 - 24	0.3, 0.4, 0.5	± 0.5%	± 3%

<sup>1</sup>/<sub>2</sub> inch pipe size

**Table 1-2. Accuracy, 1620L**

Pipe Size in Inches	WEDGE Ratio W/D	Accuracy in % of Flow Span	
		Water Calibrated in ABB Kent-Taylor Flow Lab	Uncalibrated
1, 1 1/2, 2 3, 4	0.2 0.3 0.4	± 0.75%	± 5%

**INTRODUCTION**

**Table 1-3. Weight (Approx.) – Flanged End Connection  
1610L, 1630L**

Pipe Size (Inches)	Flange Class					
	150		300		600	
	lbs	kg	lbs	kg	lbs	kg
1/2	23	10.4	23	10.4	23	10.4
1	26	11.7	29	13.1	30	13.6
1 1/2	43	19.5	49	22.2	51	23.1
2	51	23.1	55	24.9	59	26.7
3	69	31.3	79	35.8	84	38.1
4	91	41.2	109	49.4	135	61.2
6	115	52.1	155	70.3	219	99.3
8	140	63.5	198	89.8	294	133.3
10	206	93.4	286	129.7	462	209.5
12	280	127.0	394	178.7		
14	347	157.4	517	243.5		
16	430	195.0	644	292.1		
18	498	225.8	790	358.3		
20	615	278.9	973	441.3		
24	848	384.6	119	540.6		

**Table 1-4. Weight (Approx.) –  
Wafer Style End Connection  
1610L, 1615L**

Pipe Size (Inches)	lbs	kg
0.5	2	0.8
1	4	1.6
1.5	9	4.1
2	18	8.2
3	30	13.6
4	45	20.4

**Table 1-5. Weight (Approx.) –  
Dual WEDGE Plate  
1620L**

Pipe Size (Inches)	lbs	kg
1	2.5	1.1
1.5	5.5	2.5
2	10	4.5
3	17	7.7
4	25	11.4

## SECTION 2 MOUNTING AND INSTALLATION

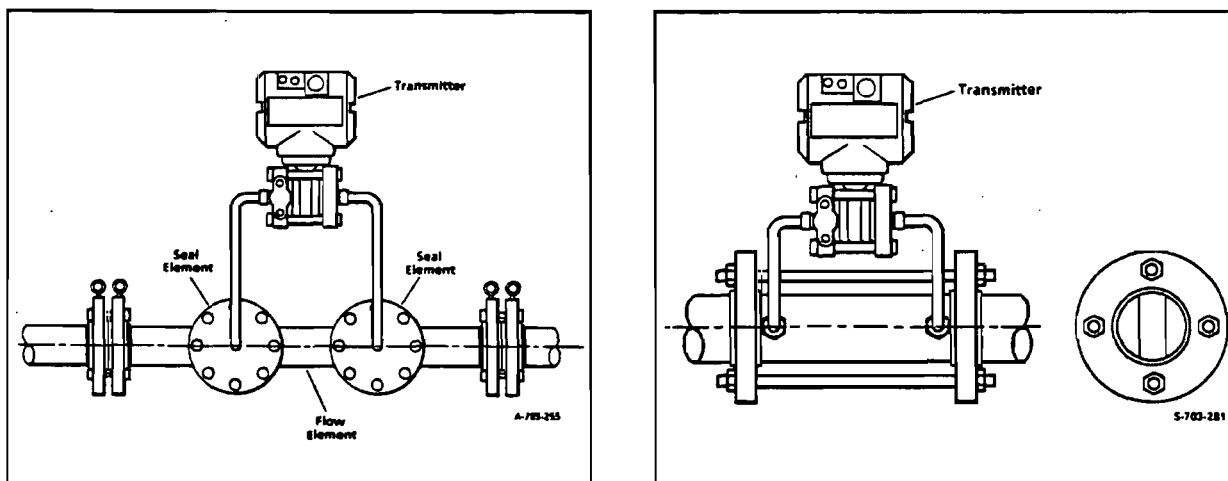
### 2.1 SELECTING A MOUNTING LOCATION

#### 2.1.1 General

A horizontal installation is recommended for all WEDGE elements rotated 45° to approximately 90° along the pipe center line as shown in Figure 2-1. This method of mounting allows for free passage of solids and eliminates air entrapment at the transmitter connection. Other positions are acceptable provided proper venting of the transmitter is accomplished and differences in lead line elevations are considered. Vertical installations as shown in Figure 2-2 may introduce a slight hydrostatic head effect which must be considered when zeroing the transmitter. Refer to **Section 3 Operation**.

#### 2.1.2 Straight Pipe Run Requirements

As with most flow elements, proper operation and performance is dependent on the required lengths of unrestricted upstream and downstream piping. The recommended minimum length of the upstream side of the 1610L, 1615L, and 1630L WEDGE Flow Element depends on the H/D ratio (the 1620L Dual WEDGE Plate depends on the W/D ratio), the type of fitting at the end of the straight run, and the pipe diameter. Minimum upstream lengths are shown in Table 2-1. WEDGE elements must have a length of straight unrestricted pipe on the upstream and downstream side of the restriction inside the element. The recommended minimum length of downstream straight pipe run is 6 pipe diameters (6D) for all pipe fittings.



**Figure 2-1. Typical Horizontal Installation of WEDGE and Dual WEDGE Plate Flow Elements**

**MOUNTING AND INSTALLATION**

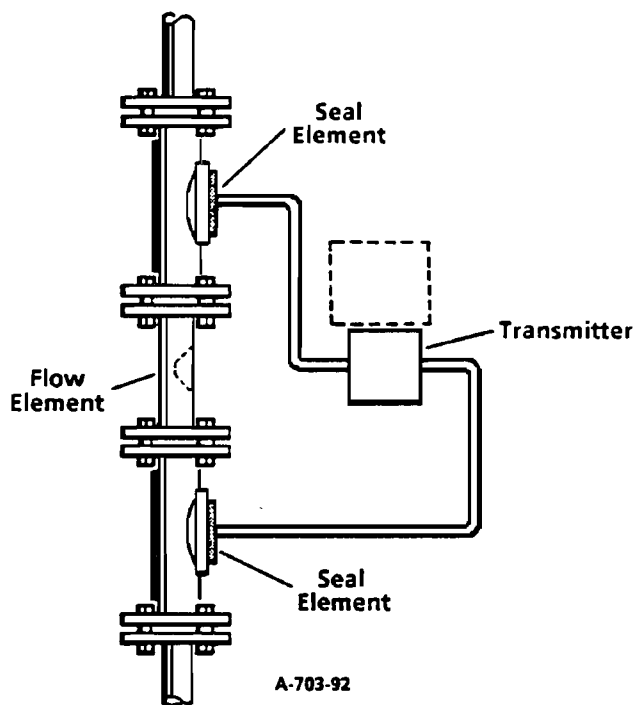


Figure 2-2. Typical Vertical Installation of Chemical Tee Type WEDGE Flow Elements

Table 2-1. Minimum Upstream Straight Pipe Lengths from Various Flow Obstructions

WEDGE Ratio	Minimum Upstream Straight Pipe Lengths - Inches			
	90° Elbow	Pipe Tee	Globe Valve	Gate Valve (Wide Open)
0.2	6D	6D	10D	6D
0.3	8D	8D	11D	6D
0.4	12D	10D	14D	8D
0.5	14D	12D	16D	10D

D = 1.049 for 1-inch pipe and 1.61 for 1½-inch pipe. WEDGE ratio digit of serial number is stamped on data plate.

---

## 2.2 INSTALLATION AND DIFFERENTIAL PRESSURE CONNECTIONS

---

### WARNING

*Never exceed the maximum pressure or temperature recommended for the measured process. Exceeding proper pressure or temperature ratings can lead to personal injury or equipment damage. The process piping flanges for installation should be identical as called out in the serial number on the data plate. The process temperature and pressure should never exceed the ratings for the element stamped on the data plate.*

### 2.2.1 General

---

Before installation of any WEDGE element inspect for damage; particularly at sealing surfaces. Any damage should be reported to the ABB Kent-Taylor Factory Service Department as soon as possible. Also check the data plate to ensure that the stamped ratings match the process conditions of the pipeline in which it will be installed. Each flow element has a data plate attached with an arrow indicating the required direction of flow. Failure to properly orientate the WEDGE element according to the direction of flow may result in improper results when using data supplied for an element that has been calibrated.

### 2.2.2 Line Installation

---

All WEDGE flow elements require a gasket between the process line connection and the wafer body or mating flange. Select gaskets that will be able to withstand the maximum process temperature and pressure and resist corrosive attack of the process itself. End gaskets and gaskets for the 3-inch wafer type seal are not provided by ABB Kent-Taylor. To provide safe installation, it is important that the pipeline flanges be suitable for the temperature and pressure of the measured process. When completing the bolting process, be sure that the gaskets are properly centered so that protrusion into the pipe opening is minimized. Misalignment may cause added flow turbulence, however performance affects are typically minimal depending upon the application. Bolt the element in line with suitable hardware using recommended bolt torques for the type and class rating of the flanges. Tables 2-2 and 2-3 list the maximum recommended torque values for 316 SST mounting studs.

### 2.2.3 Differential Pressure Connections

---

The high pressure connection is always on the upstream side of the flow direction arrow and the low pressure connection on the downstream side. WEDGE elements having NPT thread connections typically require use of 3/8-inch (minimum) impulse lines between the transmitter and WEDGE. Fittings used must be able to withstand the process temperature and pressure conditions as well as provide proper corrosion resistance. Refer to the appropriate transmitter manual for connections to the transmitter high and low ports.

The 3-inch wafer seals require a backup flange rated for the same type and class as that on the WEDGE element. Backup flanges with bolts and nuts are generally offered as an option to the transmitter and are not supplied with the WEDGE element. Again, observe recommended torque specifications for the type and class being used.

WEDGES ordered for chemical tee type seals are supplied with the seal mounting hardware and gaskets. Do not substitute the type of cap screws or gaskets supplied as injury may



## MOUNTING AND INSTALLATION

---

result due to improper installation. Refer to Figure 2-3 for the identification code of mounting screws. When installing chemical tee seals, tighten caps screws uniformly and avoid excessive tightening of one while others are loose. Final torque values are dependent on selected temperature rating of the WEDGE as two different gaskets are employed. Final torque values are:

400°F maximum temperature  
fiber gasket – 140-150 inch/pounds

650°F maximum temperature  
metal gasket – 110-120 inch/pounds

DO NOT EXCEED SPECIFIED TORQUE

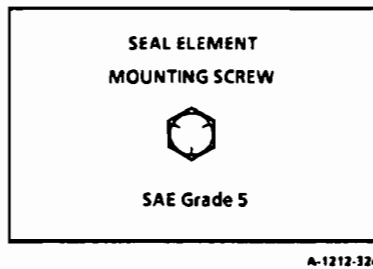


Figure 2-3. Mounting Screw Identification

### 2.2.4 Mounting Dimensions

---

Refer to mounting dimension drawings MD-L-1610-1, -2 and -3; MD-L-1615-1; MD-L-1620-1 and MD-L-1630-1, and -2.

## MOUNTING AND INSTALLATION

**Table 2-2. Maximum Recommended Torque Values  
1610L Wafer Style Design**

Pipe Size (Inches)	Flange Class	Bolt Size (Inches)	No. of Bolts	Torque (ft/lbs)
1/2	150	1/2	4	17
1/2	300	1/2	4	18
1/2	600	1/2	4	20
1	150	1/2	4	26
1	300	5/8	4	47
1	600	5/8	4	52
1 1/2	150	1/2	4	26
1 1/2	300	3/4	4	80
1 1/2	600	3/4	4	92
2	150	5/8	4	52
2	400	5/8	8	45
2	600	5/8	8	52
3	150	5/8	8	52
3	400	3/4	8	75
3	600	3/4	8	92
4	150	5/8	8	52
4	400	3/4	8	92
4	600	7/8	8	135

**NOTE:** If threads are lubricated, reduce torque by 25%.

## MOUNTING AND INSTALLATION

**Table 2-3. Maximum Recommended Torque Values  
1620L Dual Wafer Style**

Pipe Size (Inches)	Flange Class	Bolt Size (Inches)	No. of Bolts	Torque (ft/lbs)
1	150	1/2	4	45
1	300	5/8	4	96
1	600	5/8	4	96
1	1500	7/8	4	200
1 1/2	150	1/2	4	45
1 1/2	300	3/4	4	80
1 1/2	600	3/4	4	92
1 1/2	1500	1	4	270
2	150	5/8	4	96
2	300	5/8	8	96
2	600	5/8	8	96
2	1500	7/8	8	200
3	150	5/8	8	96
3	300	3/4	8	75
3	600	3/4	8	92
3	1500	1 1/8	8	408
4	150	5/8	8	96
4	300	3/4	8	92
4	600	7/8	8	200
4	1500	1 1/4	8	504

**NOTE: If threads are lubricated, reduce torque by 25%.**

---

## SECTION 3 OPERATION

### 3.1 STARTUP

---

Before any true zero reading can be taken it is necessary to establish that the process pipe and flow element are completely filled with the process fluid and that there is no flow. A shutoff valve or control valve downstream of the element will facilitate this condition. Opening the valve for a short period of time will remove any gases that are present in the system. In the case of the 1610L, 1615L and 1620L WEDGE, it is necessary to purge air from the transmitter body by opening the vent valves on the high and low side flanges. Any air present in the transmitter body will result in a false zero reading.

#### 3.1.1 Zero Check

---

With the flow element under full line pressure, at normal operating temperature, and at zero flow, the transmitter zero can be adjusted to an exact reading on the readout device. If possible, open the downstream valve for a few seconds and close it. The output should return to a zero reading. If it does not, readjust the zero screw on the transmitter. Repeat this procedure two or three times to establish a true zero.

#### 3.1.2 Span Check

---

In most cases, it will not be possible to check for the correct span as this would require a field calibration. The transmitter may be calibrated at the factory if ordered to agree with the calibration and/or calculation of the WEDGE flow element.

#### NOTE

A calibration report is supplied with each WEDGE flow element that is flow laboratory calibrated. Check that the maximum differential of the flow element agrees with the differential span of the transmitter. If it does not, it will be necessary to recalibrate the transmitter.

### 3.2 ACCURACY

---

All WEDGE flow elements that are calibrated in the ABB Kent-Taylor Flow Laboratory are calibrated to within  $\pm 0.5\%$  ( $\frac{1}{2}$ -inch 1610L, 1615L, and 1630 WEDGE and the 1620L WEDGE are  $\pm 0.75\%$ ) of the flow. The accuracy of uncalibrated elements may be up to 3% of flow span, depending upon the type of element, pipe size, and WEDGE ratio (refer to Table 1-1). Additional errors will be evident if the process fluid density differs from the designed value. Also, the same will be true if improper upstream pipe conditions exist. The percent errors given do not include the inherent errors of the transmitter which are normally very small until flow rates fall below 30% of maximum (9% of maximum differential pressure).

OPERATION

3.3 FLOW EQUATIONS

The standard flow equations for all WEDGE flow elements are as follows:

$$\text{Liquid Flow: } h = g_f \left[ \frac{q}{5.668 \times F_a \times Kd^2} \right]^2$$

$$\text{Gas Flow: } h = \frac{G \times T}{P} \left[ \frac{Q}{7727 \times F_a \times Y \times F_{pv} \times Kd^2} \right]^2$$

$$\text{Steam Flow: } h = \bar{V} \left[ \frac{W}{359 \times F_a \times Y \times Kd^2} \right]^2$$

- h = differential pressure, inches of water
- Kd<sup>2</sup> = WEDGE flow coefficient
- F<sub>a</sub> = expansion factor, Figure 3-1
- G = gas specific gravity
- g<sub>f</sub> = liquid specific gravity at flow conditions
- P = process pressure, psia (psig + 14.7)
- Q = gas flow rate, scfh
- q = liquid flow rate, U. S. gpm
- T = process temperature, °R (°F + 460)
- $\bar{V}$  = steam specific volume, ft<sup>3</sup>/lb
- W = steam flow rate, lb/hr
- Y = correction factor, Figure 3-2
- F<sub>pv</sub> = gas compressibility factor

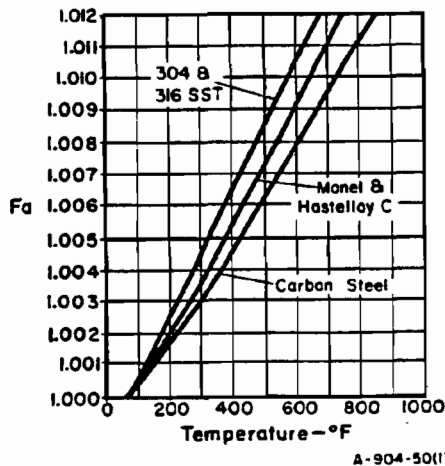


Figure 3-1. Expansion Factor (F<sub>a</sub>)

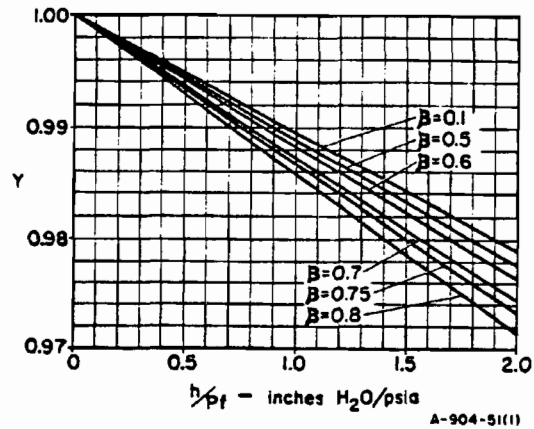


Figure 3-2. Correction Factor (Y)

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**3.4 METRIC CONVERSIONS**

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1 kPa	=	0.1450 psi	1 liter	=	0.2642 gal
1 bar	=	14.50 psi	1 imp gal	=	1.201 gal
1 kg/cm	=	14.22 psi	1 m/sec	=	3.281 ft/sec
1 mm Hg	=	0.5357 in. H <sub>2</sub> O	1 cu m/sec	=	35.32 cu ft/sec
1 m	=	3.281 ft	1 fg/hr	=	2.205 lb/hr
1 cm	=	0.3937 in.	°C	=	5/9 x (°F-32)

3-4

## SECTION 4 MAINTENANCE

### 4.1 REMOVING ELEMENT FROM SERVICE

---

#### CAUTION

*Process pressure and material retained in the flow element can cause injury and damage to equipment. Standard plant safety procedures must be followed when removing the element from service.*

The WEDGE has no moving parts that require servicing. Removal of the element is generally not required other than normal maintenance cleaning of process lines. Before removal, shut off all process flow, pressure, and drain lines if possible before loosening any bolts. Disconnect transmitter connections and remove impulse lines or remote seal elements. Loosen and disconnect element line connections and remove from process pipe line.

### 4.2 INSPECTION

---

General practices suggest that sealing surfaces be periodically checked for nicks and gouges before reinstallation. Elements under severe operating conditions should also be inspected for affects of corrosion and erosion to minimize unexpected shutdowns.

### 4.3 REINSTALLATION

---

Reinstallation should follow procedures outlined in **Section 2 Mounting and Installation**. Chemical tee seal screws should be applied with Molykote 505 or equivalent lubricant to prevent seizure of threads. Gaskets should be replaced upon reinstallation.



**MAINTENANCE**

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4-2

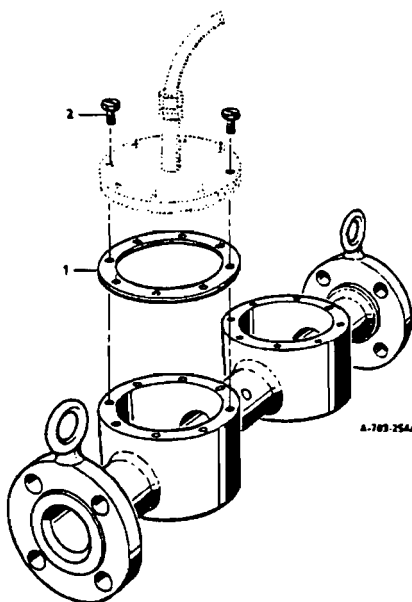
## SECTION 5 REPLACEMENT PARTS

### 5.1 1610LW MOUNTING KIT FOR WAFER STYLE WEDGE

(Consists of Stainless Steel mounting Studs and Nuts)

Pipe Size (Inches)	Flange Rating	Kit Number	Pipe Size (Inches)	Flange Rating	Kit Number
0.5	150 300/600	155S841-9	2.0	150 300/600	155S841-1
		155S841-10			155S841-2
1.0	150 300/600	155S841-11	3.0	150 300 600	155S841-3
		155S841-12			155S841-4
					155S841-5
1.5	150 300/600	155S841-13	4.0	150 300 600	155S841-6
		155S841-14			155S841-7
					155S841-8

### 5.2 1630LF REPLACEMENT PARTS



Ref	Description	Part No.	Qty Req'd
1	Gasket, Chemical Tee: Up to 204°C (399.2°F) Above 204°C (399.2°F)	43P1604	2
		43P1568	2
2	Chemical Tee Cap Screw	9P2342	16

**REPLACEMENT PARTS**

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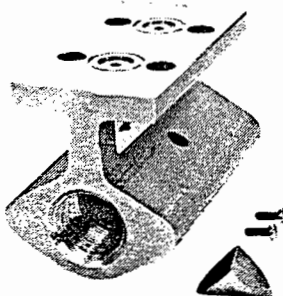


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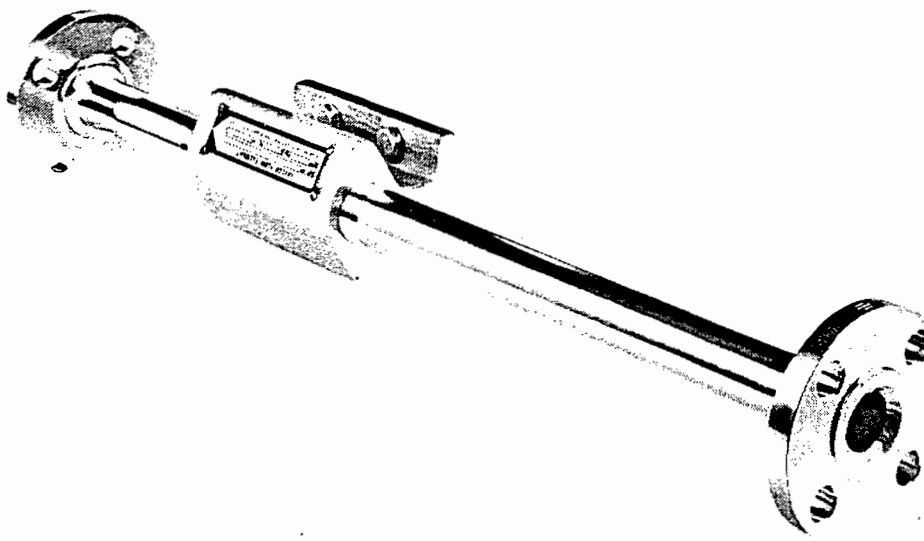
# Instructions for WEDGE™ Integral Flow Element

IB-4H103  
Issue 4  
Feb 1991

1335L, 1336L, 1337L Model A



E-703-71A



E-703-888

ABB Kent-Taylor

PID, INC.  
(Our Name Spells Control)

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### Use of **DANGER**, **WARNING**, **CAUTION** and **NOTE**

This publication includes **DANGER**, **WARNING**, **CAUTION** and **NOTE** information where appropriate to point out safety related or other important information.

**DANGER** - Hazards which will result in severe personal injury or death.

**WARNING** - Hazards which could result in personal injury.

**CAUTION** - Hazards which could result in equipment or property damage.

**NOTE** - Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING** and **CAUTION** notices.

## TRADEMARKS

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Prepared by:  
TECHNICAL COMMUNICATIONS DEPARTMENT 506

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## SECTION 1 INTRODUCTION

### 1.1 DESCRIPTION

---

The ABB Kent-Taylor Integral WEDGE Flow Elements are primary measuring elements which sense fluid flow and develop a differential pressure as a function of the volume flow rate. This differential pressure is measured by an ABB Kent-Taylor differential pressure transmitter. The differential pressure measurement can be related to volume flow rate by using either a calibration curve for the specific element or a standard flow equation applying to all WEDGE flow elements. A calibration report based on an ABB Kent-Taylor Flow Laboratory calibration is supplied with the element when specified on the order. Refer to **3.2 Accuracy** and **3.3 Flow Equations**.

The WEDGE elements are available with four different WEDGE ratios to provide the required differential pressures over a wide range of flow rates. The WEDGE ratio is defined as  $H/D$  where  $H$  is the WEDGE opening height and  $D$  is the nominal pipe diameter.

The integral WEDGE flow elements 1335L, 1336L, and 1337L connect directly to standard differential pressure transmitters with a 2-1/8 inch center-to-center distance between the high and low pressure ports. The ABB Kent-Taylor transmitters which accept these flow elements are available with either electronic or pneumatic output.

The integral WEDGE flow elements are available in 1 inch and 1-1/2 inch pipe sizes. The WEDGE restriction inside the element is removable. This permits the WEDGE ratio of the element to be changed in the field if process requirements change.

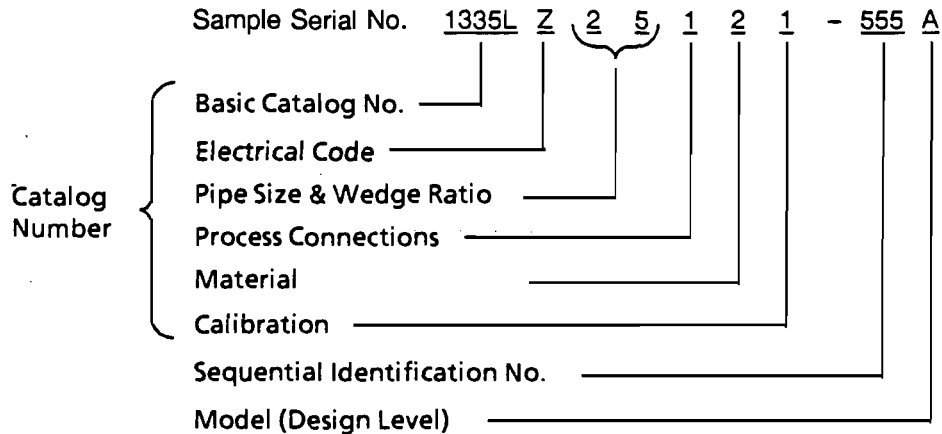
The WEDGE restriction is V-shaped at an optimum angle to give the best possible characteristics when measuring viscous fluids. The element will handle applications where the pipe Reynolds number is as low as 300 (well into the laminar flow zone) and as high as several million. This makes the element well suited to gas or steam flow measurement.

The body of the integral WEDGE element is machined to match the inside diameter of schedule 40 pipe. The 1335L element has internal National pipe thread process connections, and the 1336L has British Standard pipe thread connections. The 1337L element has a section of pipe threaded into the upstream and downstream ports in the element body. The pipe sections have flanged end connections with several flange options available. The pipe sections provide the minimum straight pipe lengths required for accurate operation.

## INTRODUCTION

### 1.2 EXPLANATION OF SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the element. An X before the catalog number indicates that the element has been built to meet a customer's special requirements.



#### BASIC CATALOG NUMBER

- 1335L - Integral WEDGE Flow Element with internal NPT connections
- 1336L - Integral WEDGE Flow Element with internal BSPT connections
- 1335L - Integral WEDGE Flow Element with flanged pipe sections

#### ELECTRICAL CODE

- Z - No Electrical Components

#### PIPE SIZE

- 2 - 1 inch
- 3 - 1-1/2 inch

#### WEDGE RATIO

- 2 - 0.2
- 3 - 0.3
- 4 - 0.4
- 5 - 0.5
- 9 - Special

#### PROCESS CONNECTIONS

- 0 - Internal thread
- 1 - Class 150 ANSI flanges
- 2 - Class 300 ANSI flanges
- 4 - BS 10 Table D flanges
- 5 - DIN ND10 flanges
- 6 - BS 10 Table H flanges
- 8 - DIN ND40 flanges
- 9 - Special

## INTRODUCTION

## MATERIAL

- 0 - Type 316 SST for NACE Standard per MR-01-81 (latest revision)
- 1 - Carbon Steel
- 2 - Type 316 SST

## CALIBRATION

- 0 - Not Calibrated
- 1 - Water Calibration
- 9 - Special

## EXAMPLE:

Serial number 1335LZ25121-555A identifies an Integral WEDGE Flow Element with flange connections (1335L). It has no electrical components (Z). The pipe size is 4 inches (2), the WEDGE ratio is 0.5 (5) and the process connections are Class 150 ANSI flanges (1). The material is Type 316 SST (2), and the element has been water calibrated (1). The sequential identification number is 555 and the design level is Model A.

## 1.3 TECHNICAL CHARACTERISTICS

## ACCURACY

Refer to Table 1-1

## MAXIMUM WORKING PRESSURE

1335L, 1336L

- 1 inch Pipe Size: 3000 psig (21 000 kPa) at 300°F (149°C)
- 1-1/2 inch Pipe Size: 1500 psig (10 000 kPa) at 300°F (149°C)

## MAXIMUM OPERATING TEMPERATURE

300°F (149°C)

## WEIGHT

- 1335LZ2 (1 inch Pipe Size): 7 lb (3.2 kg)
- 1335LZ3 (1-1/2 inch Pipe Size): 13 lb (5.9 kg)
- 1336LZ2 (1 inch Pipe Size): 7 lb (3.2 kg)
- 1336LZ3 (1-1/2 inch Pipe Size): 13 lb (5.9 kg)
- 1337LZ2 (1 inch Pipe Size): 17 lb (7.7 kg)
- 1337LZ3 (1-1/2 inch Pipe Size): 30 lb (13.6 kg)

Table 1-1. Accuracy

Catalog No.	Pipe Size Inches	Wedge Ratio (H/D)	Accuracy in % of Flow Rate	
			Calibrated With Water in ABB Kent-Taylor Flow Lab*	Uncalibrated
1335L	1, 1-1/2	0.2, 0.3	0.5	± 3
1336L				
1337L		0.4, 0.5	0.5	± 3

\*Refer to calibration curve supplied with each calibrated instrument

## INTRODUCTION

Table 1-2. Maximum Working Pressures for WEDGE Elements With Flanged Process Connections

## U. S. Units

Flange Type	Max. Working Pressure - psig			
	100°F	200°F	400°F	700°F
Class 150 ANSI	275	240	180	110
Class 300 ANSI	300	300	300	300
BS 10 Table D	100	100	100	65
DIN ND10	140	140	140	70
BS 10 Table H	300	300	300	300
DIN ND40	300	300	300	300

## SI Units

Flange Type	Max. Working Pressure - kPa			
	38°C	93°C	204°C	370°C
Class 150 ANSI	1900	1650	1240	760
Class 300 ANSI	2100	2100	2100	2100
BS 10 Table D	700	700	700	450
DIN ND10	980	980	980	480
BS 10 Table H	2000	2000	2000	2000
DIN ND40	2000	2000	2000	2000

## SECTION 2 INSTALLATION

### 2.1 SELECTING A MOUNTING LOCATION

#### 2.1.1 Integral Flow Elements

The recommended mounting location for integral elements is in the horizontal plane as shown in Figure 2-1. This location allows the integrally mounted differential pressure transmitter to be mounted in its recommended vertical position. Note that the WEDGE restriction is on its side and the opening is at the side of the pipe. The element is not recommended for use on slurries (liquids with entrained solids) when mounted in this position.

The integral element can be installed in a vertical line as shown in Figure 2-2. However, care must be taken to ensure that the transmitter measuring element is properly vented. With the transmitter on its side, the lower flange cavity is difficult to vent. Gas bubbles in this chamber can cause excessive zero shifts. Routine zero checks can minimize, if not eliminate, this problem. In a vertical installation, the flow direction can be either up or down.

#### 2.1.2 Straight Pipe Run Requirements

The 1335L and 1336L integral WEDGE elements must have a length of straight unrestricted pipe on the upstream and downstream side of the WEDGE restriction inside the element. The recommended minimum length of the upstream side of the WEDGE restriction depends on the WEDGE ratio (H/D), the type fitting at the end of the straight run, and the pipe diameter. Minimum upstream lengths are shown in Table 2-1. The recommended minimum length of downstream straight pipe run is 6 pipe diameters (6D) for all pipe fittings.

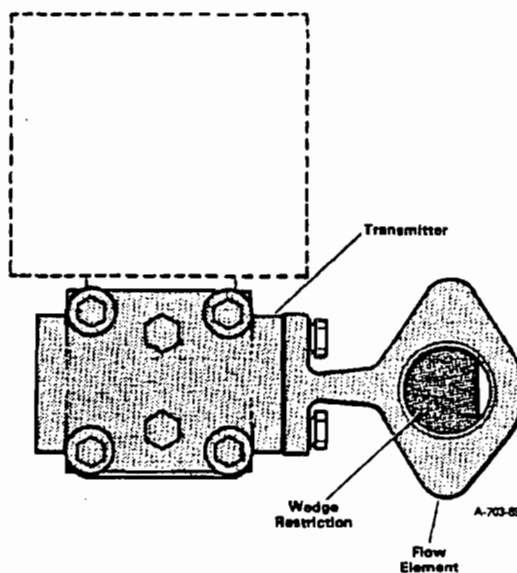
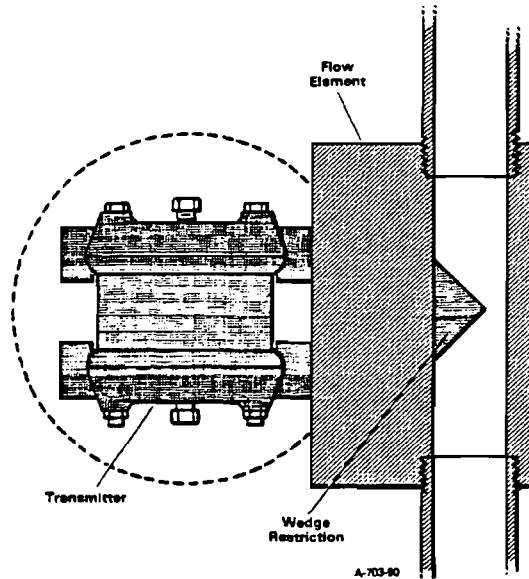


Figure 2-1. Horizontal Location of Flow Element

**INSTALLATION**

The 1337L element has the minimum upstream and downstream straight lengths built into the element. No additional straight pipe run is required.



*Figure 2-2. Vertical Location of Flow Element*

*Table 2-1. Minimum Upstream Straight Pipe Length Required for Various Flow Obstructions*

WEDGE Ratio	Minimum Straight Pipe Length - Inches			
	90° Elbow	Pipe Tee	Globe Value	Gate Value (wide open)
0.2	6D	6D	10D	6D
0.3	8D	8D	11D	6D
0.4	12D	12D	14D	8
0.5	14D	14D	16D	10D

D = 1.049 for 1-inch pipe size; 1.61 for 1-1/2-inch pipe size. WEDGE Ratio Digit of serial Number stamped on data plate. Refer to 1.2 Explanation of Serial and Catalog Numbers

---

## 2.2 MOUNTING AND DIFFERENTIAL PRESSURE CONNECTIONS

---

**WARNING**

*Exceeding the maximum pressure rating of the element can cause personal injury and damage to equipment. Make sure that process pressure does not exceed pressure rating (MWP) stamped on data plate.*

### 2.2.1 General

---

A data plate is attached to each flow element. Note that the plate has an arrow indicating the required direction of flow through the element. When mounting the element, be sure that the flow will be in the direction indicated by the arrow. The high pressure tap is always on the upstream side of the arrow and must be connected to the high pressure side of the differential pressure transmitter.

WEDGE flow elements with flanged ends require a gasket between each element flange and its mating process flange. End flange gaskets are not supplied by ABB Kent-Taylor. These gaskets should be of a type which will withstand the maximum process temperature, and resist corrosive attack by the process fluid. Asbestos gaskets are generally compatible with most process fluids.

When installing an element with flanged ends, it is important that the pipe line flanges be of the same class or type as the element flanges. The element flanges can be Class 150, Class 300, British Standard, or DIN.

Recommended upstream and downstream straight lengths of pipe should be provided for 1335L and 1336L elements. Refer to 2.1.2 Straight Pipe Run Requirements.

### 2.2.2 Integral Elements 1335L, 1336L, and 1337L

---

**WARNING**

*Maximum working pressure rating of element may be different than rating of transmitter. Exceeding the pressure rating can cause personal injury and damage equipment. Make sure that process pressure does not exceed lowest pressure rating of either the element or transmitter.*

Mounting dimension for the integral elements are shown in Figures 2-3 and 2-4. The integral WEDGE elements are supplied with two O-ring gaskets and four mounting screws for connection to a differential pressure transmitter with a 2-1/8 inch center-to-center distance between the high and low pressure ports. The O-rings and mounting screws are supplied in a poly bag with the element.

Remove the shipping cover taped to the mating surface of the element. Remove any foreign matter from the mating surfaces of the element and the transmitter. Properly position O-rings supplied in poly bag in the grooves of the element. Connect the element to the transmitter using the four mounting screws supplied in the poly bag. Be sure the high pressure side of the transmitter is on the upstream side of the flow direction arrow on

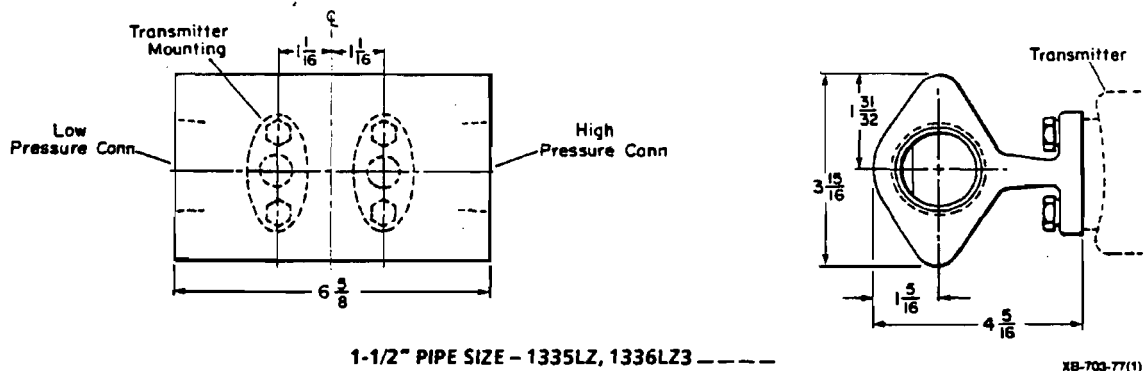
**INSTALLATION**

the element data plate. Tighten the four mounting screws to a torque of 250 to 300 in.-lb (28.2 to 33.9 Nm).

Mount the assembled transmitter and flow element in the pipe line. The transmitter should be supported independently by its mounting bracket. Refer to the transmitter instructions for mounting information. On 1335L and 1336L elements, a union connection is required in-line to permit installation of the element. On 1337L elements, mate the flanged ends of the element with the pipe line flanges, and insert a gasket between each pair of flanges. Be sure that the gaskets are properly centered on the flanges so they do not protrude into the pipe opening. Bolt the flanges together using the recommended torque specified for the class rating of the flanges. Ratings are stamped on each flange.

**NOTE**

If it is more convenient, the flow element can be mounted in the pipe line before connecting the transmitter to the element.

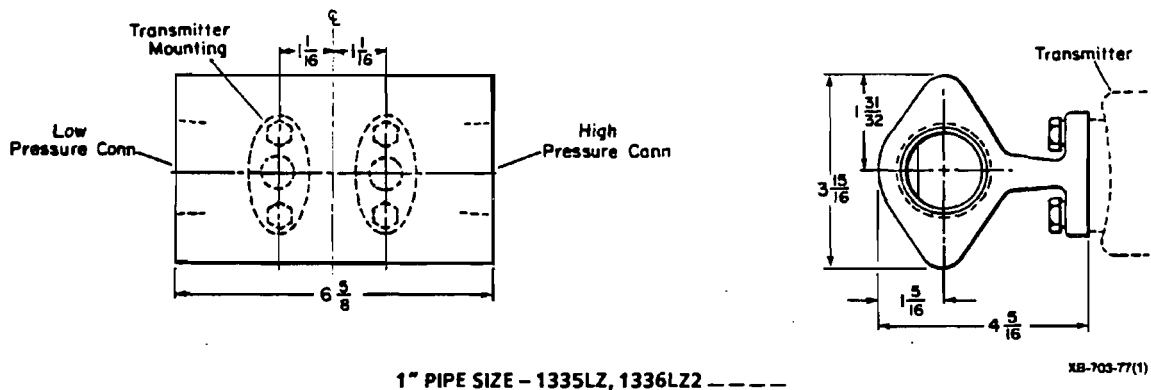


1-1/2" PIPE SIZE - 1335LZ, 1336LZ3 -----

Catalog No.	High and Low Pressure Connection
1335LZ2 -----	1-inch Int NPT
1335LZ3 -----	1-1/2 inch Int NPT
1336LZ2 -----	1-inch Int BSPT
1336LZ3 -----	1-1/2 inch Int BSPT

For reference only,  
not for construction.

All dimensions in inches.

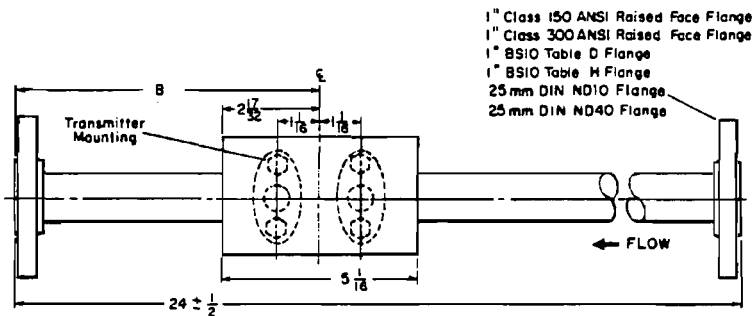


1" PIPE SIZE - 1335LZ, 1336LZ2 -----

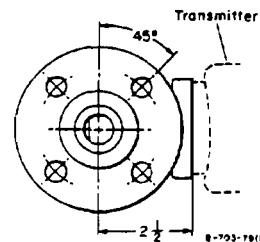
Figure 2-3. Mounting Dimensions for 1335L and 1336L Integral Elements



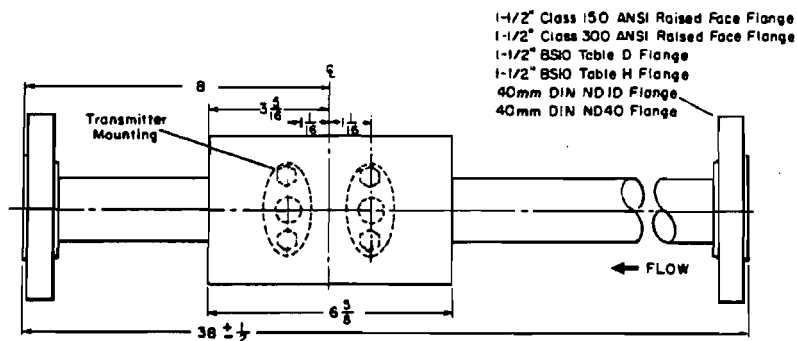
INSTALLATION



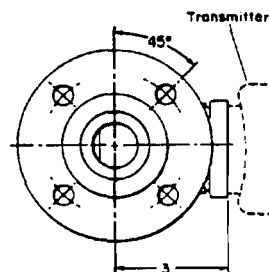
1-INCH PIPE SIZE - 1337LZ2 -----



INCHES	mm
2-1/2	63.50
3	76.20
5-1/16	128.59
6-5/8	168.28
8	203.20
30	762.20
38	965.20



1-1/2 INCH PIPE SIZE - 1337LZ3 -----



For reference only,  
not for construction.

All dimensions in inches.

Figure 2-4. Mounting Dimensions for 1337L Integral Element With Flanged Pipe Sections

IB-4H103

**INSTALLATION**

---

---

## SECTION 3 OPERATION

### 3.1 STARTUP

---

Before any true transmitter zero reading can be taken, it is necessary to establish that the process pipe and flow element are solid filled with process fluid and that there is no flow. A shutoff valve or control valve downstream from the element will facilitate this condition. Opening the valve for a short time will remove any gasses that are present in the system. It will also be necessary to purge air from the transmitter body by opening the vent valves on the high- and low-side flanges. Any air present in the transmitter body will cause a false zero reading.

#### 3.1.1 Zero Check

---

With the flow element under full line pressure, at normal operating temperature and at zero flow, the transmitter output can be adjusted to an exact zero reading on the readout device. If possible, open the downstream valve for a few seconds and then close it. The readout device should return to a zero reading. If it does not, readjust the zero screw on the transmitter. Repeat this procedure two or three times to establish a true zero.

#### 3.1.2 Span Check

---

In most cases it will not be possible to check for the correct span because this would require a field calibration. The transmitter associated with the WEDGE flow element may be calibrated at the factory to agree with the calibration and/or calculation of the element.

#### NOTE

A calibration report is supplied with each flow element that is calibrated in the ABB Kent-Taylor Flow Laboratory. Check the calibration report to see that the maximum differential of the element agrees with the differential span of the transmitter. If it does not, it will be necessary to recalibrate the transmitter. A flow data sheet with calculations is provided for flow elements that are not laboratory calibrated.

### 3.2 ACCURACY

---

All WEDGE flow elements that are calibrated in the ABB Kent-Taylor Flow Laboratory are calibrated to  $\pm 0.5\%$  of flow. The accuracy of uncalibrated flow elements may be 2 to 4% of flow span, depending on the type of element, pipe size and WEDGE ratio; refer to Table 1-1. Additional errors will occur if the process fluid density differs from the design value. Also, the same will be true if improper upstream pipe conditions exist. The percent errors given do not include the inherent errors of the transmitter which are normally very small until flow rates fall below 30% of maximum flow (9% of maximum differential pressure).

**OPERATION****3.3 FLOW EQUATIONS**

The standard flow equations for all WEDGE flow elements is as follows:

$$\text{gpm}_f = 5.668 \text{ Fa Kd}^2 \sqrt{\frac{h}{g_f}}$$

where	$\text{gpm}_f$	=	maximum gallons/minute at flowing temperature
	Fa	=	WEDGE expansion factor due to process temperature
	$\text{Kd}^2$	=	flow coefficient factor for WEDGE elements
	h	=	differential pressure in inches of water
	$g_f$	=	specific gravity of liquid at flowing temperature

**NOTE**

Fa,  $\text{Kd}^2$ , and h values can be obtained from the calibration curve or flow data sheet supplied with each WEDGE element. This data is shipped separately.

**3.4 METRIC CONVERSIONS**

1 kPa	=	0.1450 psi
1 bar	=	14.50 psi
1 kg/cm <sup>2</sup>	=	14.22 psi
1 mm Hg	=	0.5357 inches of water
1 meter	=	3.281 ft
1 cm	=	0.3937 inches
1 liter	=	0.2642 gals
1 Imp Gal	=	1.201 gals
1 meter/sec	=	3.281 ft/sec
1 cu meter/sec	=	35.32 cu ft/sec
1 kg/hr	=	2.205 lbs/hr
°C	=	5/9(°F - 32)

---

## SECTION 4 MAINTENANCE

---

### 4.1 REMOVING ELEMENT FROM SERVICE

---

**WARNING**

*Process pressure and material retained in the flow element can cause injury and damage to equipment. Standard plant safety procedures must be followed when removing the element from service.*

Shut off the process pressure before loosening any bolts. Disconnect the transmitter from the element by removing the four mounting bolts, Figure 4-1, connecting the element to the transmitter flanges, then disconnect the element from the process pipe line.

---

### 4.2 DISASSEMBLING WEDGE OR BODY

---

The WEDGE or body can be replaced by disassembling the element as shown in Figure 4-1. On the 1337L, it is not necessary to remove the connections from each side of the body if only the WEDGE is being replaced; remove only the shortest pipe length.

---

### 4.3 INSTALLING INTEGRAL WEDGE ELEMENT

---

When installing WEDGE, lubricate the WEDGE mounting screws, Figure 4-1, with Molkote 505 supplied in kit. Apply Molkote on screws to approximately 0.25 inch (6.35 mm) away from head of screw. Tighten screws to a torque of 12 to 15 in.-lb (1.4 to 1.6 Nm). Reconnect element to process pipe line as shown in Figure 4-1.

When connecting element to transmitter, the correct mounting must be used to maintain the specified pressure rating of the element. The identification code on the bolt heads must be as shown in Figure 4-1.

**NOTE**

When reconnecting the element to the transmitter, use new gaskets and torque connecting screws as specified under **2.2 Mounting and Differential Pressure Connections**.

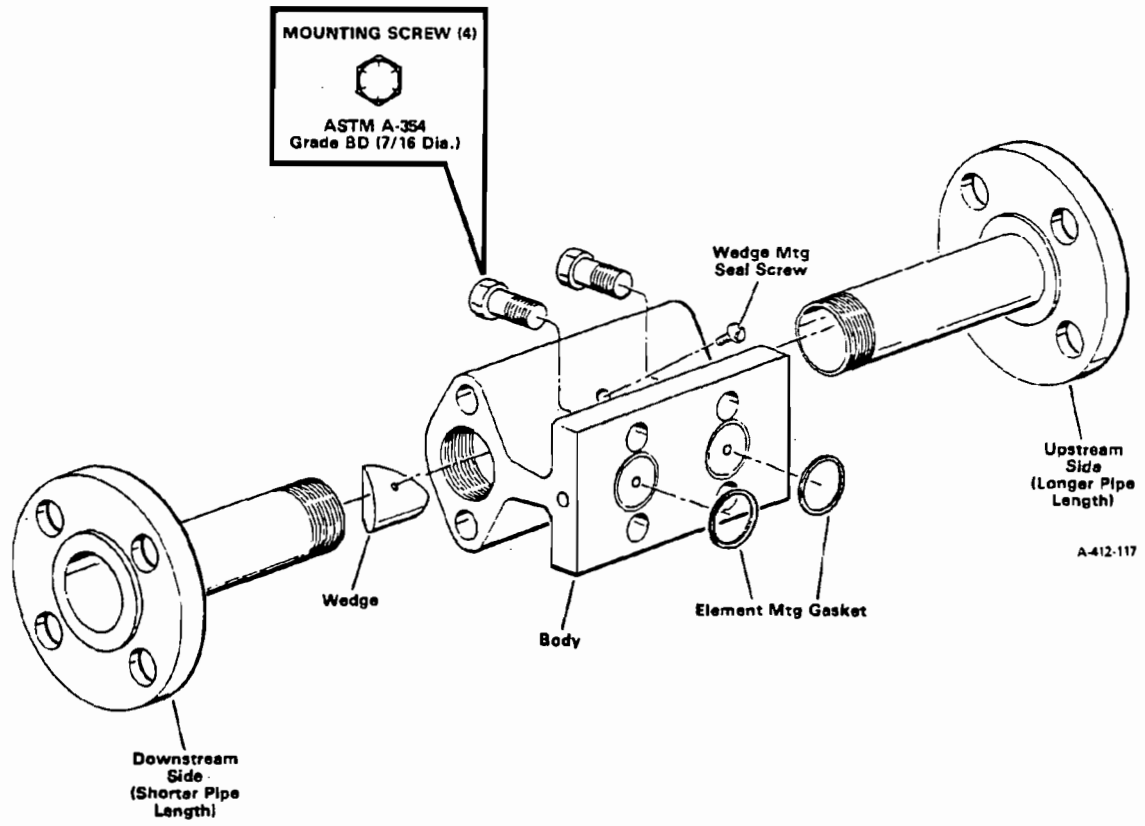


Figure 4-1. Exploded View of Integral WEDGE Flow Element

## SECTION 5 PARTS LIST

### 5.1 ORDERING INFORMATION

---

When ordering parts, always specify the complete serial number of the instrument.

### 5.2 RECOMMENDED SPARE PARTS

---

A plus (+) sign before the item number indicates that the item is a recommended spare part.

### 5.3 PARTS AVAILABILITY

---

This parts list may contain parts that are not saleable. These parts are identified with an asterisk (\*) in the part number column. They are listed and shown as required to provide a comprehensive breakdown of the assembly.

### 5.4 PARTS IDENTIFICATION

---

A dash (-) in the item number column indicates that the part is not illustrated in the referenced figure. A dash (-) in the part number column indicates there is no part identification available.

Some part descriptions have dots preceding them. These dots indicate that the parts are components of the assembly or subassembly (SA) which immediately proceeds them in the listing.

### 5.5 UNDERSCORE IDENTIFICATION

---

Underscores in place of characters in a catalog number (e.g. 1335LZ\_\_ \_ \_ \_ \_ - 555A) indicate any character may apply. Refer to **1.2 Explanation of Serial and Catalog Numbers**. Underscores in place of characters in a part number (e.g. 127S932-\_\_ \_) indicate that more than one character may apply. The part number may be referenced to another page or section for selection of required characters.

**PARTS LIST**

**5.6 PARTS LISTING**

Refer to Figure 5-1.

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>No. Req'd</u>
1	3P1424	Protective Cover	1
2	9P1566	Element Mounting Bolt, Grade BD	4
+3	9S385	WEDGE Mounting Seal Screw	2
4	27S_ _ _	Pipe and Flange, Downstream; refer to Table 5-1 for part numbers	1
5	27S_ _ _	Body and Flange, Upstream; refer to Table 5-1 for part numbers	1
6	33P_ _ _	WEDGE - 1337L; refer to Table 5-2 for part numbers	1
6	155S_ _ _	WEDGE Kit - 1335L, 1336L; refer to Table 5-2 for part numbers	1
7	42P_ _ _	Body - 1337L; refer to Table 5-2 for part numbers	1
7	155S_ _ _	Body Kit - 1335L, 1336L; refer to Table 5-2 for part numbers	1
+8	43P900-1	Element Mounting Gasket	2
9	43P2296	Label - 1337L	1
10	*	Data Plate	1
11	542M167	Protective Cover Retaining Nut, 7/16"-20	4

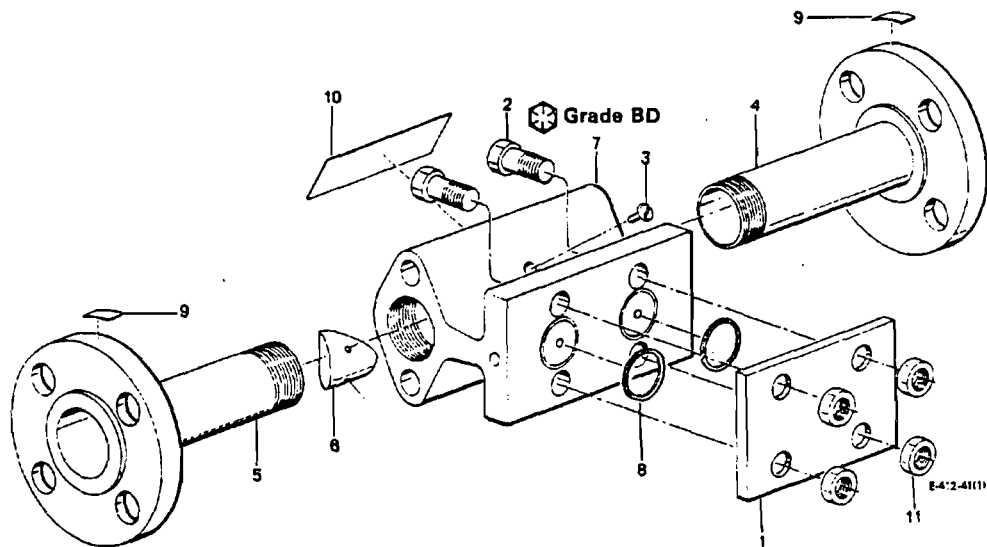
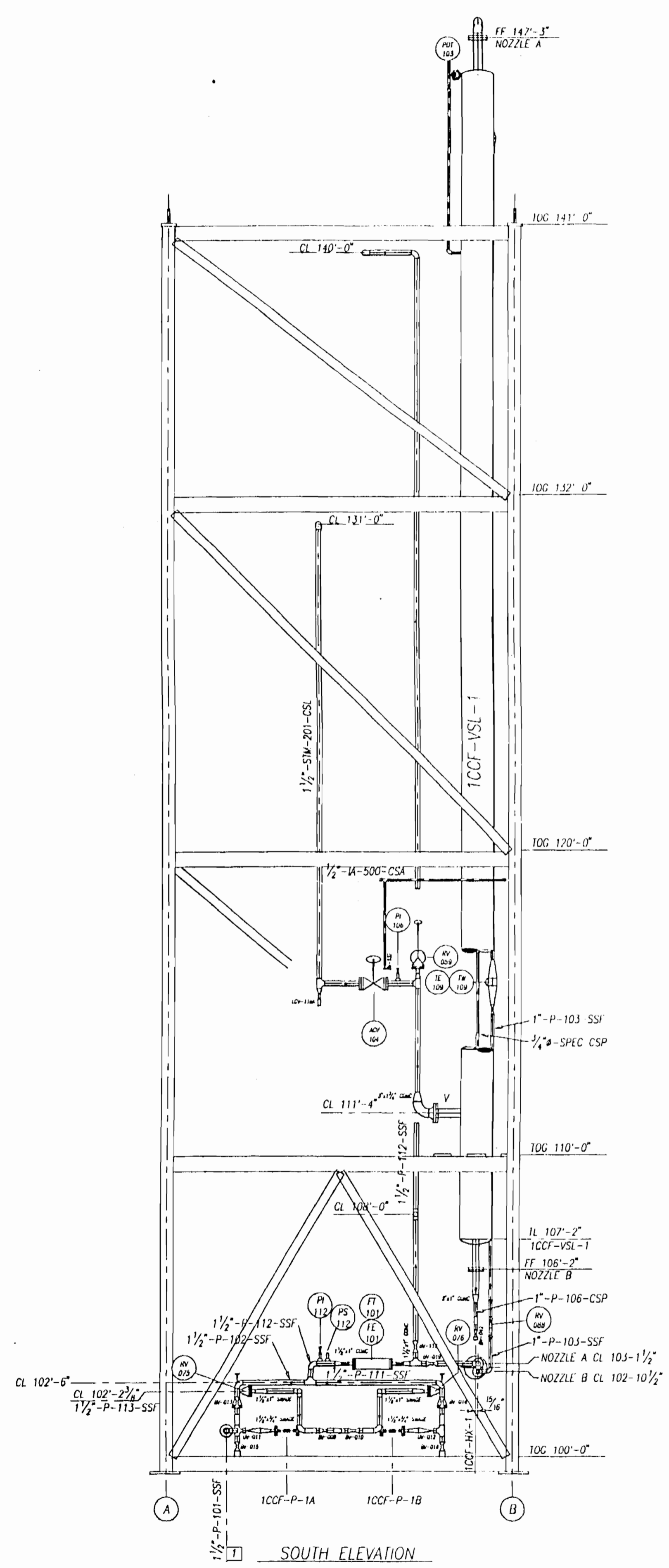


Figure 5-1. Integral WEDGE Flow Element

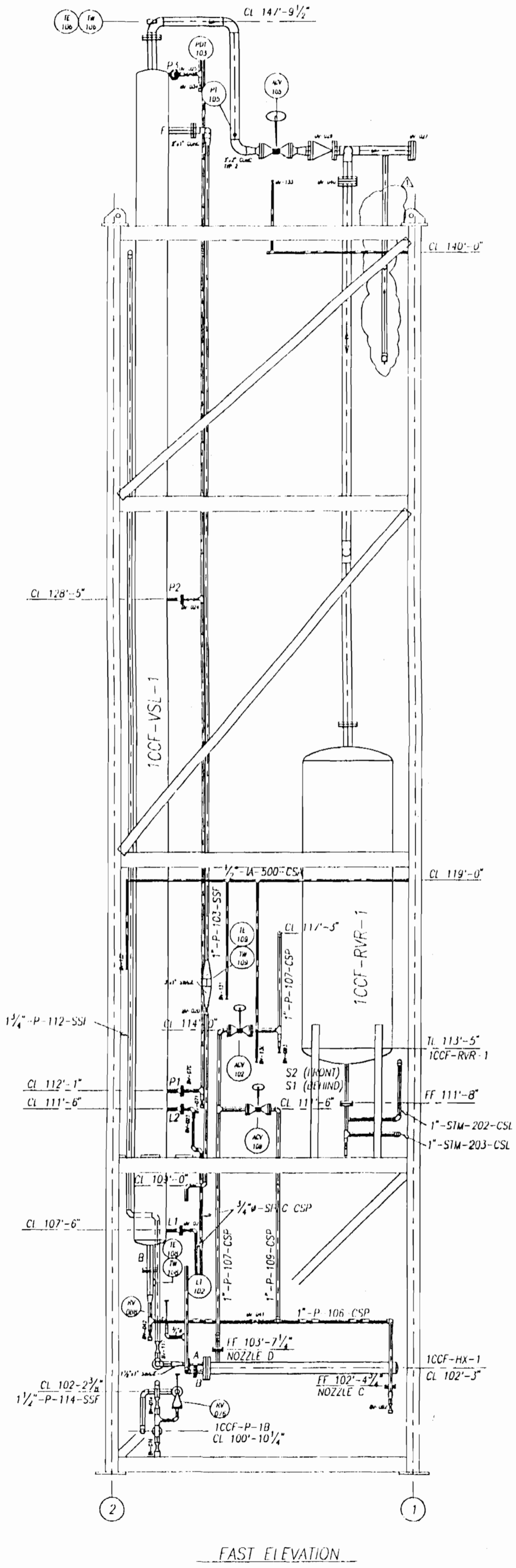


① 0310337

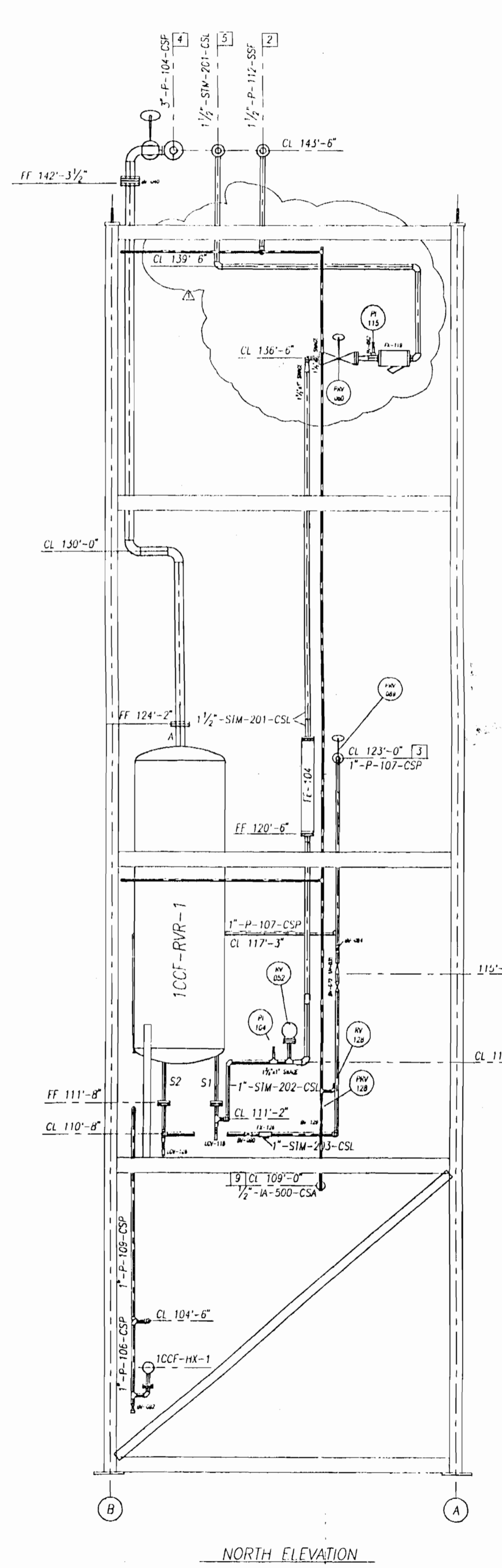
144-2  
352386 07877-03-02



SOUTH ELEVATION



FAST ELEVATION



NORTH ELEVATION

**PYROPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. 552586-D-7877-03-02  
B & V PROJECT 15637  
15637.62.3401

APPROVED FOR CONSTRUCTION  
DATE 6/22/93

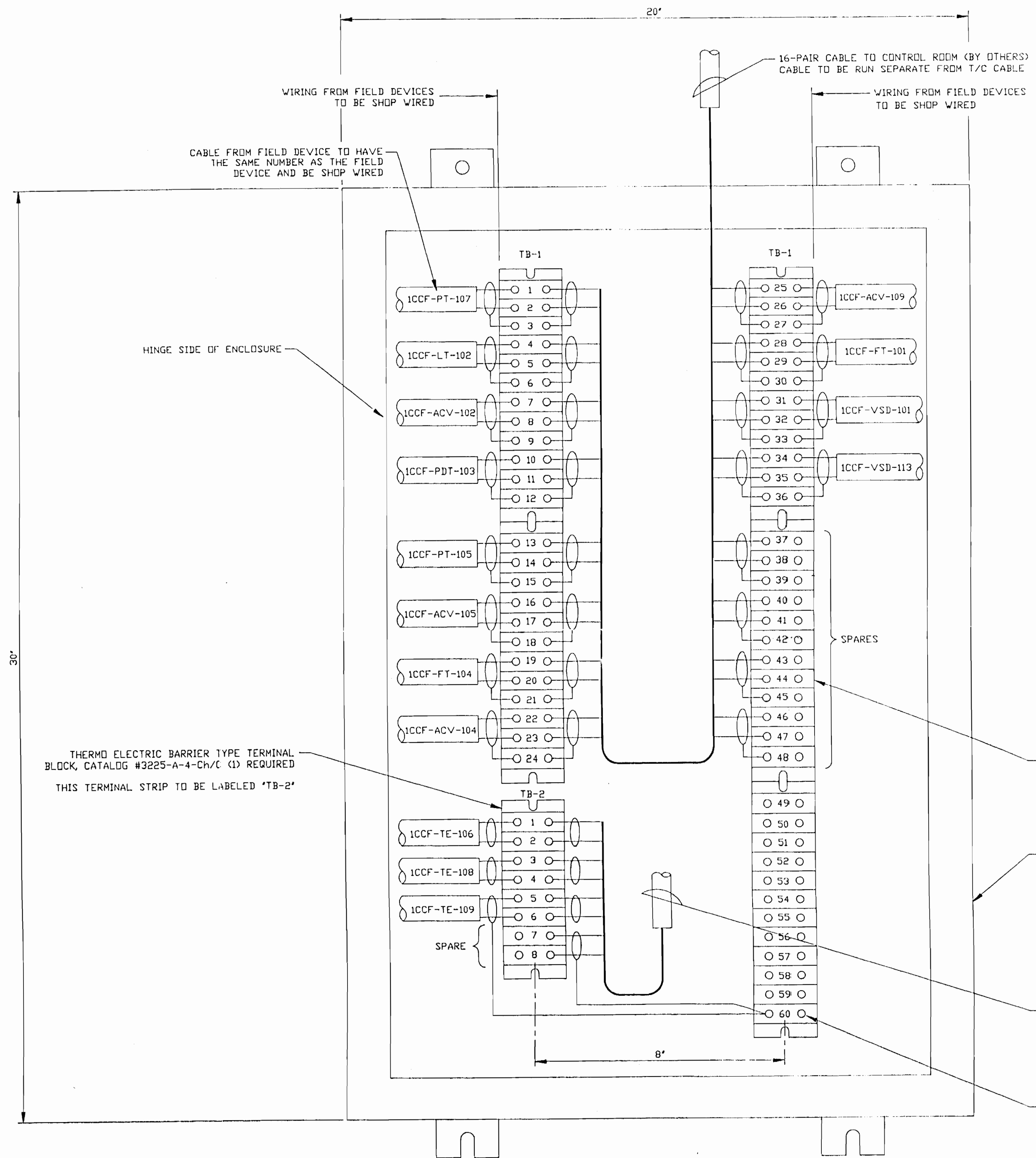
PYROPOWER CORPORATION	
SELLER'S REVIEW STATUS	
A	Working Drawings Not for Construction
B	Working Drawings Subject to Change
C	Working Drawings for Construction
D	Working Drawings for Construction
E	Working Drawings for Construction
REVIEWED BY	DATE
Mt	6-28-93

CERTIFIED  
BY RL DATE 6-22-93

1	CHANGED LINE SIM-201	6/18/93	
SYMBOL	DESCRIPTIONS	DATE	APPVD
REVISIONS			
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<b>GLITSCH, INC.</b>			
Package Plants Division		PIPING ELEVATIONS	
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		SCALE 3/8"=1'-0"	
DRAWN DC	DATE 4/29/93	JOB NO. 6J-7877	REV.
CHECK	DATE	DRAWING NO.	REV.
ENGR.	DATE	D-7877-03-02	1







**N O T E :**

- FABRICATOR TO PROVIDE A PHENOLIC ENGRAVABLE NAMEPLATE ON THE JUNCTION BOX DOOR WITH THE JUNCTION BOX TAG NUMBER (THIS BOX TO BE LABELED 'JUNCTION BOX #1CCF-JBX-3')

MARATHON SERIES 1500 HEAVY DUTY TERMINAL BLOCKS, CATALOG #1512 STD (5) REQUIRED THESE (5) STRIPS TO BE LABELED 'TB-1'

HOFFMAN ENGINEERING NEMA 4 ENCLOSURE CATALOG #A-30H20ALP WITH INTERIOR MOUNTING PANEL, CATALOG #A-30P-20

4-PAIR THERMOCOUPLE EXTENSION CABLE TO CONTROL ROOM BY OTHERS. SEE DRAWING D-7877-06-01 FOR CABLE SPECIFICATIONS. THIS CABLE TO BE RUN IN SEPARATE CONDUIT TO CONTROL ROOM.

TERMINAL #60 ON 'TB-1' TO BE USED TO CONNECT ALL SHIELDS FROM THERMOCOUPLE EXTENSION CABLES. SHIELDS TO BE GROUNDED AT DCS ONLY.

APPROVED	
SAN DIEGO, CALIFORNIA	
DATE	REV
5/25/93	3
PROJECT 15637	
15637-02-0401	

APPROVED FOR CONSTRUCTION  
BY *SELL* DATE JUN 4 1993  
GLITSCH PACKAGE PLANTS

1	REVISED AS PER PYROPOWER COMMENTS	5/26/93	SCH
0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPROV

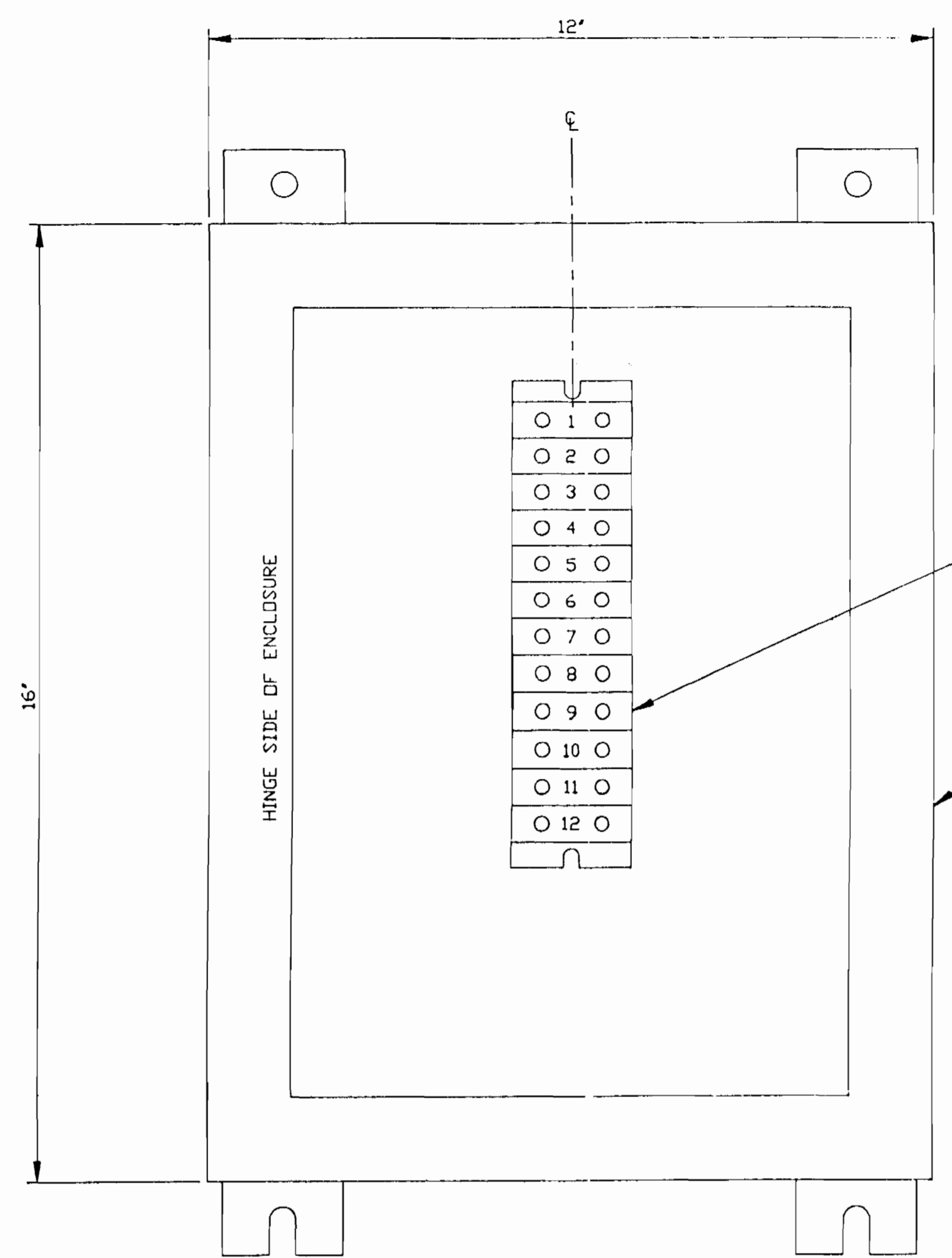
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Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		INSTRUMENT JUNCTION BOX #1CCF-JBX-3 FOR STRIPPER SKID	
SCALE	HALF SIZE	JOB NO.	6J-7877
DRAWN	J E R R Y	DATE	4/16/93
CHECK		DATE	
ENGR.		DATE	
		DRAWING NO.	D-7877-05-01
		REV.	1

<b>AHLSTROM</b>	
SELLER DOCUMENT REVIEW STATUS	
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<input checked="" type="checkbox"/>	Reviewed for Compliance
<input checked="" type="checkbox"/>	Reviewed for Safety
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<input checked="" type="checkbox"/>	Reviewed for Risk
<input checked="" type="checkbox"/>	Reviewed for Overall
DATE	4/18/93

FRONT VIEW OF JUNCTION BOX #1CCF-JBX-3  
(DOOR REMOVED FOR CLARITY)

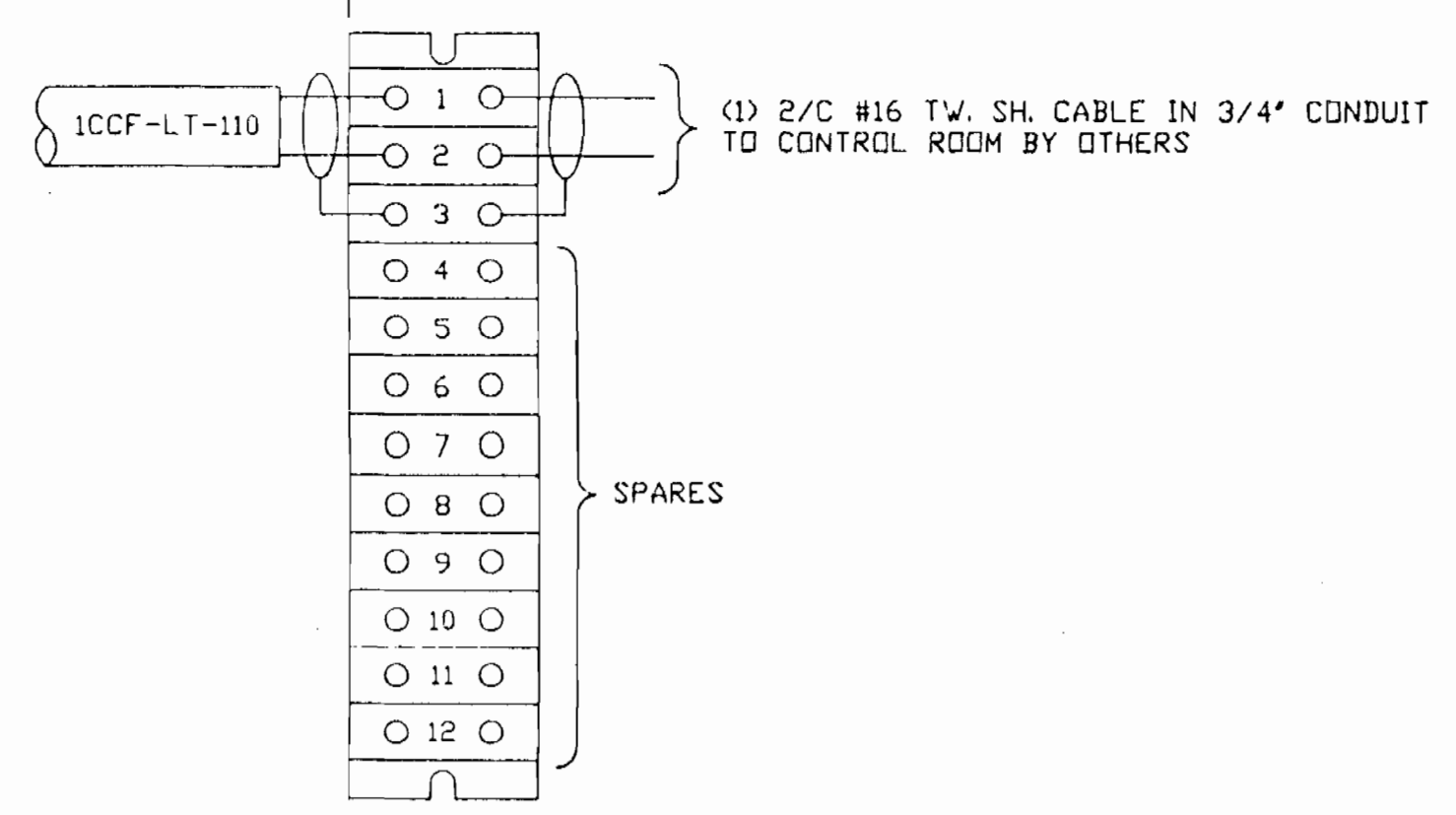


MARATHON SERIES 1500 HEAVY DUTY TERMINAL BLOCK, CATALOG #1512 STD (1) REQ'D PER BOX

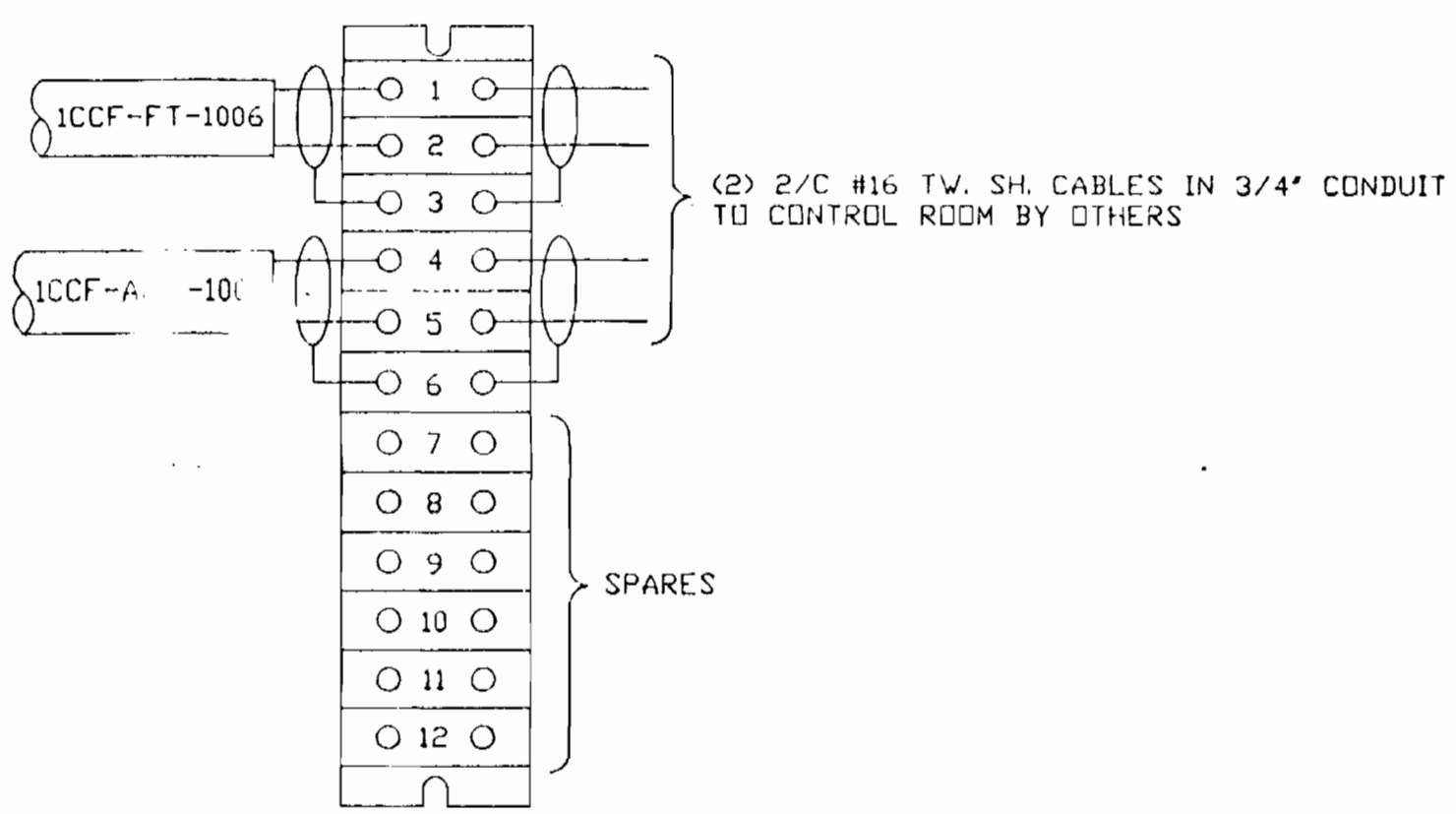
HOFFMAN ENGINEERING NEMA 4 ENCLOSURE CATALOG #A-16H12ALP WITH INTERIOR MOUNTING PANEL, CATALOG #A-16P12

FRONT VIEW OF TYPICAL JUNCTION BOX  
(DOOR REMOVED FOR CLARITY)

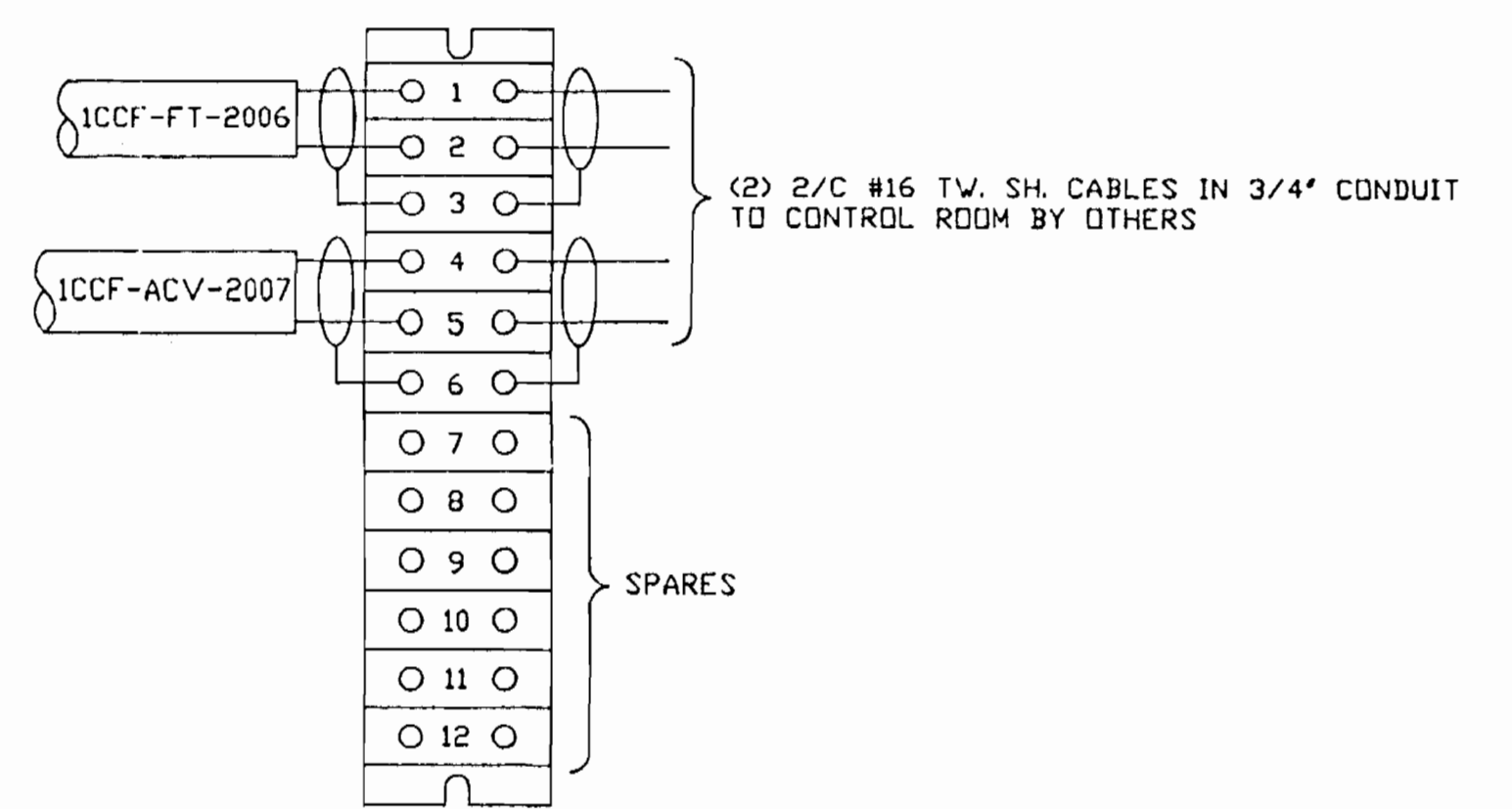
WIRING FROM FIELD DEVICES TO BE SHDP WIRED (TYPICAL)



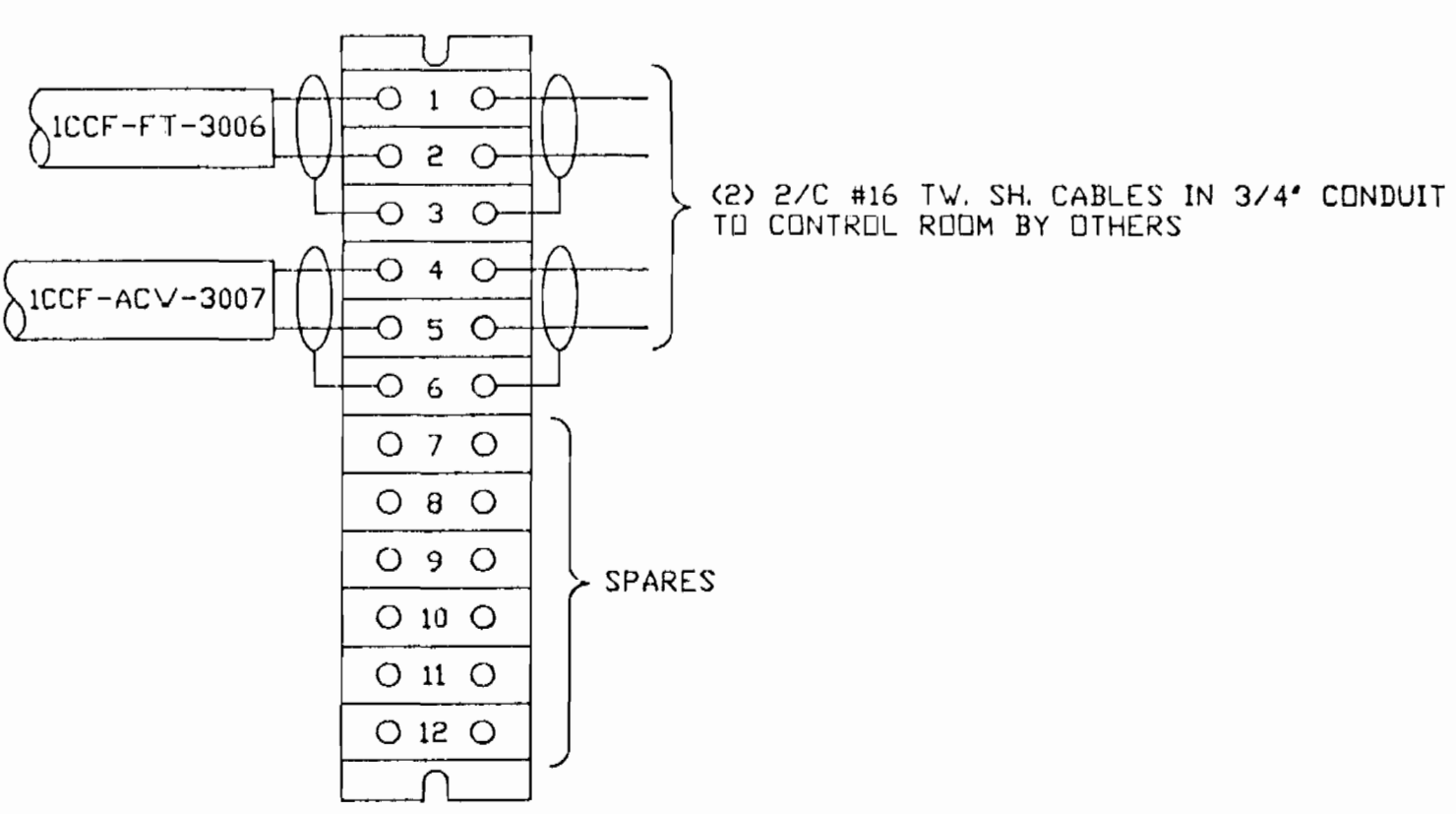
TERMINAL ARRANGEMENT FOR  
AQUEOUS AMMONIA STORAGE TANK SKID  
JUNCTION BOX #1CCF-JBX-1



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1A" JUNCTION BOX  
#1CCF-JBX-1001



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1B" JUNCTION BOX  
#1CCF-JBX-2001



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1C" JUNCTION BOX  
#1CCF-JBX-3001

- NOTE:**
- THIS DRAWING IS FOR THE FABRICATION OF (4) INSTRUMENT JUNCTION BOXES. THE BOXES ARE FOR THE AQUEOUS AMMONIA STORAGE TANK SKID AND THE AMMONIA VALVE RACK '1A', '1B' AND '1C' SKIDS.
  - INSTALLER TO PROVIDE A PHENOLIC ENGRAVABLE TYPE NAMEPLATE ON EACH JUNCTION BOX DOOR WITH THE JUNCTION BOX TAG NUMBER ON IT (EXAMPLE: 'JUNCTION BOX #1CCF-JBX-'X', WHERE 'X' IS THE NUMBER INDICATED ON THE TERMINAL DETAILS).

APPROVED FOR  
CONSTRUCTION  
BY *SAU* JUN 04 1993  
GLITSCH PACKAGE PLANTS

<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
DRAWING NO.	REV
552536-D-7877-05-03	3
B & V PROJECT 15637	
15637.62.3401	

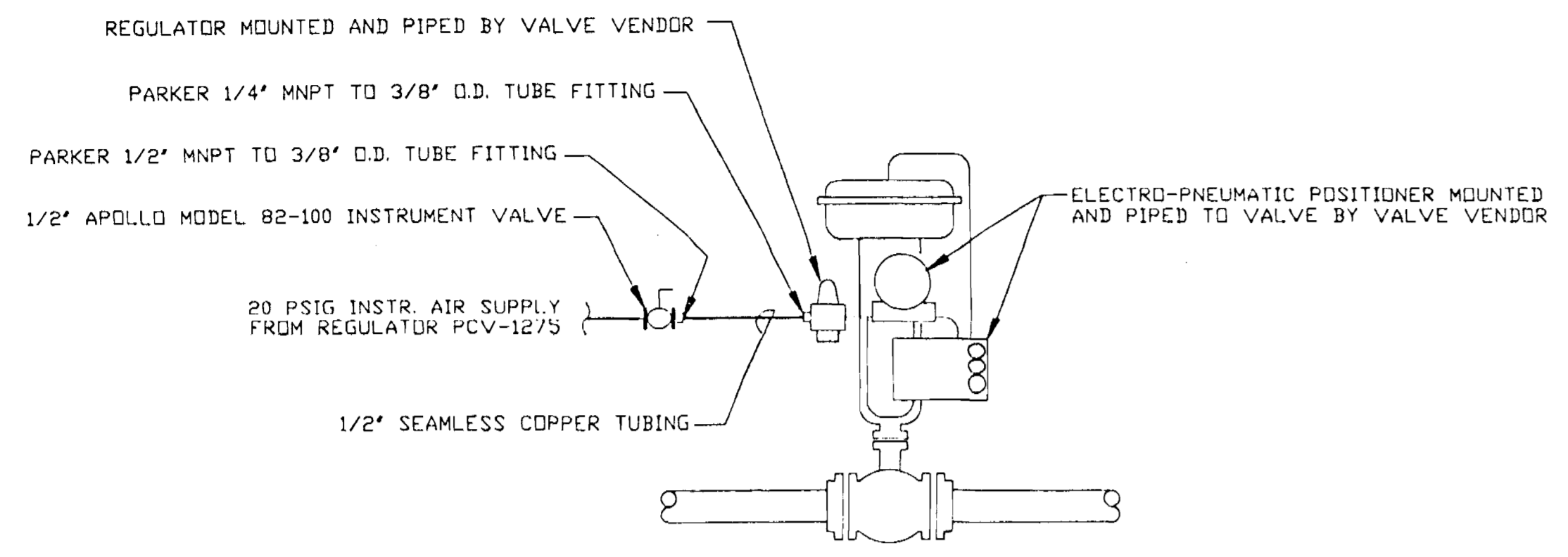
0	REVISED AS PER PYROPOWER COMMENTS	5/10/93
SYMBOL	DESCRIPTIONS	DATE
REVISIONS		

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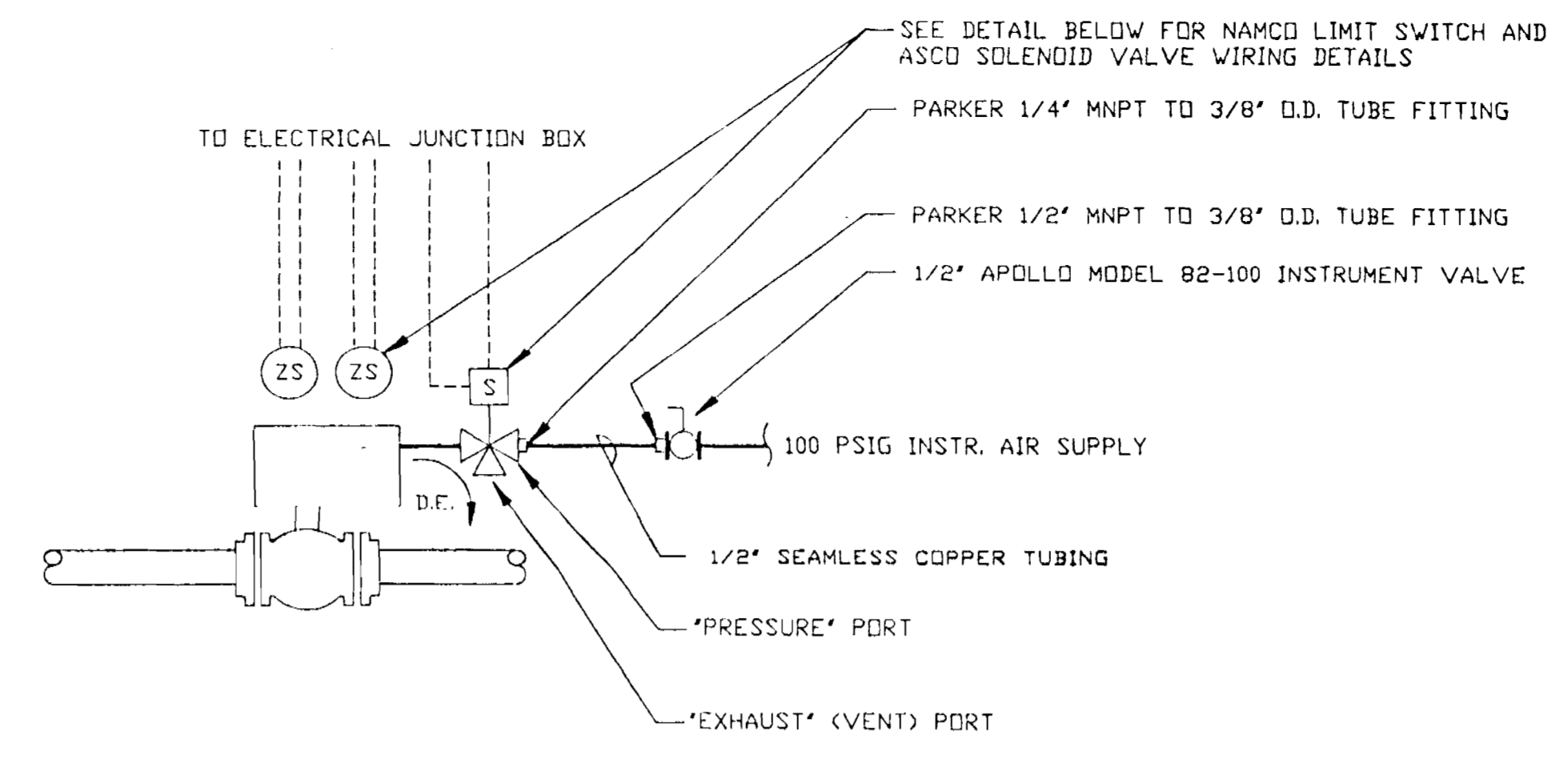
**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		INSTRUMENT JUNCTION BOXES FOR AUXILIARY SKIDS	
SCALE	HALF SIZE	JOB NO.	6J-7877
DRAWN	JERRY	DATE	4/17/93
CHECK		DATE	
ENGR.		DATE	
DRAWING NO.		D-7877-05-02	REV.
			0

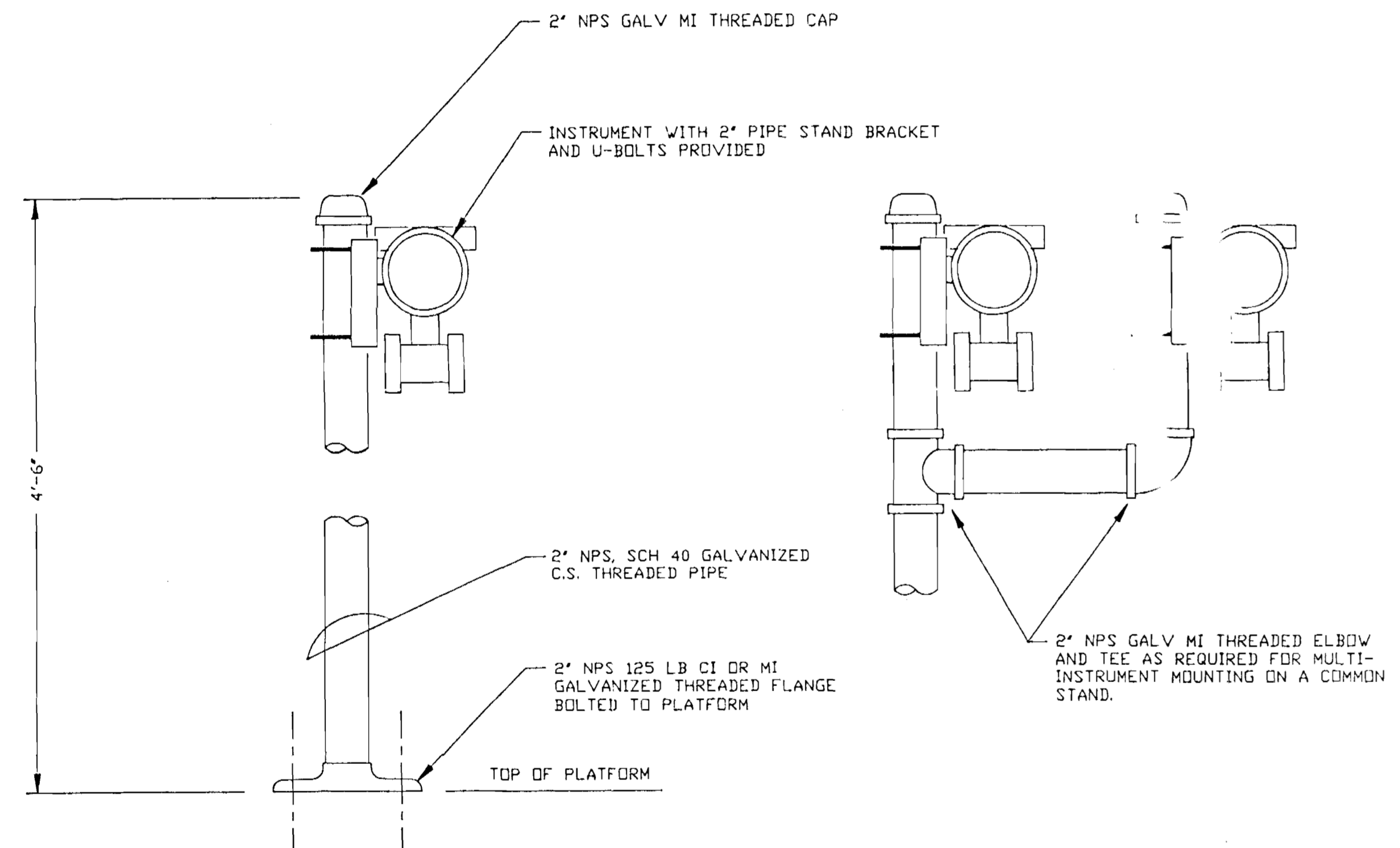
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<input type="checkbox"/>	Check All Printed, Review Not Required
Reviewed by: <i>[Signature]</i> 6-18-93	



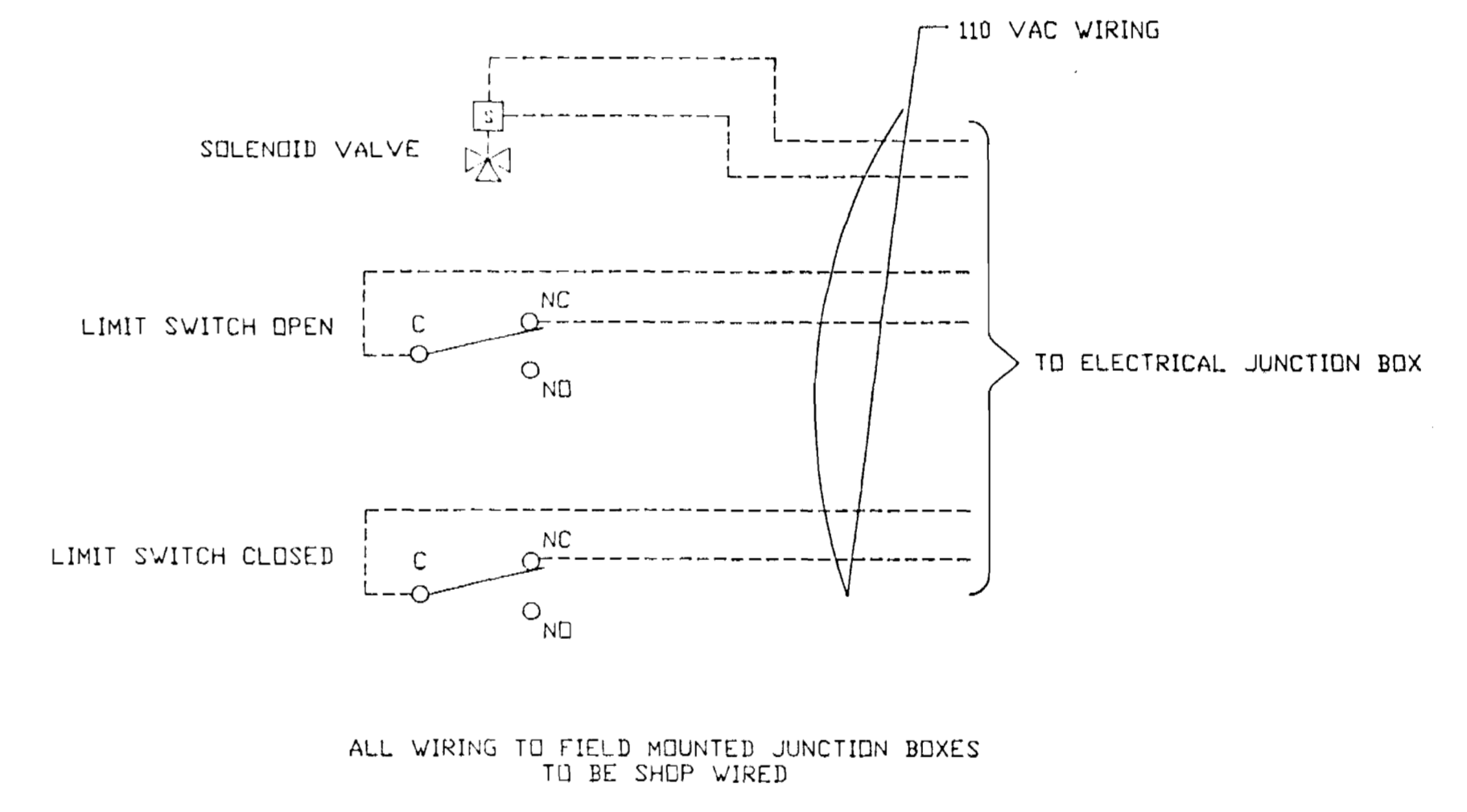
TYPICAL CONTROL VALVE PNEUMATIC TUBING DETAIL



TYPICAL BALL VALVE PNEUMATIC TUBING DETAIL



TYPICAL INSTRUMENT MOUNTING STAND



TYPICAL SOLENOID VALVE AND LIMIT SWITCH WIRING

APPROVED FOR CONSTRUCTION  
BY SCB DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
DRAWING NO.	REV
558586-D-7877-05-03	3
B & V PROJECT 15637	
15637.62.3401	

0	REVISED AS PER PYROPOWER COMMENTS	5/10/93
SYMBOL	DESCRIPTIONS	DATE
REVISIONS		

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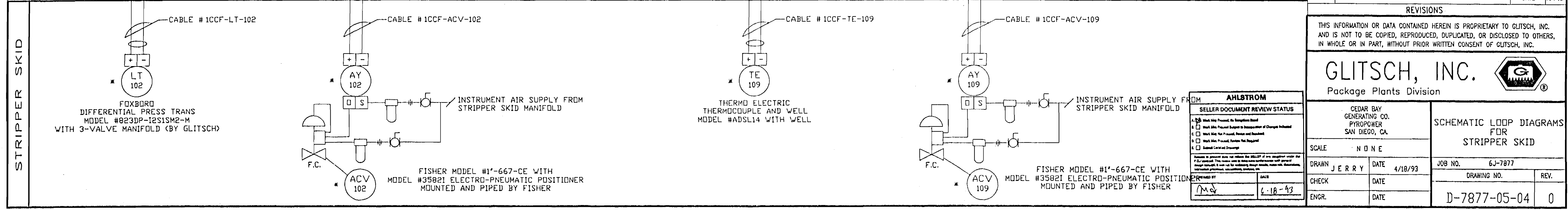
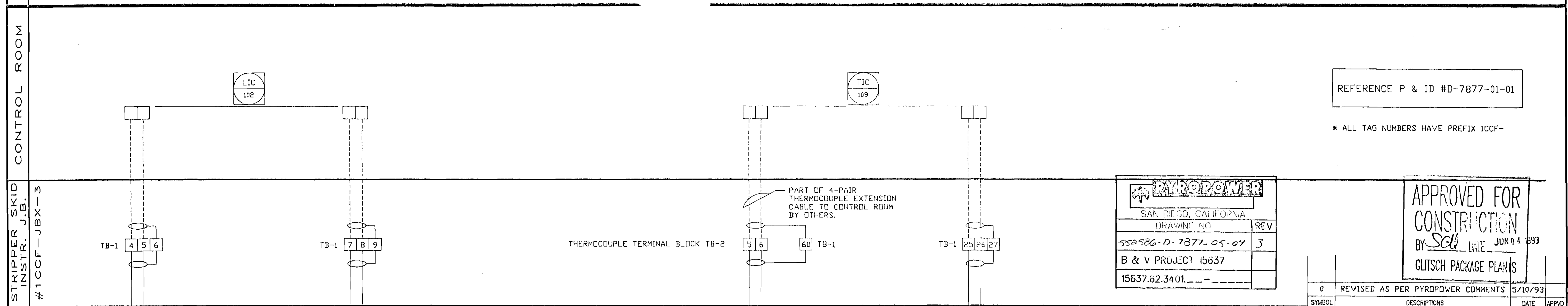
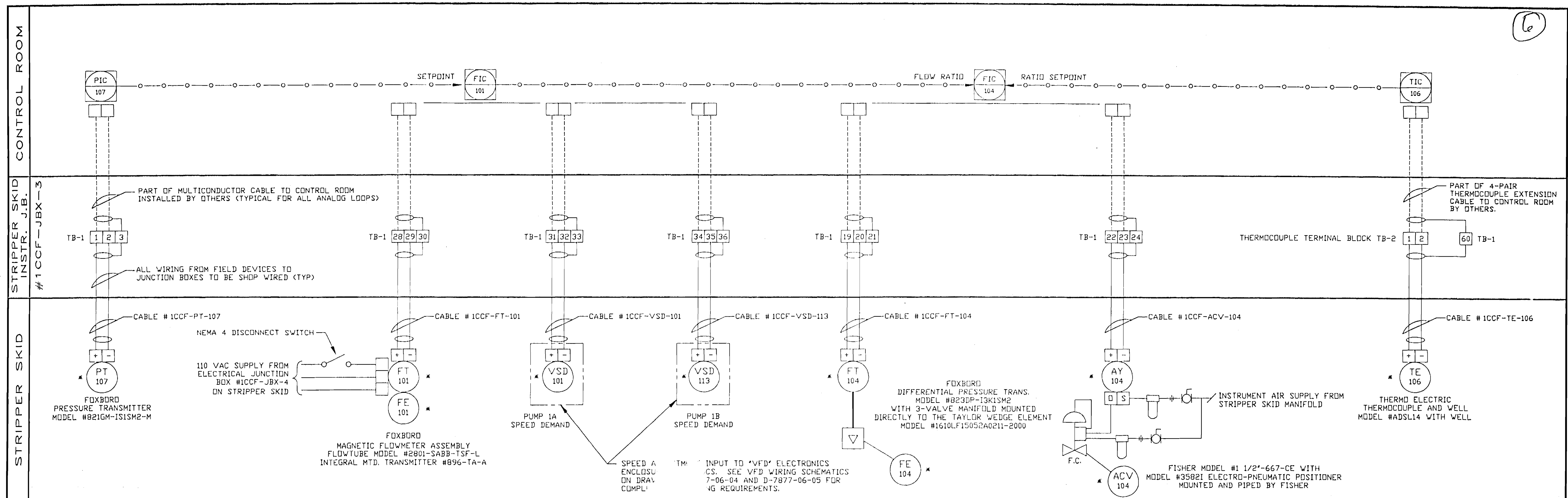
**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		INSTRUMENTATION INSTALLATION DETAILS	
SCALE	NONE	JOB NO.	6J-7877
DRAWN	JERRY DATE 4/19/93	DRAWING NO.	REV.
CHECK	DATE		
ENGR.	DATE	D-7877-05-03	0

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SELLER DOCUMENT REVIEW STATUS	
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<input type="checkbox"/>	Submit Corrected Drawings
Approved to proceed does not release the liability of any equipment under the P&ID. Consult the contract for the applicable terms and conditions of sale and purchase. This contract is subject to the terms and conditions of the contract. The contract is subject to the terms and conditions of the contract. The contract is subject to the terms and conditions of the contract.	
REVIEWED BY	DATE
<u>[Signature]</u>	6-18-93



6



<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
DRAWING NO	REV
552586-D-7877-05-01	3
B & V PROJECT 15637	
15637.62.3401	

APPROVED FOR CONSTRUCTION  
 BY *Sch* DATE JUN 04 1993  
 GLITSCH PACKAGE PLANTS

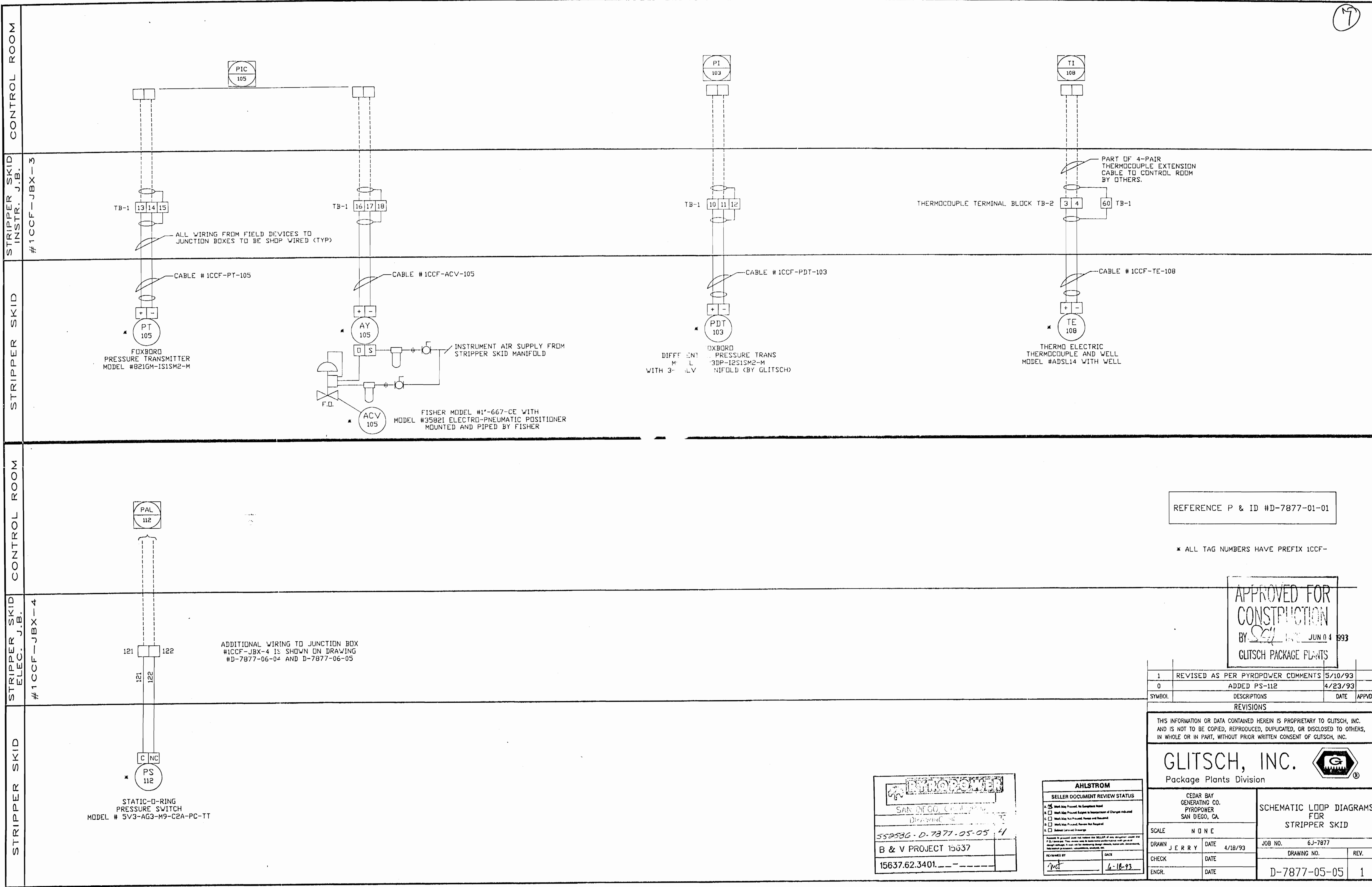
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SYMBOL	DESCRIPTIONS	DATE	APPVD
REVISIONS			

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<b>GLITSCH, INC.</b>		Package Plants Division	
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		SCHEMATIC LOOP DIAGRAMS FOR STRIPPER SKID	
SCALE	N O N E	JOB NO.	6J-7877
DRAWN	J E R R Y	DATE	4/18/93
CHECK		DATE	
ENGR.		DATE	
D-7877-05-04		REV.	0

<b>AHLSTROM</b>	
SELLER DOCUMENT REVIEW STATUS	
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Access to general data not allowed. The ability of any engineer under the P&ID contract. This contract shall be null and void if any engineer under the P&ID contract. This contract shall be null and void if any engineer under the P&ID contract.	
DATE	6-18-93

17



REFERENCE P & ID #D-7877-01-01

\* ALL TAG NUMBERS HAVE PREFIX ICCF-

APPROVED FOR CONSTRUCTION BY *[Signature]* JUN 04 1993 GLITSCH PACKAGE PLANTS

SYMBOL	DESCRIPTIONS	DATE	APPROV
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0	ADDED PS-112	4/23/93	

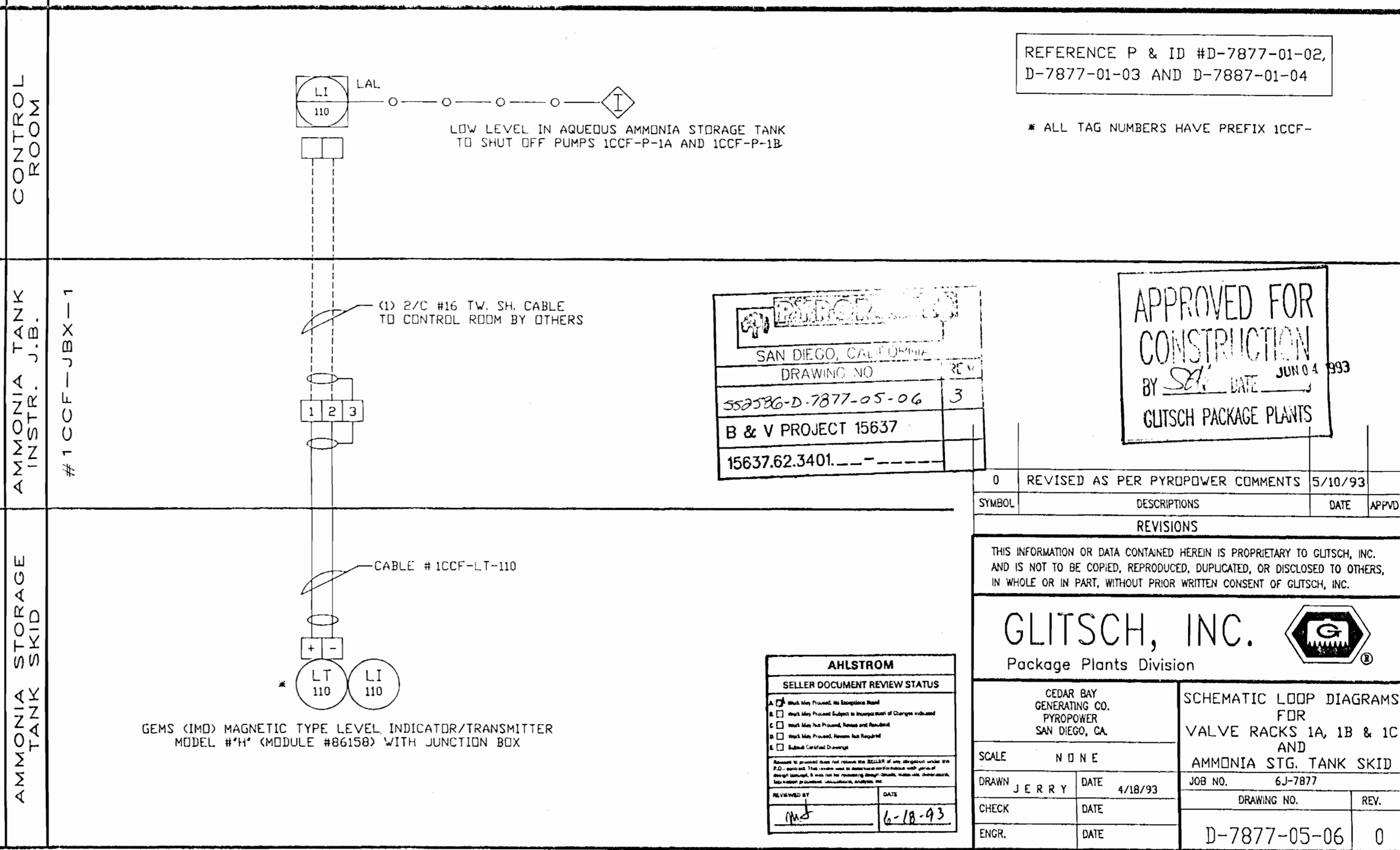
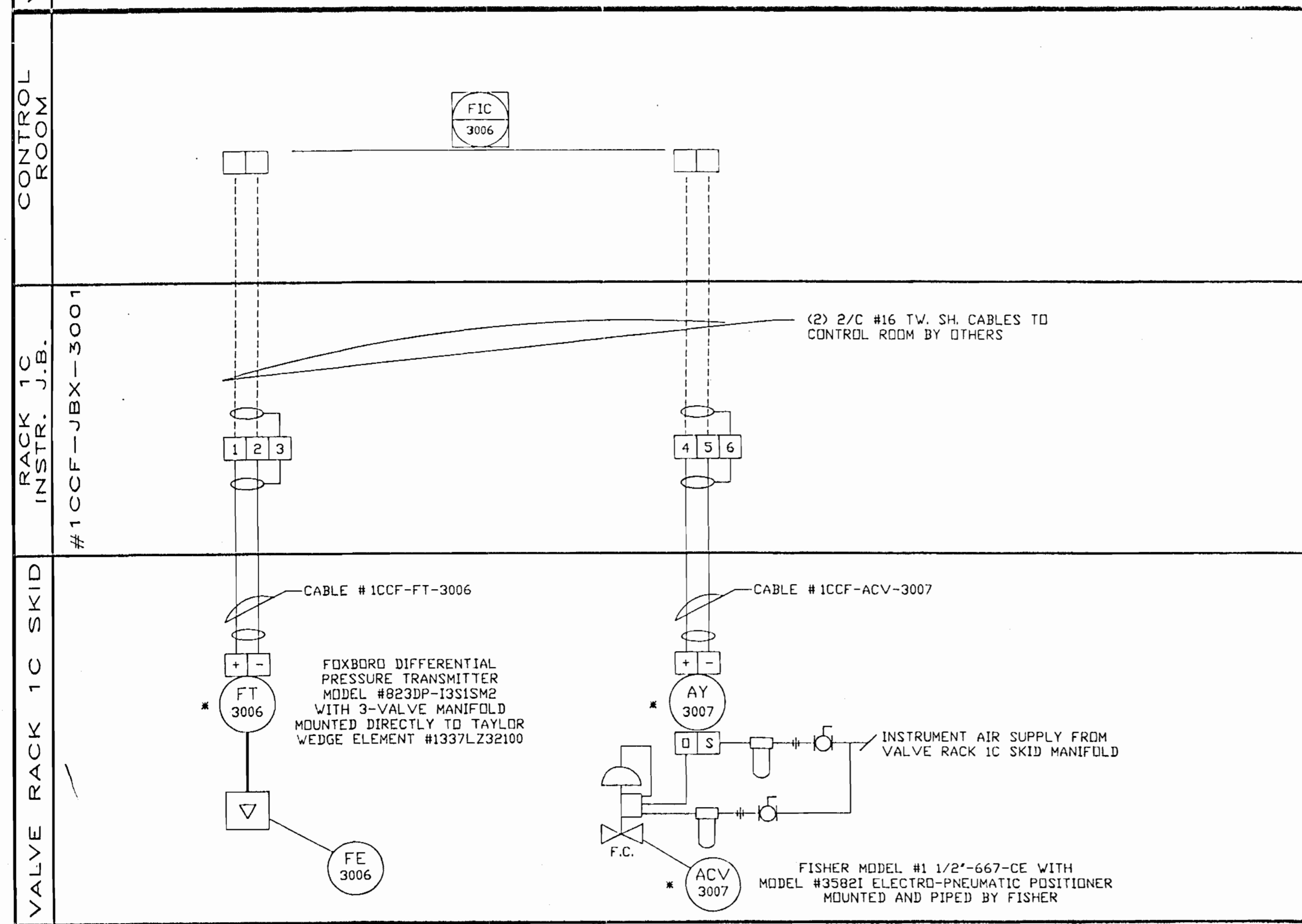
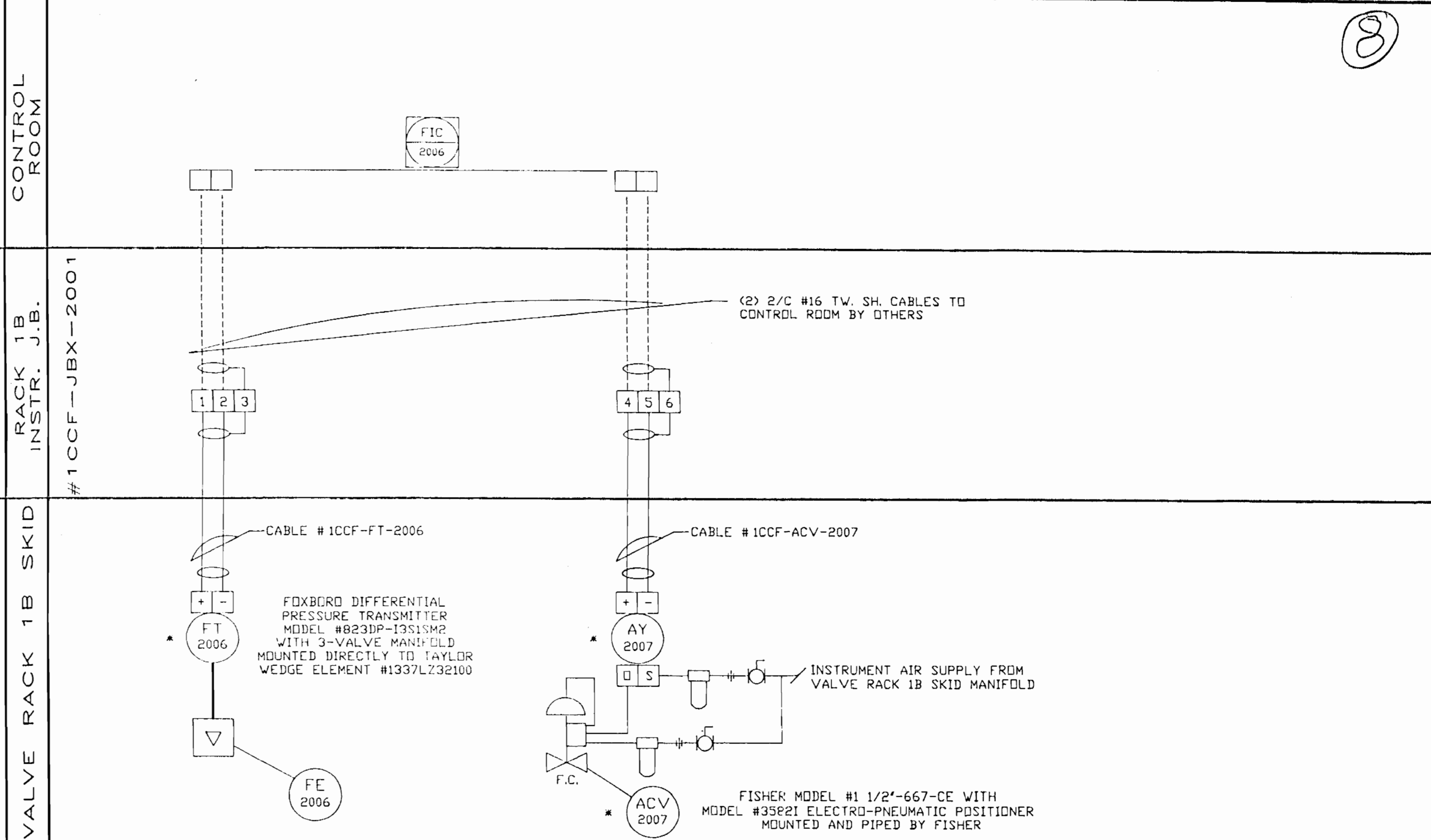
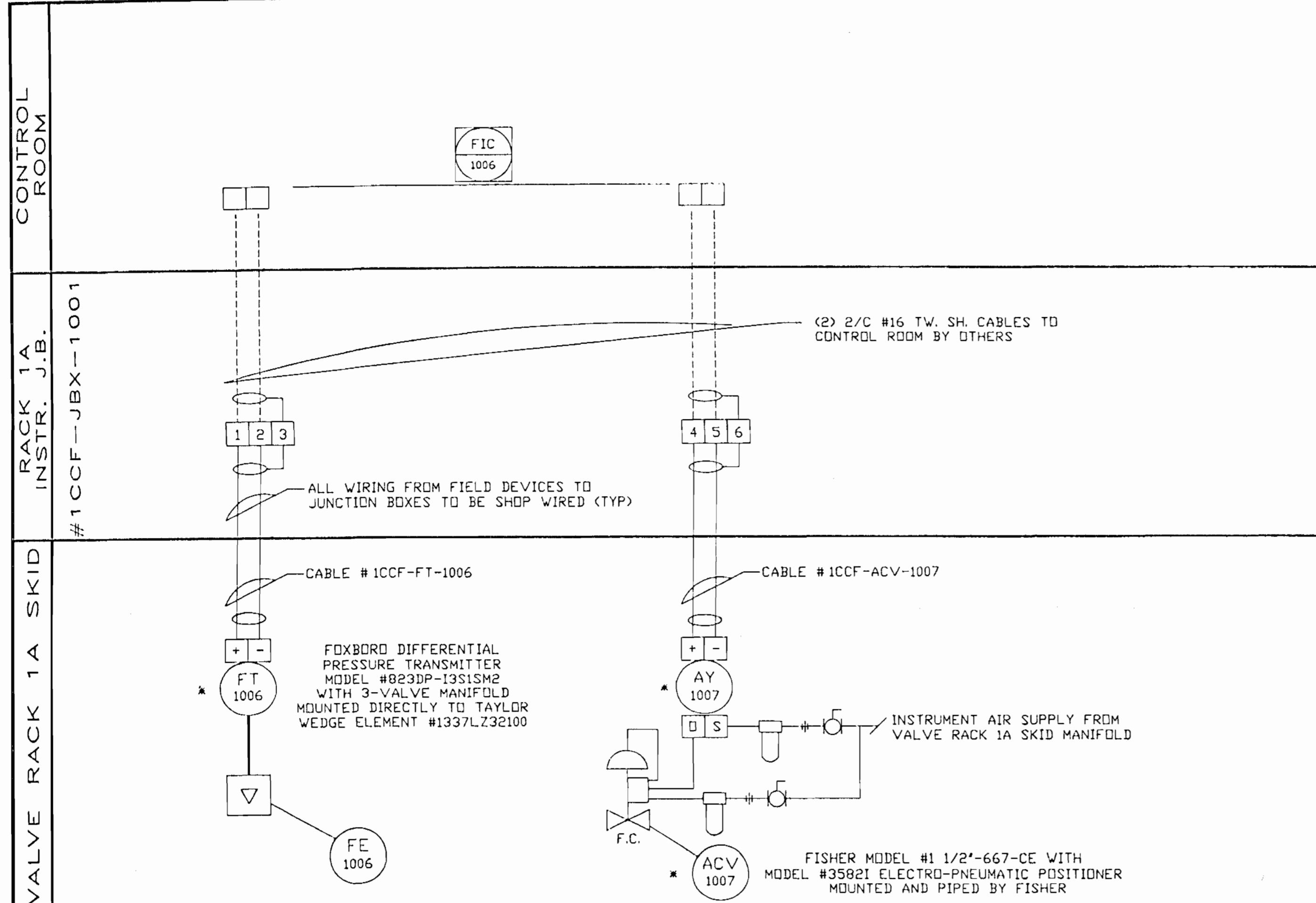
REVISIONS  
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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		SCHEMATIC LOOP DIAGRAMS FOR STRIPPER SKID	
SCALE	NONE	JOB NO.	6J-7877
DRAWN	JERRY	DATE	4/18/93
CHECK		DATE	
ENGR.		DATE	
DRAWING NO.		D-7877-05-05	REV.
			1

552586-D-7877-05-05  
B & V PROJECT 15637  
15637.62.3401

**AHLSTROM**  
SELLER DOCUMENT REVIEW STATUS  
A.  Mark Not Present, No Exception noted  
B.  Mark Not Present, Subject to Interpretation of Changes indicated  
C.  Mark Not Present, Name and Number  
D.  Mark Not Present, Name Not Required  
E.  Mark Not Present, Name Not Required  
F.  Mark Not Present, Name Not Required  
REVIEWED BY: *[Signature]* DATE: 4-18-93



SAN DIEGO, CALIFORNIA	
DRAWING NO	REV
552526-D-7877-05-06	3
B & V PROJECT 15637	
15637.62.3401	

APPROVED FOR CONSTRUCTION BY SA DATE JUN 04 1993 GLITSCH PACKAGE PLANTS

AHLSTROM	
SELLER DOCUMENT REVIEW STATUS	
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REVIEWED BY	DATE
MS	6-18-93

SYMBOL	REVISIONS	DATE	APPROVED
0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	

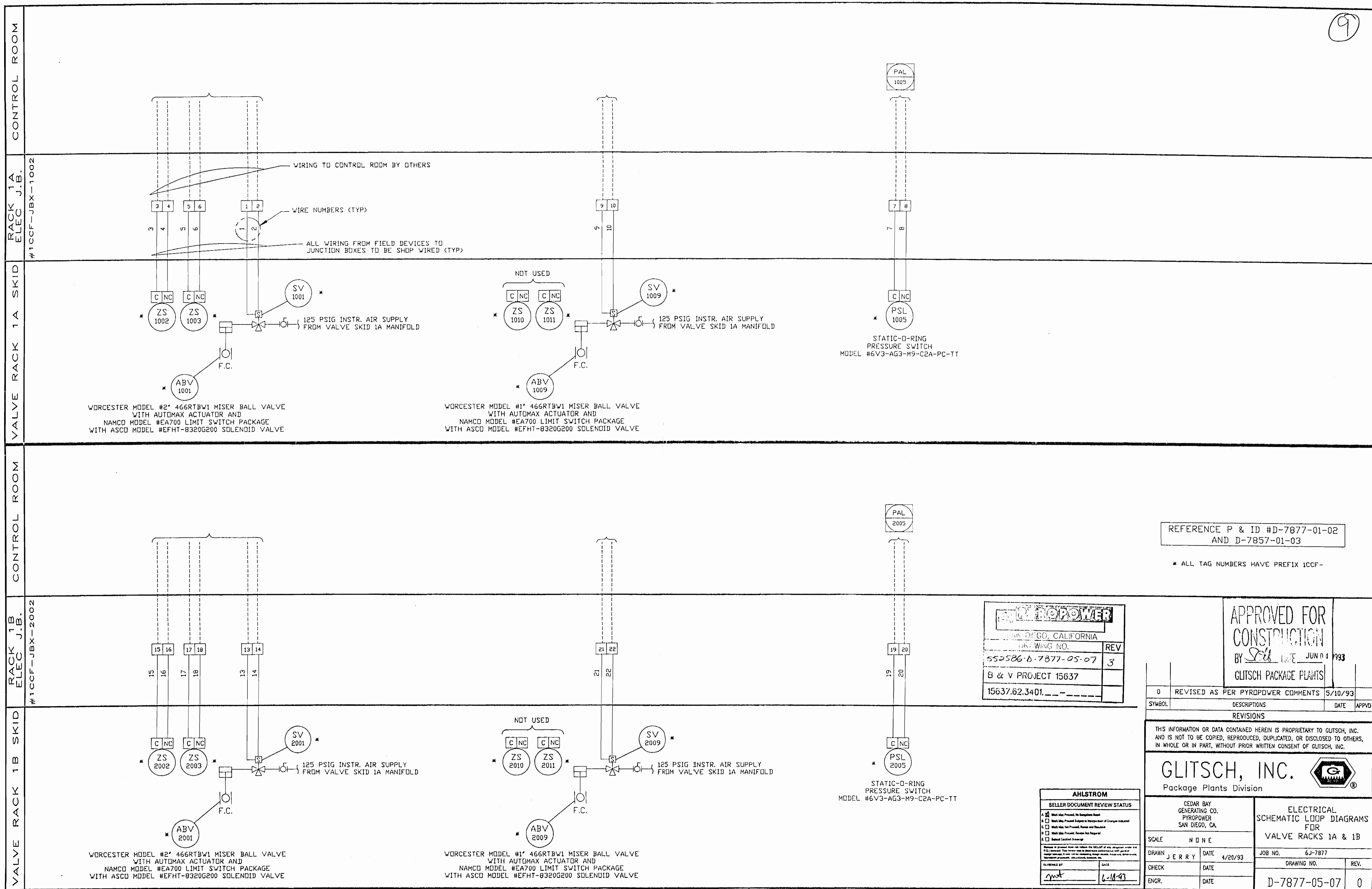
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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA	SCHMATIC LOOP DIAGRAMS FOR VALVE RACKS 1A, 1B & 1C AND AMMONIA STG. TANK SKID
SCALE NONE	JOB NO. 6J-7877
DRAWN JERRY DATE 4/18/93	DRAWING NO. REV. 0
CHECK DATE	
ENGR. DATE	D-7877-05-06 0



9



REFERENCE P & ID #D-7877-01-02 AND D-7857-01-03

\* ALL TAG NUMBERS HAVE PREFIX 1CCF-

<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
WIRING NO.	REV
552586-D-7877-05-07	3
B & V PROJECT 15637	
15637.62.3401.---	

APPROVED FOR CONSTRUCTION BY *[Signature]* DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

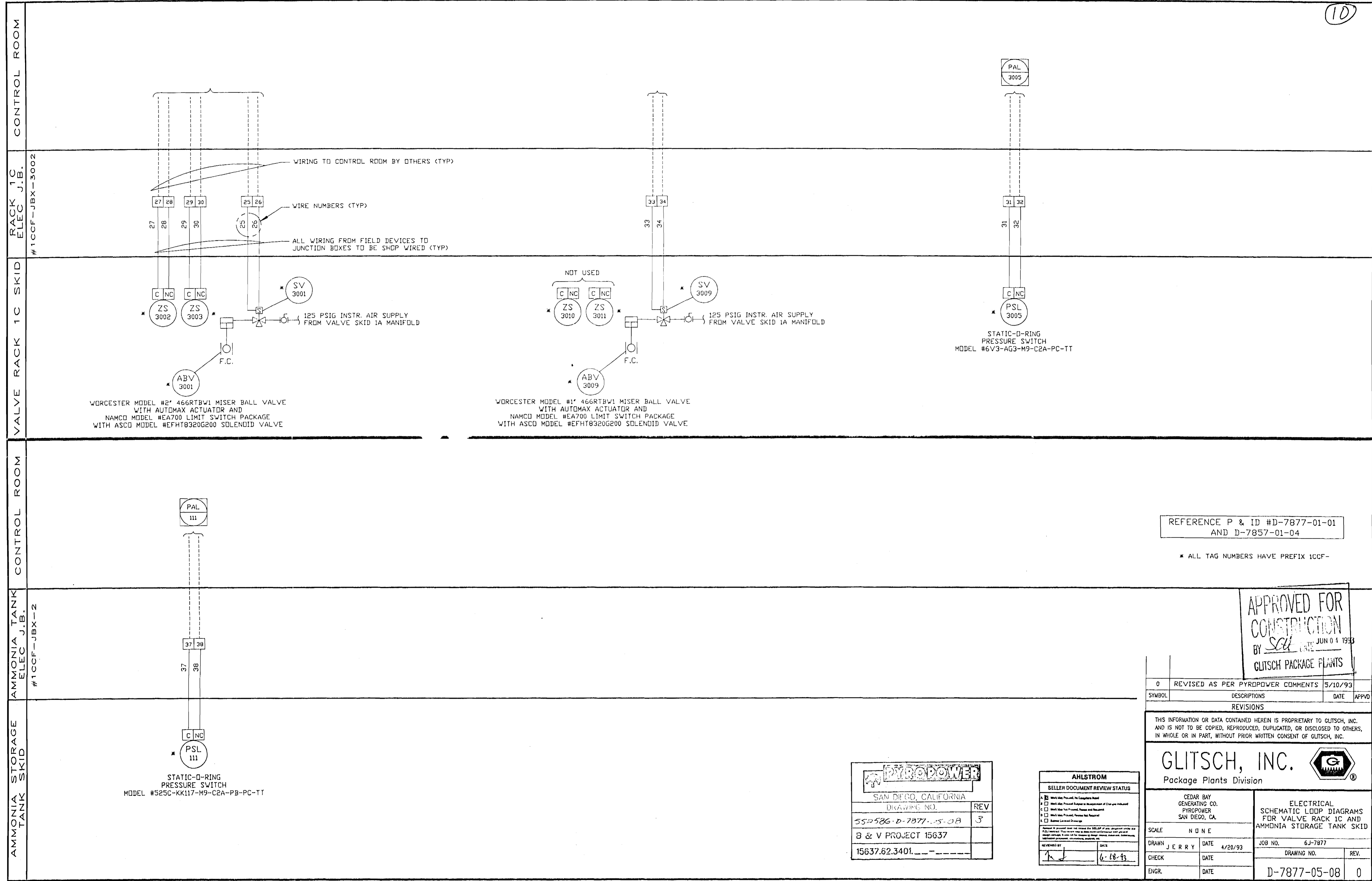
SYMBOL	DESCRIPTIONS	DATE	APPROV
0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	

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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		ELECTRICAL SCHEMATIC LOOP DIAGRAMS FOR VALVE RACKS 1A & 1B	
SCALE	N O N E	JOB NO.	6J-7877
DRAWN	J E R R Y	DATE	4/20/93
CHECK		DATE	
ENGR.		DATE	
		DRAWING NO.	D-7877-05-07
		REV.	0

AHLSTROM	
SELLER DOCUMENT REVIEW STATUS	
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<input type="checkbox"/>	Revised/Cancelled Drawing
APPROVED BY	DATE
<i>[Signature]</i>	6-18-93



REFERENCE P & ID #D-7877-01-01 AND D-7857-01-04

\* ALL TAG NUMBERS HAVE PREFIX 1CCF-

APPROVED FOR CONSTRUCTION BY *Scott* JUN 04 1993 GLITSCH PACKAGE PLANTS

0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPROV

REVISIONS

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<b>GLITSCH, INC.</b> Package Plants Division			
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		ELECTRICAL SCHEMATIC LOOP DIAGRAMS FOR VALVE RACK 1C AND AMMONIA STORAGE TANK SKID	
SCALE	NONE	JOB NO.	6J-7877
DRAWN	J E R R Y	DATE	4/20/93
CHECK		DATE	
ENGR.		DATE	
		DRAWING NO.	D-7877-05-08
		REV.	0

**PYROPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. 552586-D-7877-05-08 REV 3  
B & V PROJECT 15637  
15637.62.3401

**AHLSTROM**  
SELLER DOCUMENT REVIEW STATUS  
 Work Man Provided, No Exceptions Found  
 Work Man Provided, Subject to Disposition of Changes Indicated  
 Work Man Provided, Review Not Required  
 Submit Contract Drawings  
APPROVED BY: *[Signature]* DATE: 6-18-93

GENERAL NOTES

1. THE ELECTRICAL CONTRACTOR (EC) SHALL INSTALL ALL OF THE ELECTRICAL WORK ON THE SKIDS IN CONFORMANCE WITH THE NFPA NATIONAL ELEC. CODE FOR NEMA 4 REQUIREMENTS. 'EC' REFERS TO GLITSCH'S SUB VENDOR IN CHARGE OF ALL WIRING NOTED AS 'SHOP WIRING' OR 'SHOP WIRED'.
2. THE EC SHALL COORDINATE HIS WORK WITH THE MECHANICAL CONTRACTOR TO PREVENT THE INSTALLATION OF ANY CONDUIT OR ELECTRICAL EQUIPMENT WITHIN (4) INCHES OF PROCESS EQUIPMENT OR PIPING. BE WARNED THAT A VIOLATION OF THIS SPACING RULE SHALL BE SUFFICIENT CAUSE FOR GLITSCH, INC. TO REQUIRE THAT THE WORK BE REPAIRED AT THE EC'S EXPENSE.
3. THE EC SHALL FURNISH AND INSTALL CONDUIT AND WIRE FROM ALL TRANSMITTERS, TRANSDUCERS, THERMOCOUPLES TO THEIR RESPECTIVE TERMINAL CABINETS AS SHOWN ON THE ELECTRICAL CONDUIT PLAN. CONDUIT AND WIRE FROM FROM SKID TERMINAL CABINETS TO THE CONTROL ROOM AND MOTOR CONTROL CENTER SHALL BE FURNISHED AND INSTALLED BY OTHERS. SEAL FITTINGS SHALL BE USED ON ALL CONDUITS LEAVING THE SKID TO THE CONTROL ROOM/MCC (NON HARAZDUS AREA). ELECTRICAL MOTORS ARE TO BE PREWIRED.
4. THE EC SHALL FURNISH AND INSTALL FLEXIBLE CONDUIT AT ALL MOTORS AND INSTRUMENTS. THE FLEXIBLE CONDUITS SHALL NOT EXCEED EIGHTEEN (18) INCHES IN LENGTH AND SHALL BE A MINIMUM SIZE OF 3/4".
5. THE EC SHALL INSTALL CROUSE-HINDS CAT. #ECD17 DRAIN FITTINGS AT ALL CONDUIT LOW POINTS AND AT THE BOTTOM OF TERMINAL CABINETS.
6. THE EC SHALL FURNISH AND INSTALL SUPPORT STEEL AND ALL HARDWARE AS REQUIRED FOR TERMINAL CABINETS, HAND SWITCHES AND ALL CONDUIT SUPPDRTS AS SHOWN ON THE INSTALLATION DETAILS AND AS MAY BE REQUIRED FOR THIS PROJECT.
7. THE EC SHALL TAG INSTRUMENT CABLES AT BOTH ENDS USING 'BRADY' SHRINK TYPE WIRE MARKERS. MOTOR AND CONTROL CONDUCTORS SHALL ALSO BE TAGGED WITH WIRE MARKERS AS IN THE ABOVE.
8. THE EC SHALL INSTALL TERMINAL BLOCKS ON MOUNTING PLATES IN TERMINAL CABINETS AS SHOWN. THE EC SHALL USE 'SCOTCH' NO. 285 ARTIST'S WHITE PLASTIC COATED TAPE NEXT TO THE TERMINAL BLOCKS FOR TERMINAL NUMBER MARKINGS. THE PEN USED FOR MARKING SHALL BE 'EXTRA FINE' INDELIBLE INK.
9. THE EC SHALL BE RESPONSIBLE FOR FURNISHING ALL OF THE ELECTRICAL MATERIALS AS REQUIRED BY THIS PROJECT EXCEPT THE LIST OF MATERIALS THAT HAVE SPECIFICALLY BEEN IDENTIFIED AS 'FURNISHED BY GLITSCH, INC.'
10. THE EC SHALL PREPARE HIS PORTION OF WORK ON THE SKID FOR TRUCK SHIPMENT TO THE PLANT SITE AS FOLLOWS:
  - A) PLACE PLASTIC BAG OVER ALL INSTRUMENTS, TERMINAL CABINETS, MOTORS AND HAND SWITCHES USING DUCT TAPE TO SEAL BAG FROM WATER ENTRY.
  - B) SECURE CONDULET COVERS TO BODIES USING TWO LAYERS OF DUCT TAPE.

ELECTRICAL & INSTRUMENTATION LEGEND

SYMBOL	DESCRIPTION
	MOTOR: TOTALLY ENCLOSED FAN COOLED 480 VOLT 3 PHASE 60 HZ
	110 VAC NEMA 4 DISCONNECT SWITCH FEED THRU TYPE ASSEMBLY, 20 AMP, SINGLE POLE, 3/4" NPT HUBS
	CONDUIT
	CONDUIT: TURNING DOWN OR AWAY FROM SIGHT
	CONDUIT: TURNING UP OR TOWARDS SIGHT
	CONDUIT: 18" MAXIMUM LENGTH SEALTIGHT
	CONDUIT: RUNNING UP AND DOWN BETWEEN FLOORS
	'TEE' CONDULET: CROUSE-HINDS 'FORM 8' SERIES
	UNION: CROUSE-HINDS TYPE UNY
	TRANSMITTER: FLOW, TEMPERATURE, LEVEL AND PRESSURE
	TRANSDUCER: (I/P) MOUNTED ON CONTROL VALVE
	THERMOCOUPLE (SEE CABLE REQUIREMENTS)
	DESCRIPTION LISTED AT DEVICE

REFERENCE DRAWINGS

PIPING AND INSTRUMENTATION DIAGRAMS	D-7877-01-01 D-7877-01-02 D-7877-01-03 D-7877-01-04
INSTRUMENT JUNCTION BOX #ICCF-JBX-3 INSTRUMENT JUNCTION BOXES FOR AUX. SKIDS	D-7877-05-01 D-7877-05-02
INSTRUMENTATION INSTALLATION DETAILS	D-7877-05-03
SCHEMATIC LOOP DIAGRAMS FOR STRIPPER SKID SCHEMATIC LOOP DIAGRAMS FOR STRIPPER SKID SCHEMATIC LOOP DIAGRAMS FOR VALVE RACKS AND AMMONIA STORAGE TANK SKID	D-7877-05-04 D-7877-05-05 D-7877-05-06
ELEC SCHEMATIC LOOP DIAG'S FOR VALVE RACKS 1A & 1B ELEC SCHEMATIC LOOP DIAG'S FOR VALVE RACK 1C AND AMMONIA STORAGE TANK SKID	D-7877-05-07 D-7877-05-08
ELECTRICAL JUNCTION BOX #ICCF-JBX-4 ELECTRICAL JUNCTION BOXES FOR AUX SKIDS	D-7877-06-02 D-7877-06-03
ELECTRICAL CONTROL WIRING DIAGRAM FOR ICCF-P-1A ELECTRICAL CONTROL WIRING DIAGRAM FOR ICCF-P-1B	D-7877-06-04 D-7877-06-05
INSTRUMENTATION/ELECTRICAL CONDUIT PLAN FOR AMMONIA STRIPPER SKID	D-7877-06-06
INSTRUMENTATION/ELECTRICAL CONDUIT PLAN FOR AMMONIA STORAGE TANK AND VALVE RACK SKIDS	D-7877-06-07

CABLE REQUIREMENTS

ALL ELECTRICAL CABLES SHALL BE CONSERVATIVELY SELECTED FOR THE ELECTRICAL AND ENVIRONMENTAL CONDITIONS OF THE INSTALLATIONS AND SHALL BE THE BEST CONSTRUCTION FOR THE SERVICE WHERE UNUSUAL SERVICE CONDITIONS ARE ENCOUNTERED. OIL-RESISTANT AND PROPER TEMPERATURE APPLICATION CABLE SHALL BE USED THROUGHOUT. EXCEPT WHERE REQUIRED TO BE OTHERWISE TO PERFORM SATISFACTORILY IN THE SERVICE, ALL ELECTRICAL CONDUCTOR SHALL BE CLASS B, STRANDED COPPER, 14 AWG OR LARGER. MI CABLE IS NOT ACCEPTABLE.

CONTROL PANEL AND CABINET WIRING SHALL BE STRANDED COPPER CONDUCTOR WITH FLAME RETARDANT CROSS-LINKED POLYETHYLENE INSULATION RATED 600 VOLTS AND SHALL MEET THE REQUIREMENTS OF UL 44 FOR TYPE 'SIS'. THE INSULATION SHALL ALSO MEET THE REQUIREMENTS OF ICEA S-66-524, PARAGRAPH 7.8.3.1, AND SHALL BE ROCKBESTOS FIREWALL SIS, GENERAL ELECTRIC VULKENE TYPE SIS, SI NO. 57275, OR ACCEPTABLE EQUAL.

GENERAL SERVICE AND CONTROL CABLES, INTEGRAL TO THE EQUIPMENT FURNISHED BUT NOT INTERNAL WIRING OF CONTROL CABINETS OR PANELS, SHALL BE RATED FOR THE MAXIMUM SERVICE VOLTAGE BUT NOT LESS THAN 600 VOLTS. POWER CONDUCTORS AND SINGLE CONDUCTOR CONTROL CABLES SHALL HAVE ETHYLENE PROPYLENE RUBBER INSULATION WITH A NEOPRENE CONDUCTOR JACKET, AND MULTICONDUCTOR CONTROL CABLES SHALL HAVE FLAME RESISTANT CROSS-LINKED POLYETHYLENE CONDUCTOR INSULATION AND AN OVERALL NEOPRENE JACKET OR ACCEPTABLE EQUAL INSULATION SYSTEMS. EXCEPT NEC TYPE SF-2 SILICONE RUBBER INSULATED CABLE WITH BRAIDED GLASS JACKET SHALL BE USED WHERE AMBIENT CONDITIONS CAUSE CONDUCTOR OPERATING TEMPERATURES TO EXCEED THE TEMPERATURE RATINGS OF THE GENERAL SERVICE CABLE INSULATION FURNISHED.

ALL THERMOCOUPLE WIRE SHALL BE SOLID CONDUCTOR WITH TWISTED AND SHIELDED CONDUCTOR PAIRS. INSULATION SHALL BE COLOR CODED IN ACCORDANCE WITH THE REQUIREMENTS OF ANSI MC96.1. THESE REQUIREMENTS ALSO APPLY TO THERMOCOUPLE EXTENSION WIRE WHICH IS FURNISHED INTERNAL TO CONTRACTOR-FURNISHED EQUIPMENT. THE SHIELDED WIRE FOR EACH THERMOCOUPLE FURNISHED FOR EXTERNAL CONNECTIONS SHALL BE TERMINATED ON AN UNGROUNDED TERMINAL.

APPROVED FOR CONSTRUCTION BY SEL DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

SAN DIEGO, CALIFORNIA	
DRAWING NO	REV
552536-D-7877-06-01	3
B & V PROJECT 15637	
15637.62.3401	

1	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPROV
REVISIONS			

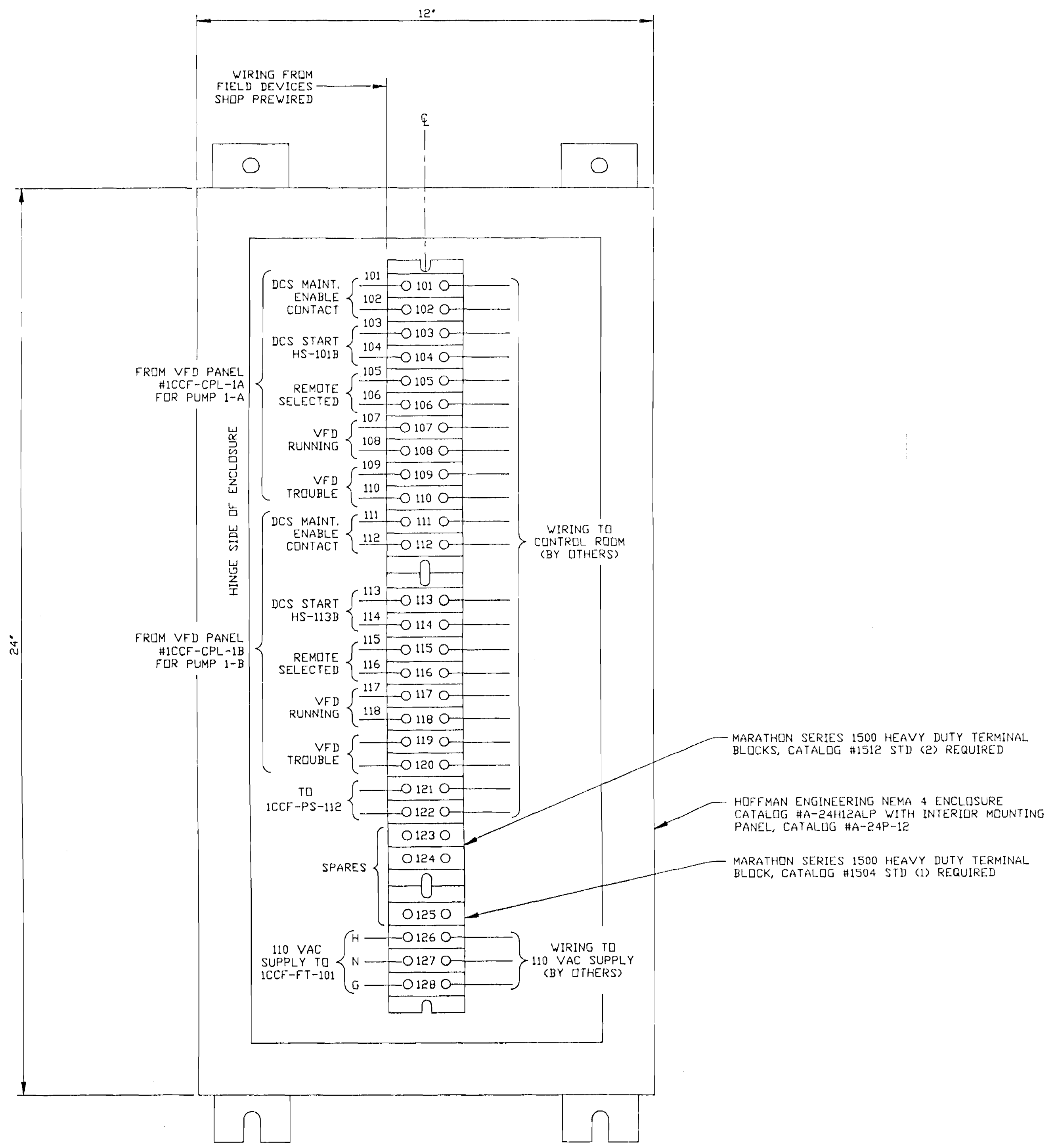
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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		INSTRUMENTATION/ELECTRICAL GENERAL NOTES & LEGEND	
SCALE	N D N E	JOB NO.	6J-7877
DRAWN	JERRY	DATE	4/29/93
CHECK		DATE	
ENGR.		DATE	
		DRAWING NO.	D-7877-06-01
		REV.	1

AHLSTROM	
SELLER DOCUMENT REVIEW STATUS	
<input checked="" type="checkbox"/>	Work Has Passed by Customer Read
<input type="checkbox"/>	Work Has Passed Review by Inspection of Changes Indicated
<input type="checkbox"/>	Work Has Not Passed, Review and Resubmit
<input type="checkbox"/>	Work Has Passed, Review Not Required
<input type="checkbox"/>	Submit Customer Drawings
<small>Approval to proceed does not release the SELLER of any obligation under the purchase contract. This is not an offer to sell or buy any goods or services, and does not constitute an offer to sell or buy any goods or services, and does not constitute an offer to sell or buy any goods or services, and does not constitute an offer to sell or buy any goods or services.</small>	
REVIEWED BY	DATE
<u>M. J.</u>	<u>6-18-93</u>





**N O T E :**  
 1. INSTALLER TO PROVIDE A PHENOLIC ENGRAVABLE NAMEPLATE ON THE JUNCTION BOX DOOR WITH THE JUNCTION BOX TAG NUMBER (THIS BOX TO BE LABELED 'JUNCTION BOX #1CCF-JBX-4')

**FRONT VIEW OF JUNCTION BOX #1CCF-JBX-4**  
 (DOOR REMOVED FOR CLARITY)

**PYROPOWER**  
 SAN DIEGO, CALIFORNIA  
 DRAWING NO. REV  
 552586-D-7877-06-02 3  
 B & V PROJECT 15637  
 15637.62.3401

APPROVED FOR CONSTRUCTION  
 BY SEU DATE JUN 04 1997  
 GLITSCH PACKAGE PLANTS

SYMBOL	DESCRIPTIONS	DATE	APP'D
2	REVISED VFD TRIP TO VFD TROUBLE	5/26/93	SCH
1	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
0	ADDED 1CCF-PS-112	4/23/93	

REVISIONS  
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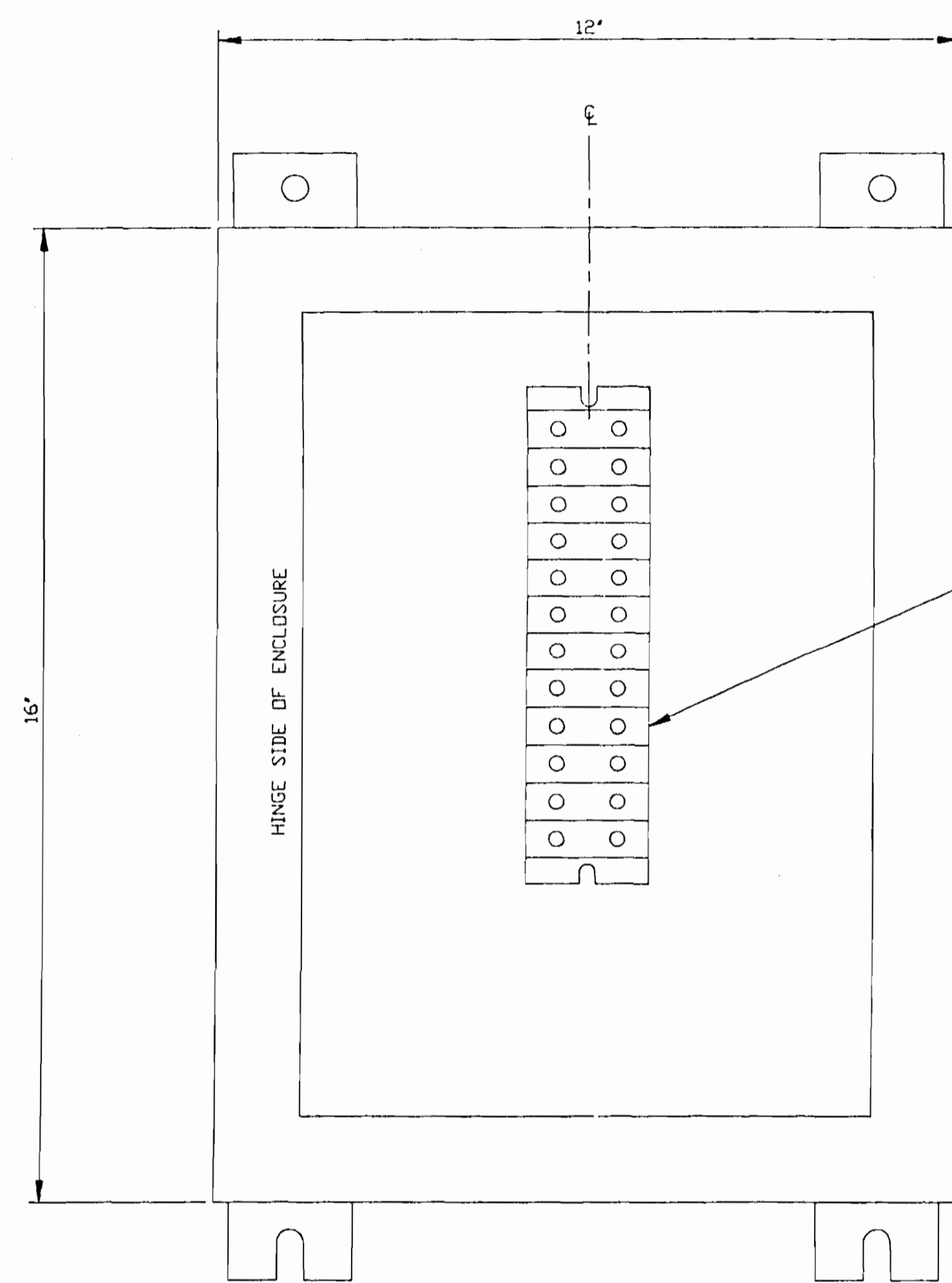
**GLITSCH, INC.**  
 Package Plants Division

**AHLSTROM**  
 SELLER DOCUMENT REVIEW STATUS

Mark May Present, No Signature Required  
 Mark May Present, Signature to be provided prior to Closing  
 Mark May Not Present, Review and Approval  
 Mark May Present, Review Not Required  
 Review Contract Drawings

REVIEWED BY: MA DATE: 6-18-93

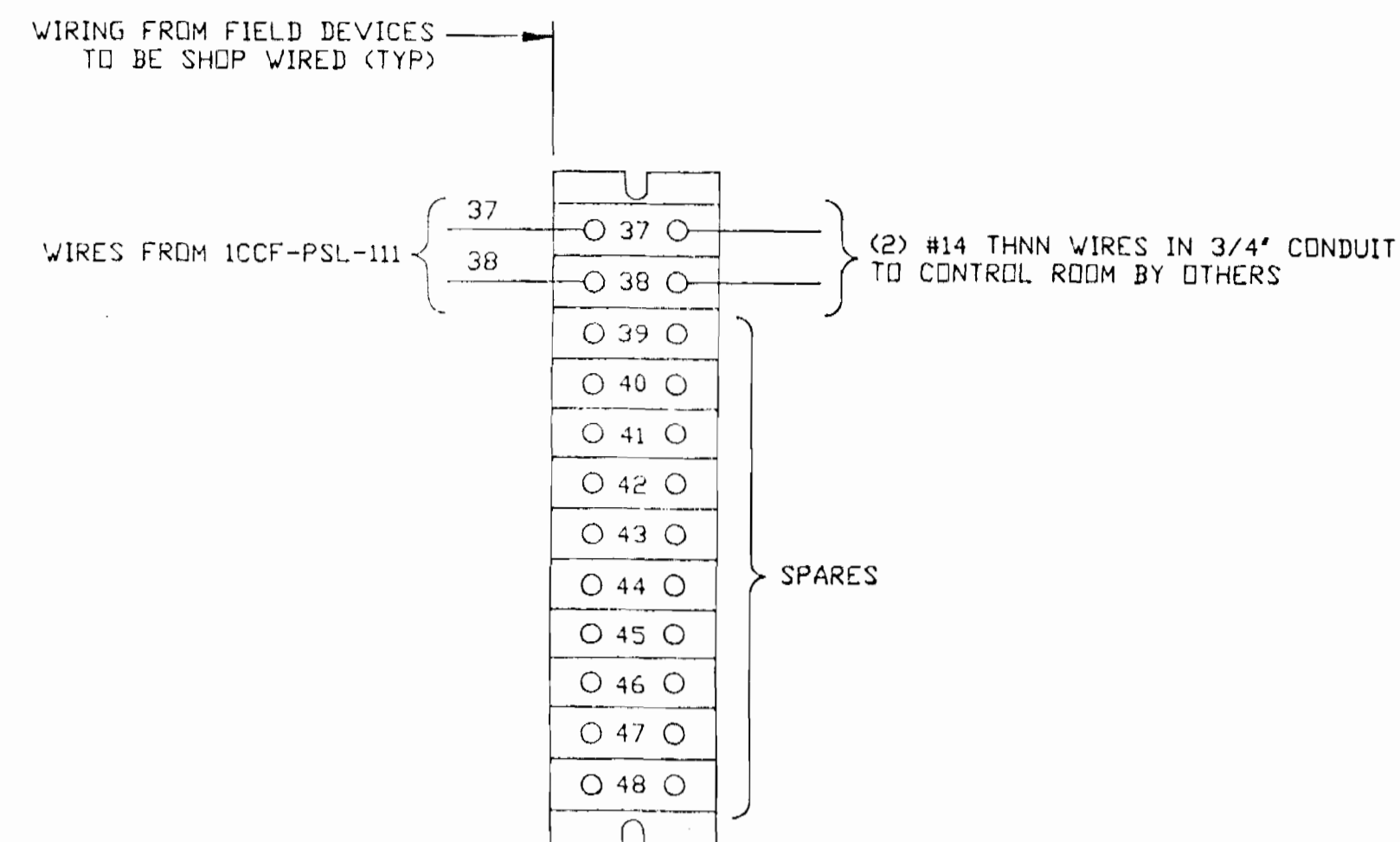
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		ELECTRICAL JUNCTION BOX 1CCF-JBX-4 FOR STRIPPER SKID	
SCALE: HALF SIZE	DRAWN: JERRY	DATE: 4/17/93	JOB NO.: 6J-7877
CHECK: ENGR.	DATE:	DRAWING NO.:	REV.:
		D-7877-06-02	2



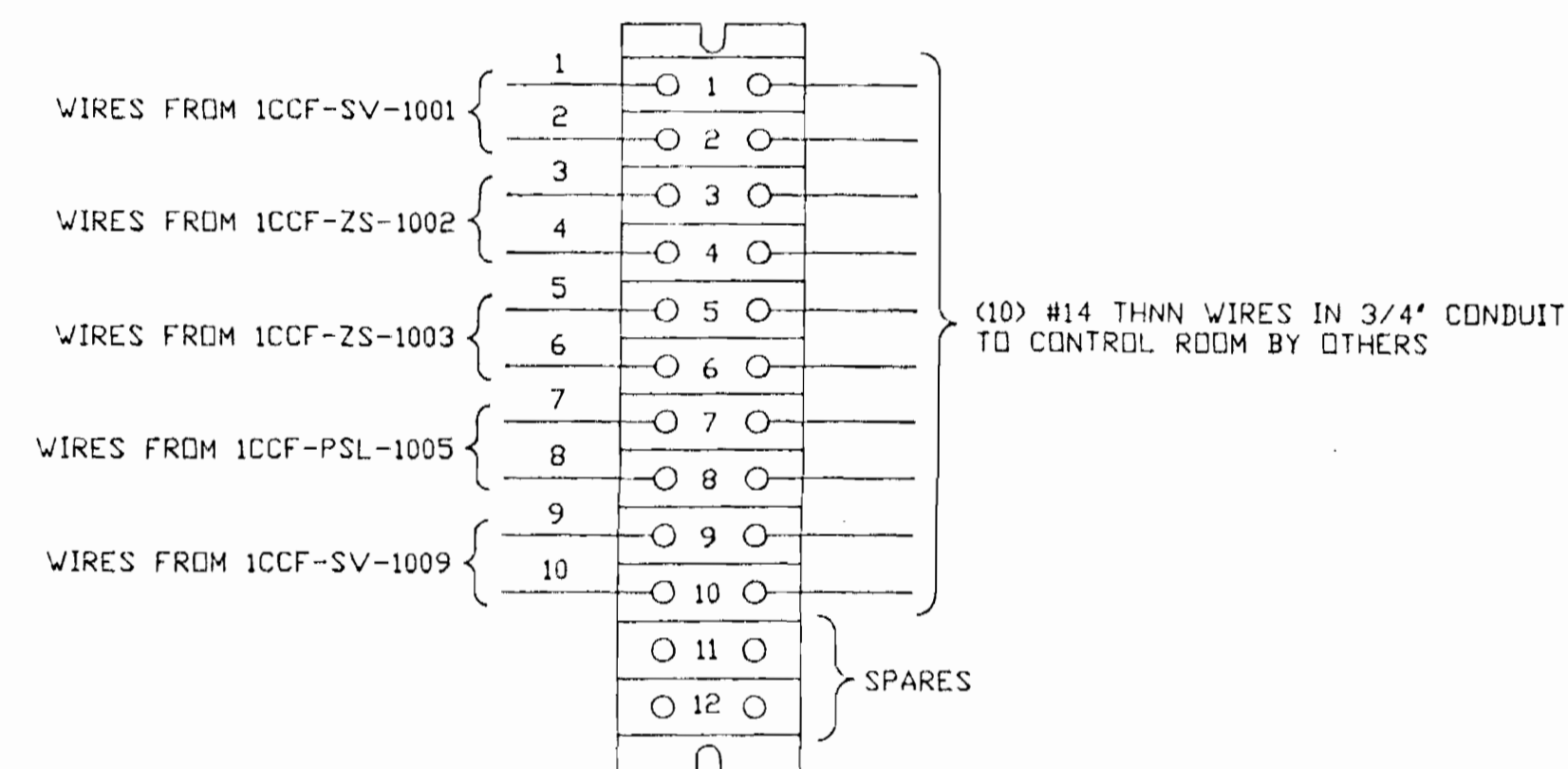
MARATHON SERIES 1500 HEAVY DUTY TERMINAL BLOCK, CATALOG #1512 STD (1) REQ'D PER BOX

HOFFMAN ENGINEERING NEMA 4 ENCLOSURE CATALOG #A-16H12ALP WITH INTERIOR MOUNTING PANEL, CATALOG #A-16P12

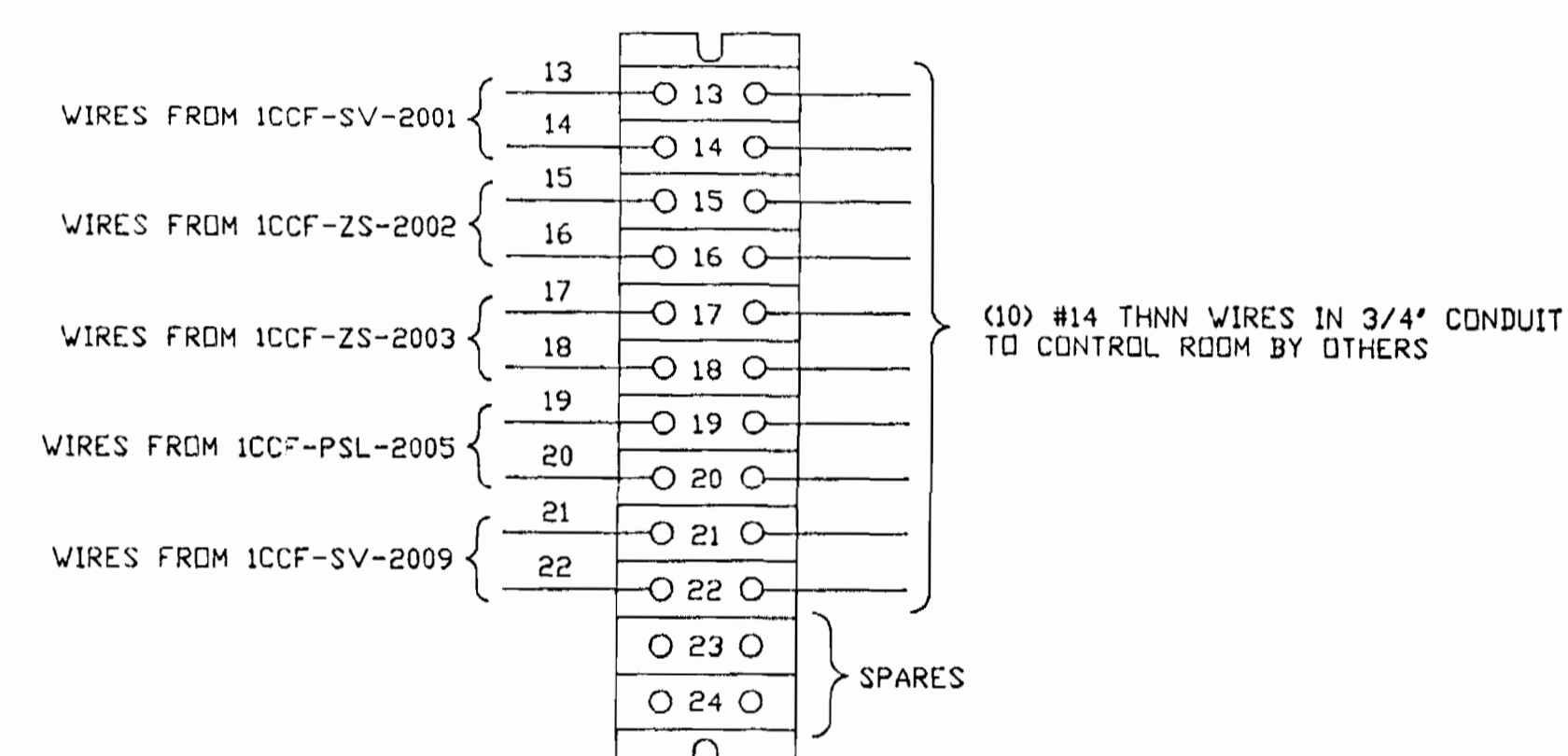
FRONT VIEW OF TYPICAL JUNCTION BOX  
(DOOR REMOVED FOR CLARITY)



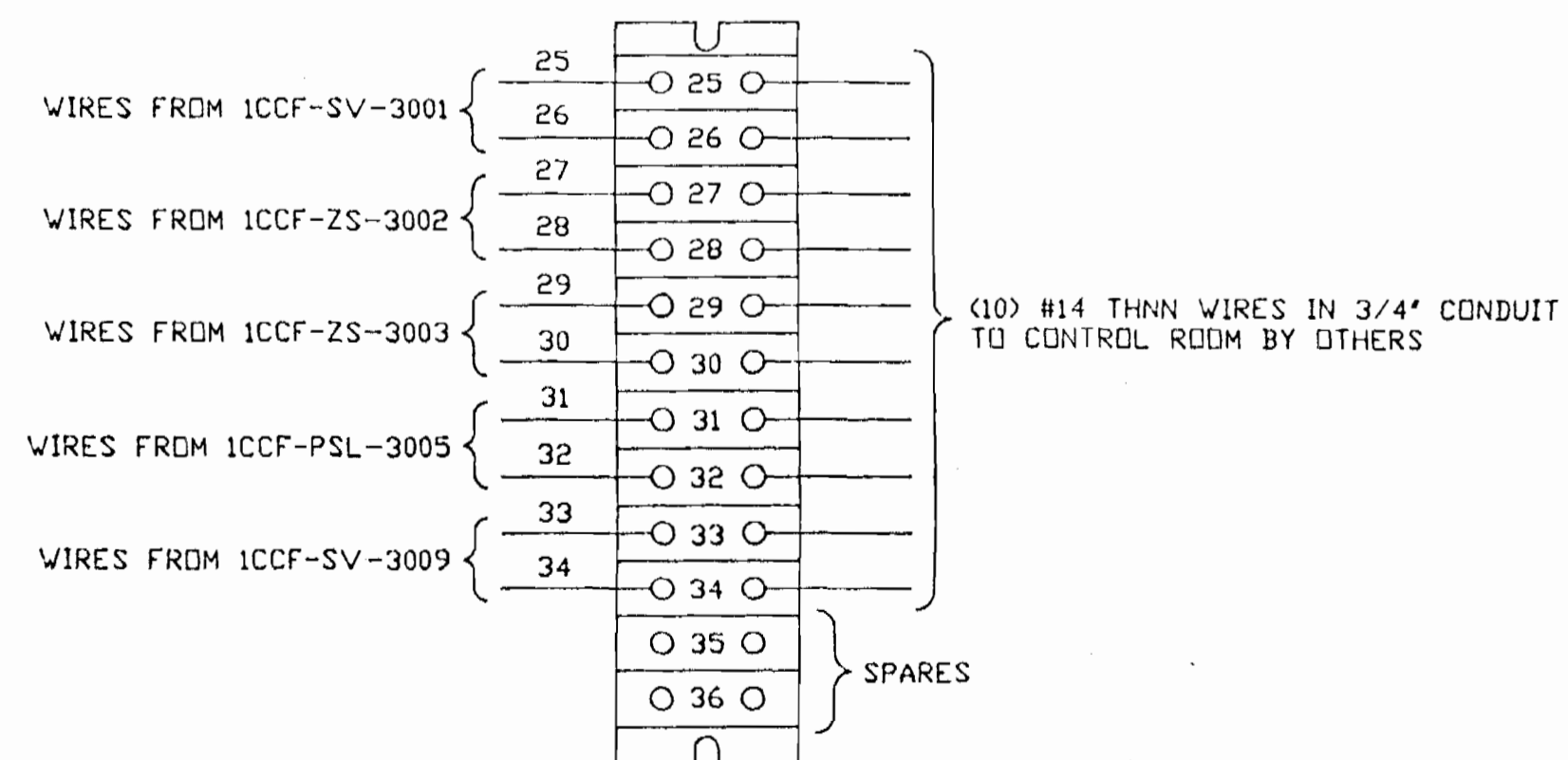
TERMINAL ARRANGEMENT FOR  
AQUEOUS AMMONIA STORAGE TANK SKID  
JUNCTION BOX #1CCF-JBX-2



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1A" JUNCTION BOX  
#1CCF-JBX-1002



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1B" JUNCTION BOX  
#1CCF-JBX-2002



TERMINAL ARRANGEMENT FOR  
VALVE RACK "1C" JUNCTION BOX  
#1CCF-JBX-3002

NOTE:

- THIS DRAWING IS FOR THE FABRICATION OF (4) ELECTRICAL JUNCTION BOXES. THE BOXES ARE FOR THE AQUEOUS AMMONIA STORAGE TANK SKID AND THE AMMONIA VALVE RACK "1A", "1B" AND "1C" SKIDS.
- INSTALLER TO PROVIDE A PHENOLIC ENGRAVABLE TYPE NAMEPLATE ON EACH JUNCTION BOX DOOR WITH THE JUNCTION BOX TAG NUMBER ON IT (EXAMPLE: "JUNCTION BOX #1CCF-JBX-'X'", WHERE 'X' IS THE NUMBER INDICATED ON THE TERMINAL DETAILS).

APPROVED FOR  
CONSTRUCTION  
BY *Sel* DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

**PYROPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. REV  
559536-D-7877-06-03 4  
B & V PROJECT 15637  
15637.62.3401

0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPVD
REVISIONS			

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**GLITSCH, INC.**  
Package Plants Division

**AHLSTROM**

SELLER DOCUMENT REVIEW STATUS

Seller May Proceed, No Exceptions Found

Seller May Proceed Subject to Implementation of Changes Indicated

Seller May Not Proceed, Review and Re-quote

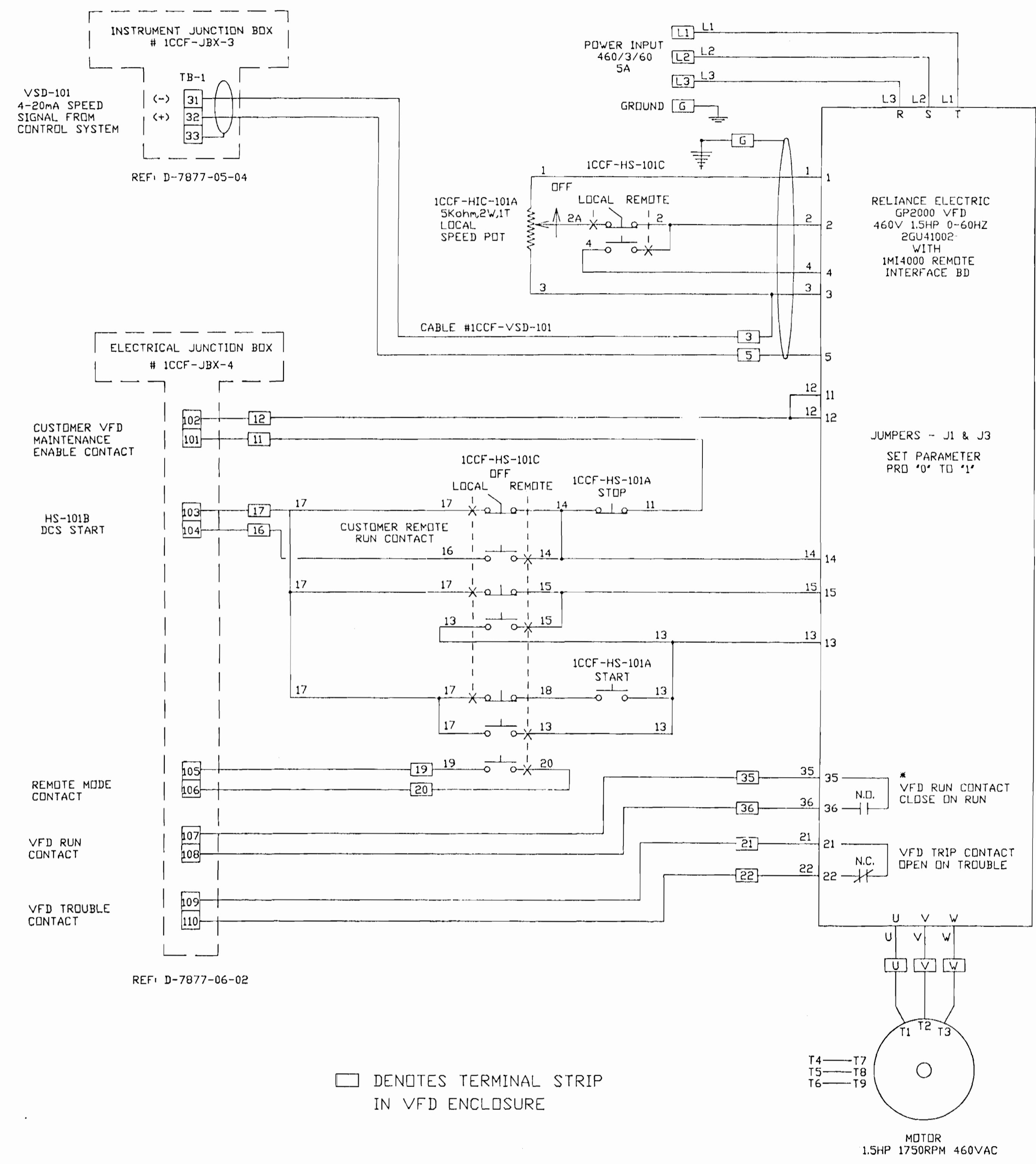
Seller May Proceed, Review Not Required

Seller Cancelled Drawing

Reviewed by: *md* Date: 6-18-93

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		ELECTRICAL JUNCTION BOXES FOR AUXILIARY SKIDS	
SCALE: HALF SIZE	DRAWN: JERRY	DATE: 4/17/93	JOB NO.: 6J-7877
CHECK: _____	DATE: _____	ENGR: _____	DRAWING NO.: D-7877-06-03
			REV: 0

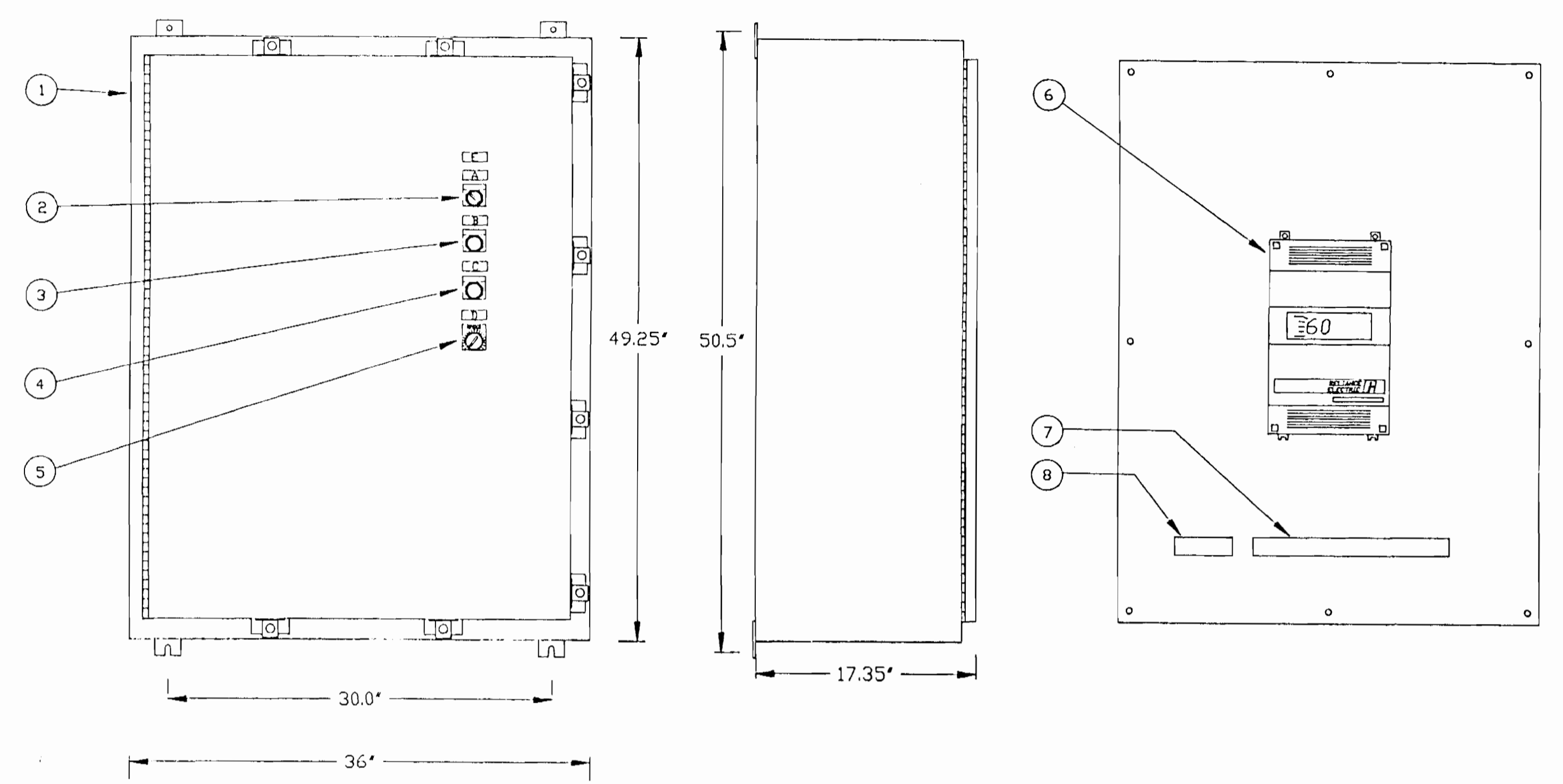
SCHMATIC



FRONT

SIDE

PANEL LAYOUT



PARTS

ITEM #	DESCRIPTION	QTY
1	HUFFMAN NEMA-4 ENCLOSURE P/N A48H36FLP WITH A48P36 BACKPANEL	1
2	AB 3 POS. MAINT. S.S. P/N 800T-JPC WITH 800T-X559E LOCAL-OFF-REMOTE LEGEND AND 800T-XA CONTACT BLOCK	1
3	AB GREEN MOM. P.B. P/N 800T-AJA WITH 800T-X532 LEGEND	1
4	AB RED MOM. P.B. P/N 800T-BGA WITH 800T-X639 LEGEND	1
5	AB 5K OHM SPEED POT IT. P/N 800T-U24 WITH 800T-X608 LEGEND	1
6	RELIANCE ELECTRIC 1.5HP 460VAC VFD P/N 2GU41002 WITH IM14000 REM. INT. BD.	1
7	AB CONTROL TERMINALS P/N 1492-CAL WITH (2) 1492-N23 END ANCHORS	13
8	AB HIGH VOLTAGE TERMINALS P/N 1492-GAL WITH (2) 1492-N23 END ANCHORS	7

TAG LISTING

ITEM #	DESCRIPTION	QTY
A	LOCAL-OFF-REMOTE / ICCF-HS-101C	1
B	START / ICCF-HS-101A	1
C	STOP / ICCF-HS-101A	1
D	ICCF-HIC-101A / SPEED ADJUST / 0-1750 RPM	1
E	VARIABLE FREQUENCY DRIVE / ICCF-SY-101	1

ALL ABOVE TAGS HAVE BLACK BACKGROUND WITH WHITE ENGRAVED LETTERING TAGS ARE 2" WIDE BY 3/4" HIGH ( / ) DENOTES NEW LINE

\* LOCATED ON REMOTE METER INTERFACE BD P/N IM14000

APPROVED FOR CONSTRUCTION  
 BY: *SCB* DATE: JUN 04 1993  
 GLITSCH PACKAGE PLANTS

**PYROPOWER**  
 SAN DIEGO, CALIFORNIA  
 DRAWING NO. 552586-D-7377-06-04 / 1  
 B & V PROJECT 15637  
 15637.62.3401

0	APPROVED FOR CONSTRUCTION	6/2/93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPVD
REVISIONS			

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**GLITSCH, INC.**  
 Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA	VFD FOR #ICCF-P-1A ELECTRICAL SCHEMATIC AND PHYSICAL ARRANGT PANEL #ICCF-CPL-1-A
SCALE: HALF SIZE	JOB NO. 6J-7877
DRAWN: S C R	DATE: 05/24/93
CHECK: DATE	DRAWING NO. REV.
ENGR: DATE	D-7877-06-04 0

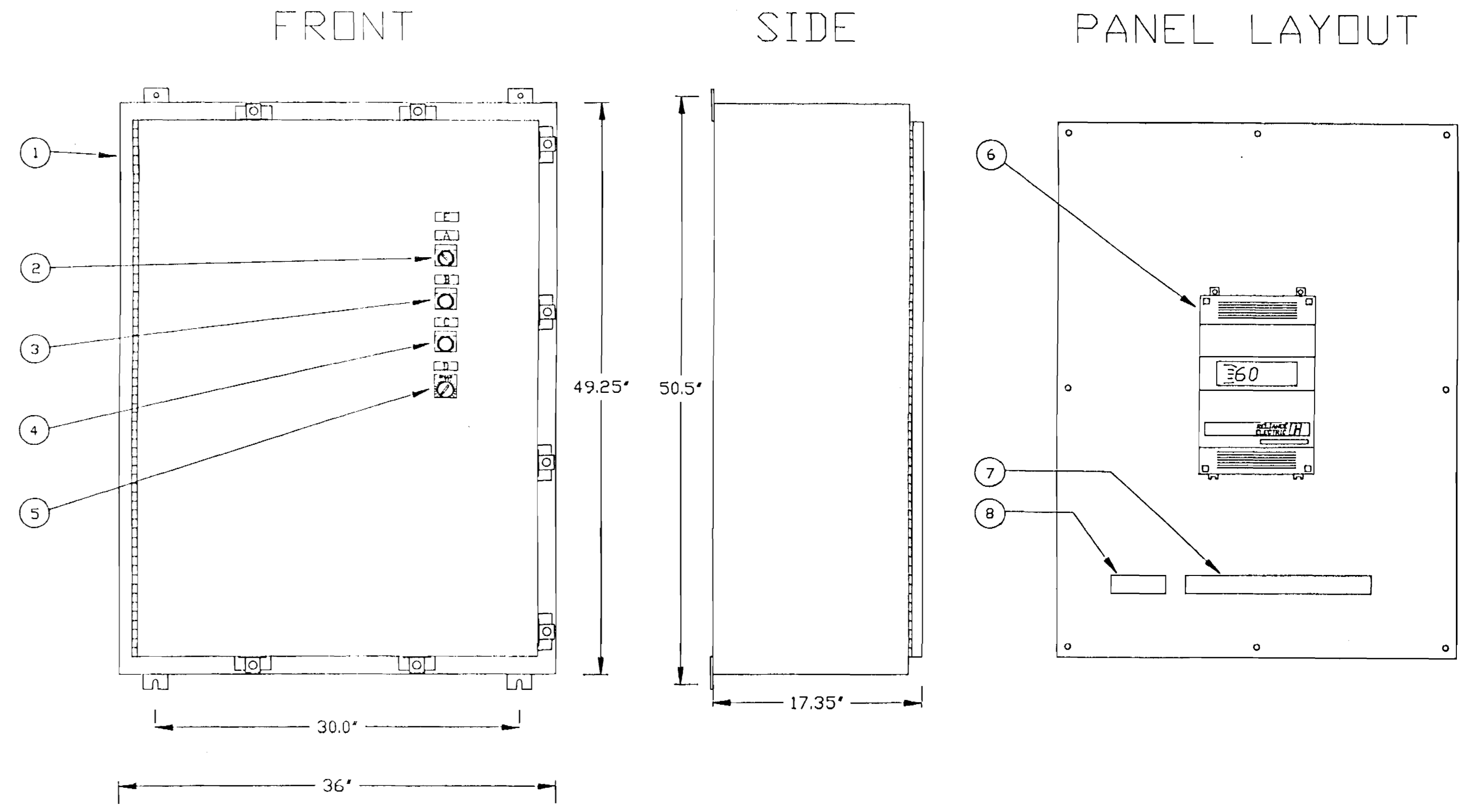
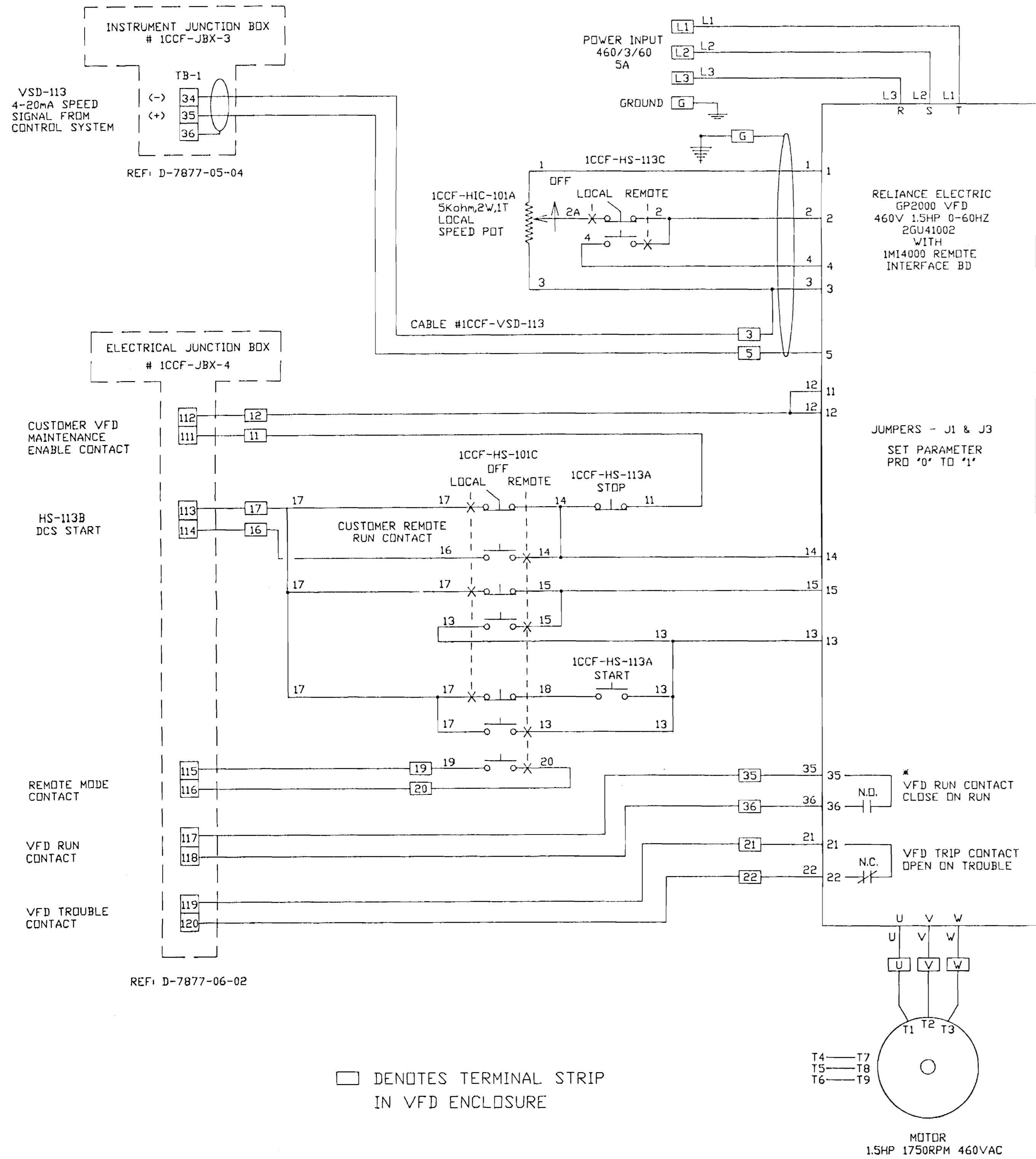
**AHLSTROM**  
 SELLER DOCUMENT REVIEW STATUS

Check Seller Printed No. Complete Hand  
 Check Seller Printed Labels to Transparencies of Changes Indicated  
 Check Seller Printed, Revised and Reissued  
 Check Seller Printed, Revised and Reissued  
 Submit Corrected Drawings

REVIEWED BY: *MA* DATE: 6-18-93



**SCHEMATIC**



**PARTS**

ITEM #	DESCRIPTION	QTY
1	HOFFMAN NEMA-4 ENCLOSURE P/N A48H36FLP WITH A48P36 BACKPANEL	1
2	AB 3 POS. MAINT. S.S. P/N 800T-J2C WITH 800T-X559E LOCAL-OFF-REMOTE LEGEND AND 800T-XA CONTACT BLOCK	1
3	AB GREEN MOM. P.B. P/N 800T-A1A WITH 800T-X532 LEGEND	1
4	AB RED MOM. P.B. P/N 800T-B6A WITH 800T-X639 LEGEND	1
5	AB 5K OHM SPEED POT. P/N 800T-U24 WITH 800T-X609 LEGEND	1
6	RELIANCE ELECTRIC 1.5HP 460VAC VFD P/N 2GU41002 WITH IM14000 REM. INT. BD.	1
7	AB CONTRL. TERMINALS P/N 1492-CAL WITH (2) 1492-N23 END ANCHORS	13
8	AB HIGH VOLTAGE TERMINALS P/N 1492-CAL WITH (2) 1492-N23 END ANCHORS	7

**TAG LISTING**

ITEM #	DESCRIPTION	QTY
A	LOCAL-OFF-REMOTE / ICCF-HS-113C	1
B	START / ICCF-HS-113A	1
C	STOP / ICCF-HS-113A	1
D	ICCF-HIC-101A / SPEED ADJUST / 0-1750 RPM	1
E	VARIABLE FREQUENCY DRIVE / ICCF-SY-113	1

ALL ABOVE TAGS HAVE BLACK BACKGROUND WITH WHITE ENGRAVED LETTERING  
TAGS ARE 2" WIDE BY 3/4" HIGH ( / ) DENOTES NEW LINE

\* LOCATED ON REMOTE METER INTERFACE BD P/N IM14000

**APPROVED FOR CONSTRUCTION**  
BY *SALE* DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

**PYROPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. 552536-D-7877-06-05  
REV 1  
B & V PROJECT 15637  
15637.62.3401

0	APPROVED FOR CONSTRUCTION	6/2/93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPVD

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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA	VFD FOR #ICCF-P-1B ELECTRICAL SCHEMATIC AND PHYSICAL ARRANG PANEL #ICCF-CPL-1-B
SCALE HALF SIZE	JOB NO. 6J-7877
DRAWN S C R DATE 05/24/93	DRAWING NO.
CHECK DATE	REV.
ENGR. DATE	D-7877-06-05 0

**AHLSTROM**

SELLER DOCUMENT REVIEW STATUS

Work Item Provided by Equipment Based

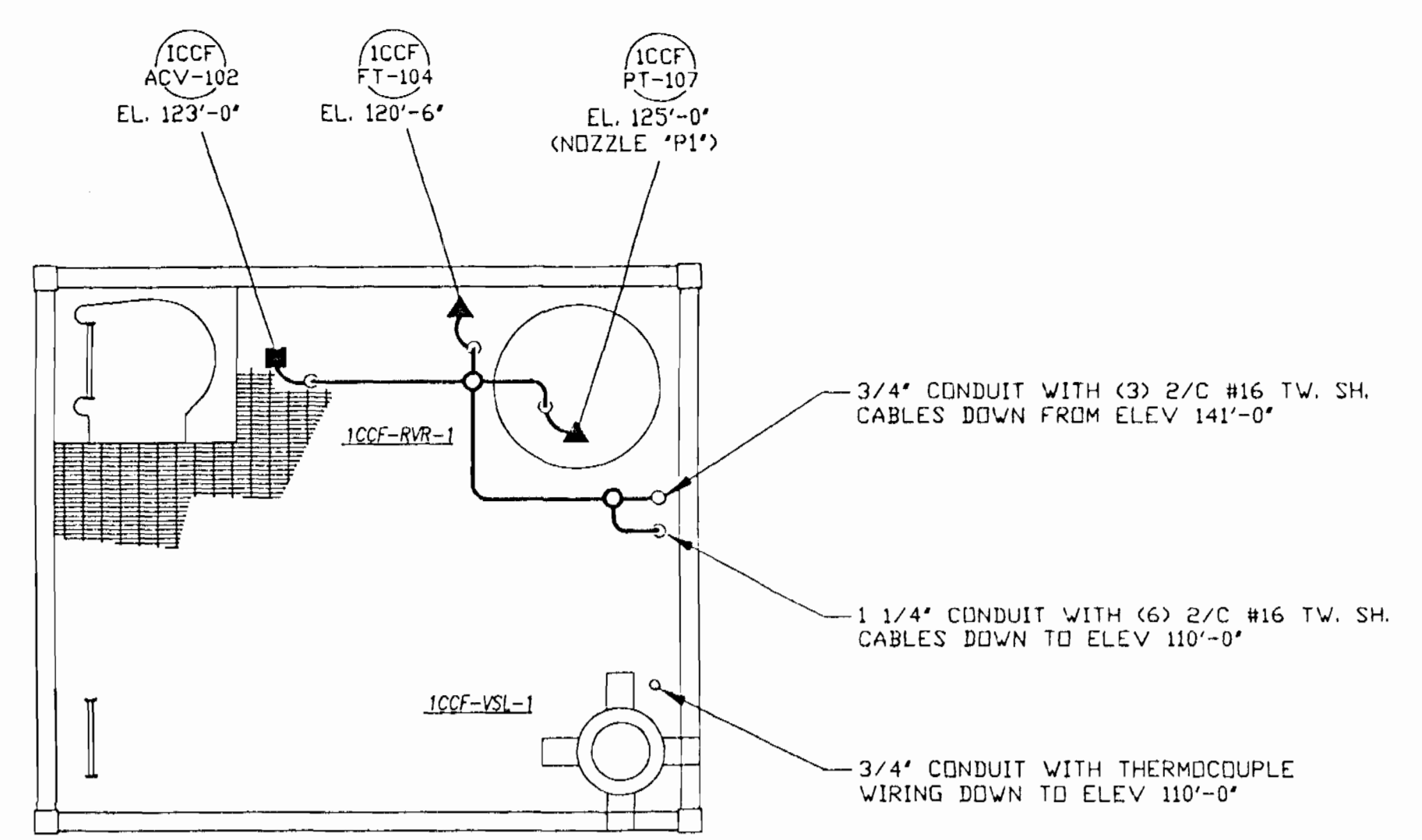
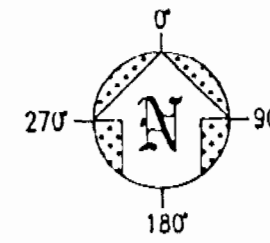
Work Item Provided by Equipment Based

Work Item Provided, Review and Rechecked

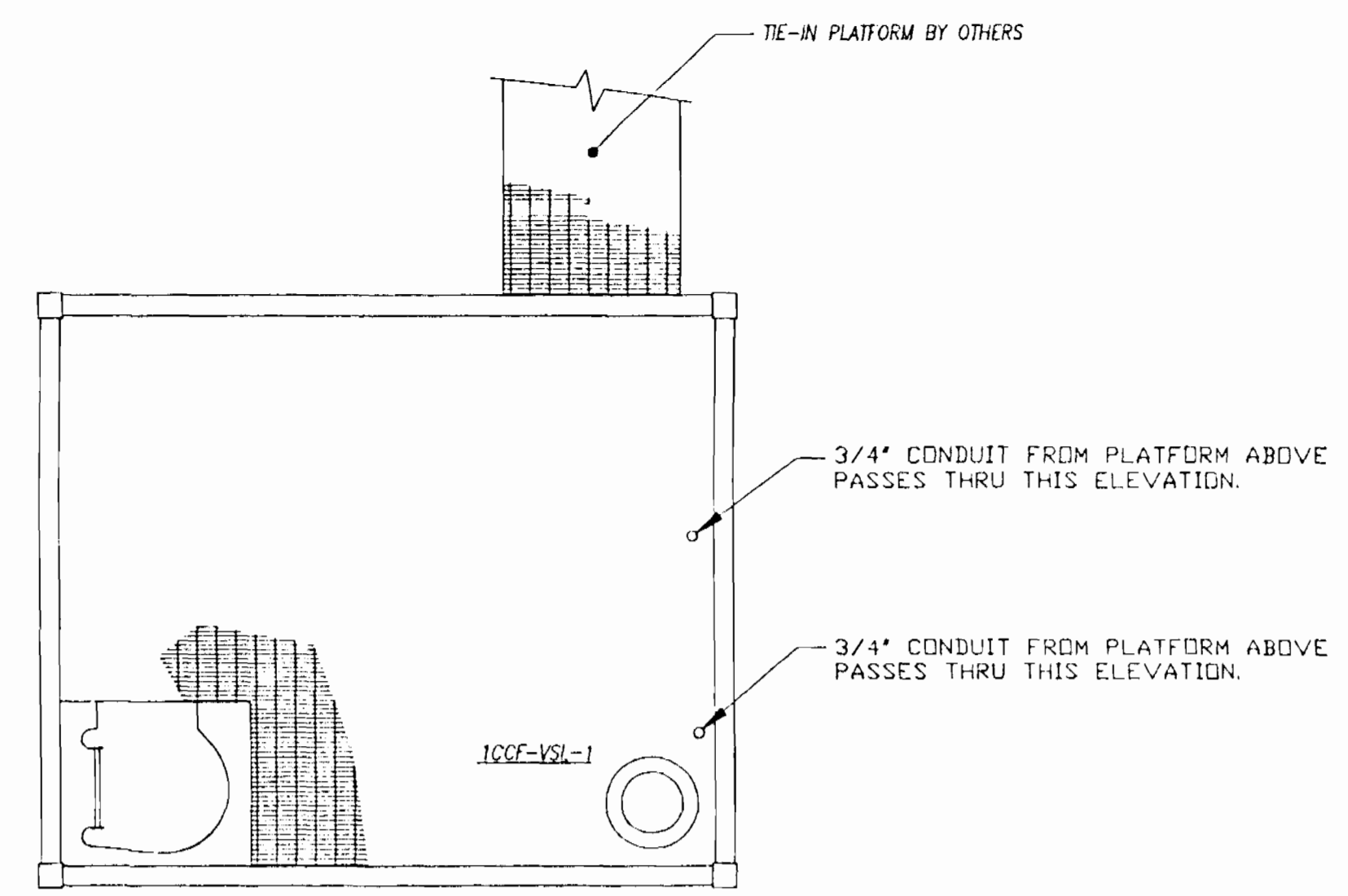
Work Item Provided, Review Not Required

Related Contract Drawings

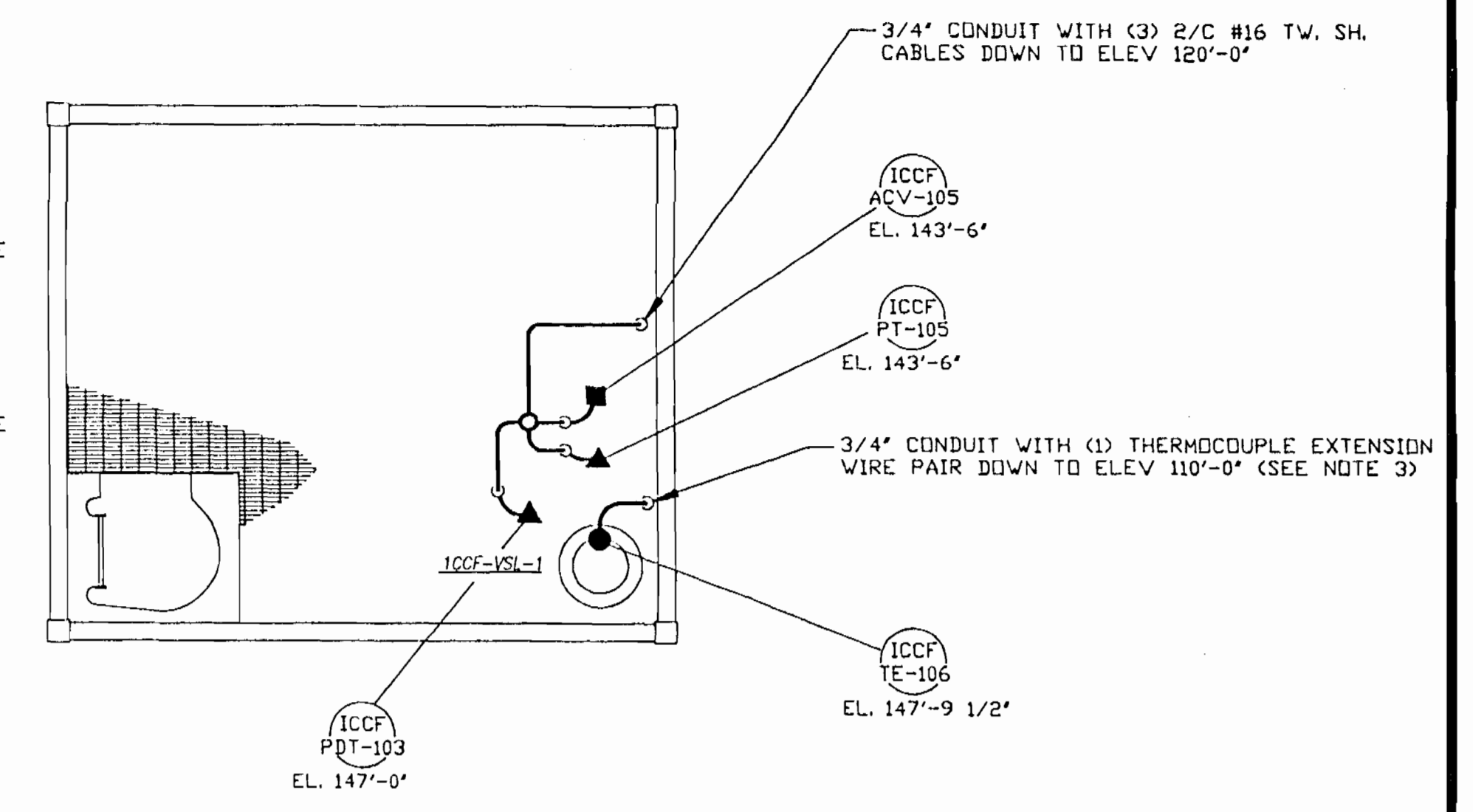
REVIEWED BY: *SALE* DATE: 6-18-93



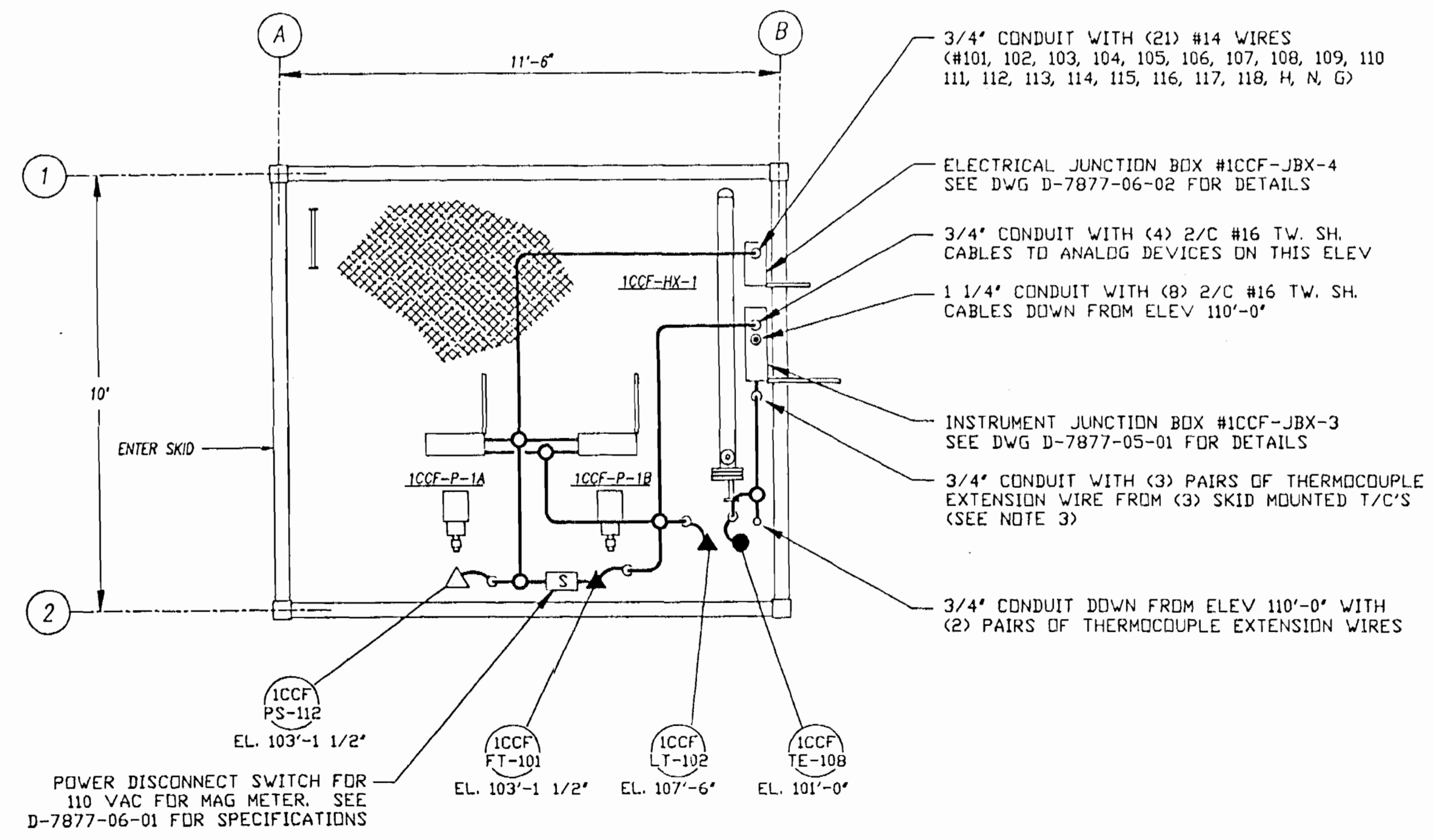
PLAN @ T.O.G. EL. 120'-0"



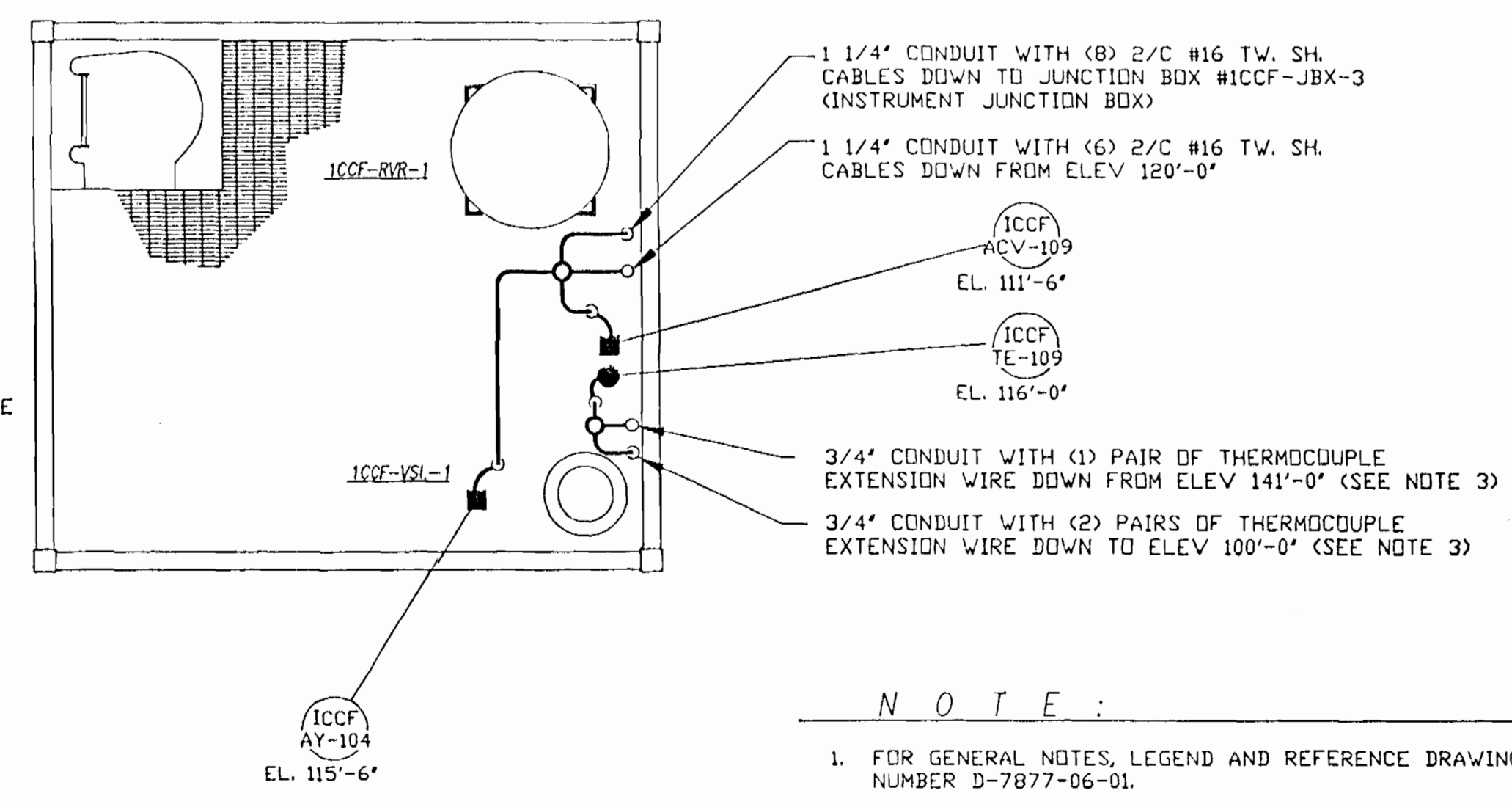
PLAN @ T.O.G. EL. 132'-0"



PLAN @ T.O.G. EL. 141'-0"



PLAN @ T.O.C.P. EL. 100'-0"



PLAN @ T.O.G. EL. 110'-0"

<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
DRAWING NO.	REV
559586-D-7877-06-06	3
B & V PROJECT 15637	
15637.62.3401	

**APPROVED FOR CONSTRUCTION**  
 BY *SELL* DATE JUN 04 1993  
 GLITSCH PACKAGE PLANTS

<b>AHLSTROM</b>	
SELLER DOCUMENT REVIEW STATUS	
<input checked="" type="checkbox"/> Work Item Presented to Buyer/Client	
<input type="checkbox"/> Work Item Presented to Buyer/Client and Changes Indicated	
<input type="checkbox"/> Work Item Not Presented, Rejected and Resubmitted	
<input type="checkbox"/> Work Item Presented, Rejected and Resubmitted	
<input type="checkbox"/> Rejected - Client Change	
<small>Approval is granted when the work is reviewed by the Buyer/Client and the Seller/Supplier. This approval does not constitute a warranty or guarantee of any kind. The Seller/Supplier is not responsible for any errors or omissions in this drawing. The Buyer/Client is responsible for any errors or omissions in this drawing.</small>	
REVIEWED BY	DATE
<i>[Signature]</i>	6-18-93

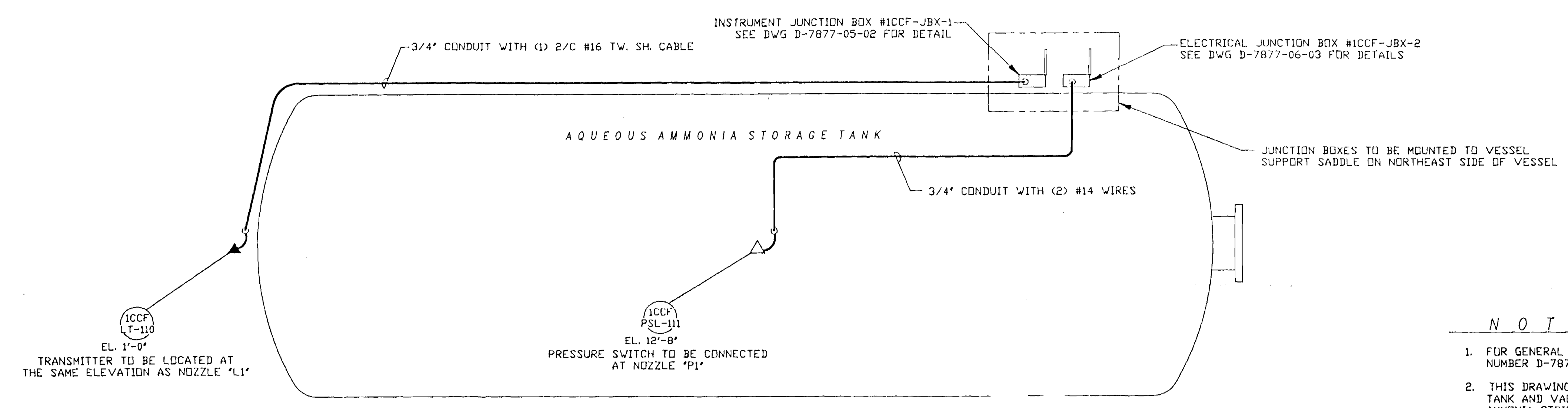
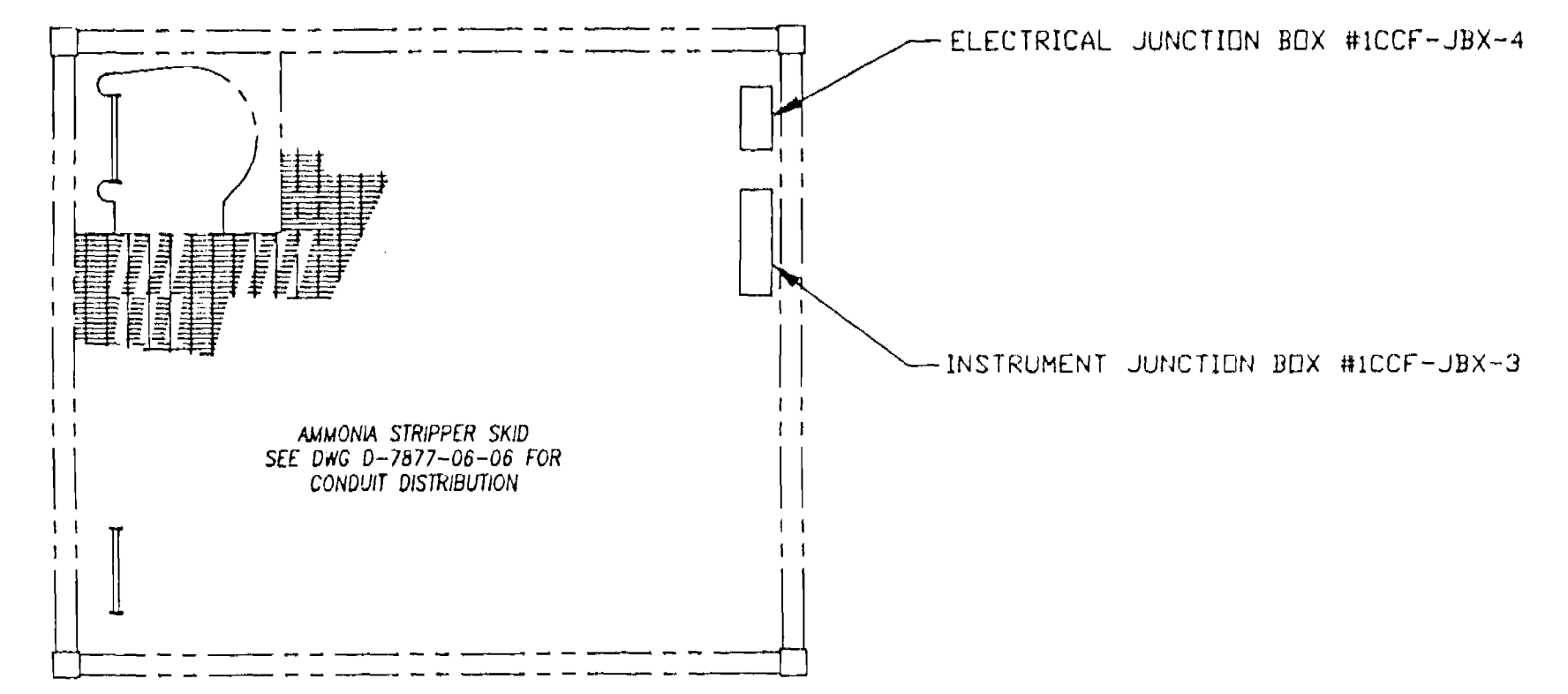
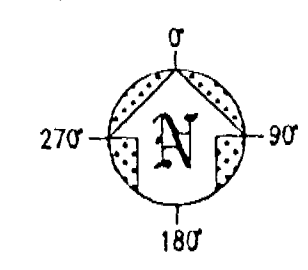
- NOTE:**
- FOR GENERAL NOTES, LEGEND AND REFERENCE DRAWING LIST, SEE DRAWING NUMBER D-7877-06-01.
  - THIS DRAWING DEPICTS THE CONDUIT DISTRIBUTION FOR THE AMMONIA STRIPPER SKID ONLY. FOR CONDUIT DISTRIBUTION ON THE AMMONIA STORAGE TANK SKID AND THE AMMONIA VALVE RACK SKIDS, SEE DRAWING D-7877-06-07.
  - SEE DRAWING D-7877-06-01 FOR RECOMMENDED THERMOCOUPLE EXTENSION WIRE SPECIFICATIONS.

0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPROV
REVISIONS			

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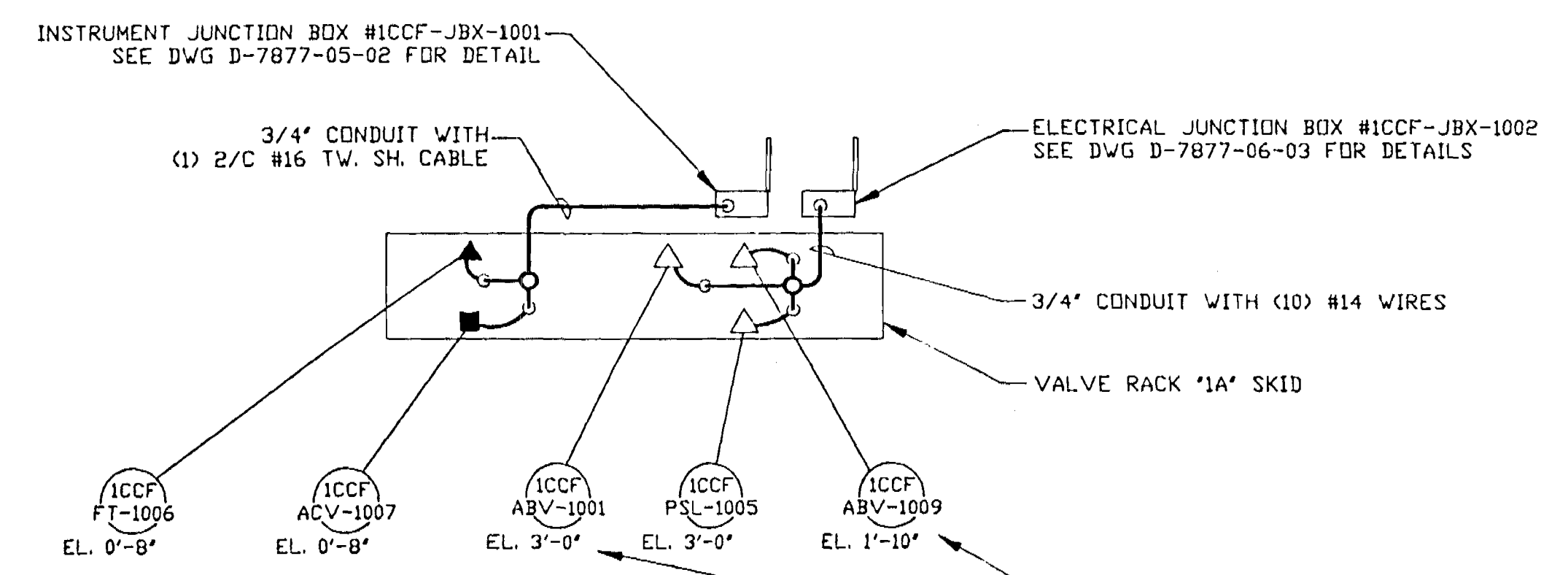
<b>GLITSCH, INC.</b>			
Package Plants Division		INSTRUMENTATION/ELECTRICAL CONDUIT PLAN FOR AMMONIA STRIPPER SKID	
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		JOB NO. 6J-7877	
SCALE 3/8" = 1'-0"	DRAWN J.E.R.Y.	DATE 4/22/93	DRAWING NO.
CHECK	ENGR.	DATE	REV.
			D-7877-06-06 0





**NOTE:**

1. FOR GENERAL NOTES, LEGEND AND REFERENCE DRAWING LIST SEE DRAWING NUMBER D-7877-06-01.
2. THIS DRAWING DEPICTS THE CONDUIT DISTRIBUTION FOR THE AMMONIA STORAGE TANK AND VALVE RACK SKIDS ONLY. FOR CONDUIT DISTRIBUTION ON THE AMMONIA STRIPPER SKID SEE DRAWING D-7877-06-06.
3. THIS DRAWING DOES NOT SHOW THE EXACT RELATIONSHIP OF THE INDIVIDUAL SKIDS WITH RESPECT TO EACH OTHER. THE AMMONIA STORAGE TANK IS DEPICTED IN IT'S APPROXIMATE ORIENTATION TO THE STRIPPER SKID. THE AMMONIA VALVE RACK ORIENTATION WAS NOT KNOWN AT THE TIME THIS DOCUMENT WAS PRODUCED. A TOTAL OF (3) VALVE RACKS ARE REQUIRED IN THE SCOPE OF THIS PROJECT AND VALVE RACK 1A IS SHOWN AS A TYPICAL INSTALLATION.



ABV-1001 AND ABV-1009 ARE SUPPLIED WITH A NAMCO VALVE MONITORING PACKAGE. ABV-1001 WILL UTILIZE THE OPEN AND CLOSED LIMIT SWITCHES AND WILL REQUIRE (6) #14 WIRES AND ABV-1009 WILL ONLY UTILIZE THE SOLENDID VALVE AND REQUIRE (2) #14 WIRES.

**AMMONIA VALVE RACK "1-A"**

THIS CONDUIT DISTRIBUTION IS TYPICAL FOR VALVE RACKS 1B AND 1C WITH THE EXCEPTION OF THE INSTRUMENT TAG NUMBERS

APPROVED FOR  
CONSTRUCTION  
BY *SA* DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

**PyroPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. REV  
559586-D-7877-06-07 3  
B & V PROJECT 15637  
15637.62.3401

0	REVISED AS PER PYROPOWER COMMENTS	5/10/93	
SYMBOL	DESCRIPTIONS	DATE	APPROV
REVISIONS			

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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA	INSTRUMENTATION/ELECTRICAL CONDUIT PLANS FOR THE AMMONIA STORAGE TANK AND VALVE RACK SKIDS
SCALE 3/8" = 1'-0"	JOB NO. 6J-7877
DRAWN JERRY DATE 4/23/93	DRAWING NO. REV.
CHECK DATE	D-7877-06-07 0
ENGR. DATE	

**AHLSTROM**

SELLER DOCUMENT REVIEW STATUS

Mark Has Passed, No Discrepancies Found

Mark Has Passed Subject to Incorporation of Changes Indicated

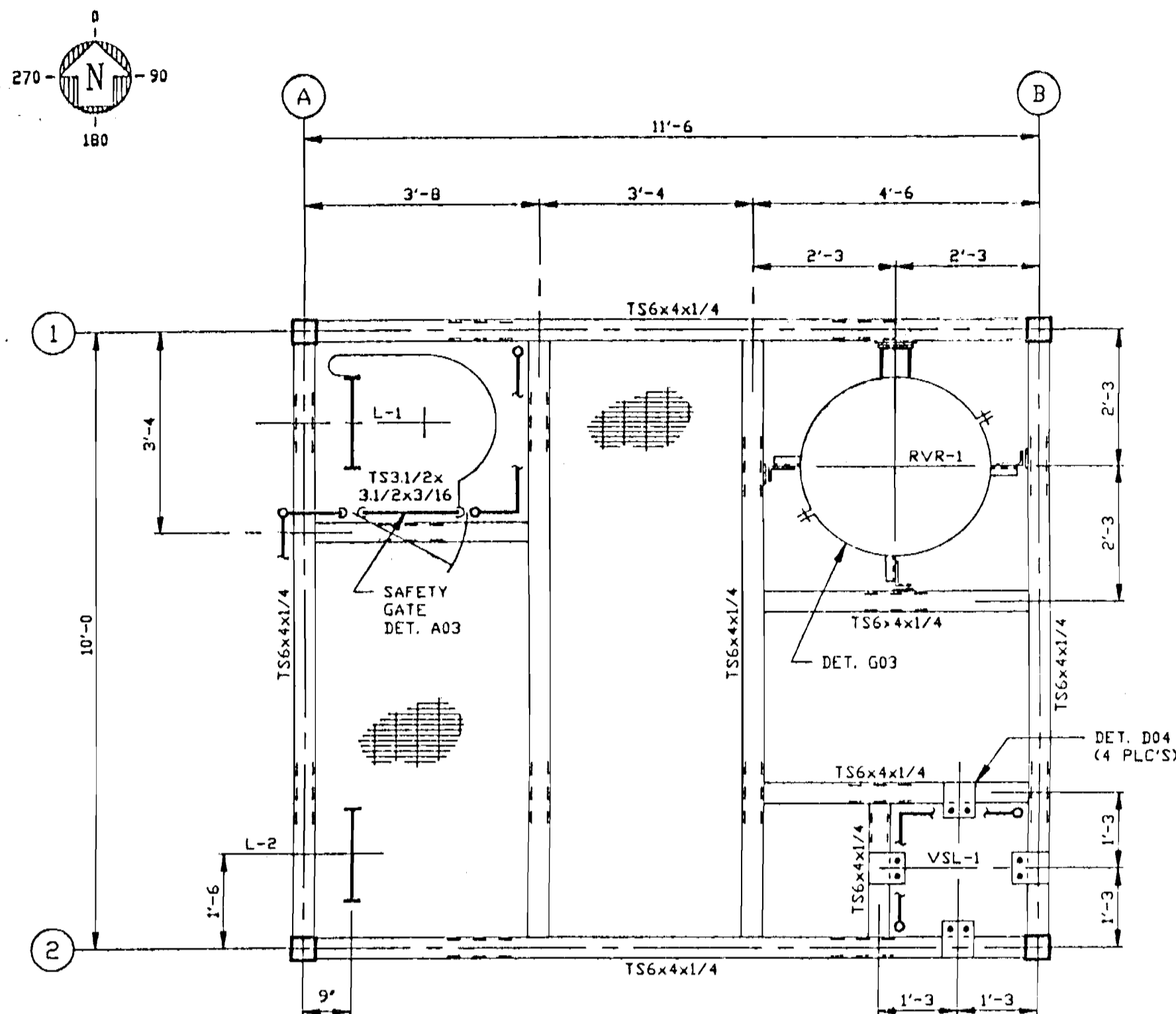
Mark Has Not Passed, Review Not Required

Mark Has Passed, Review Not Required

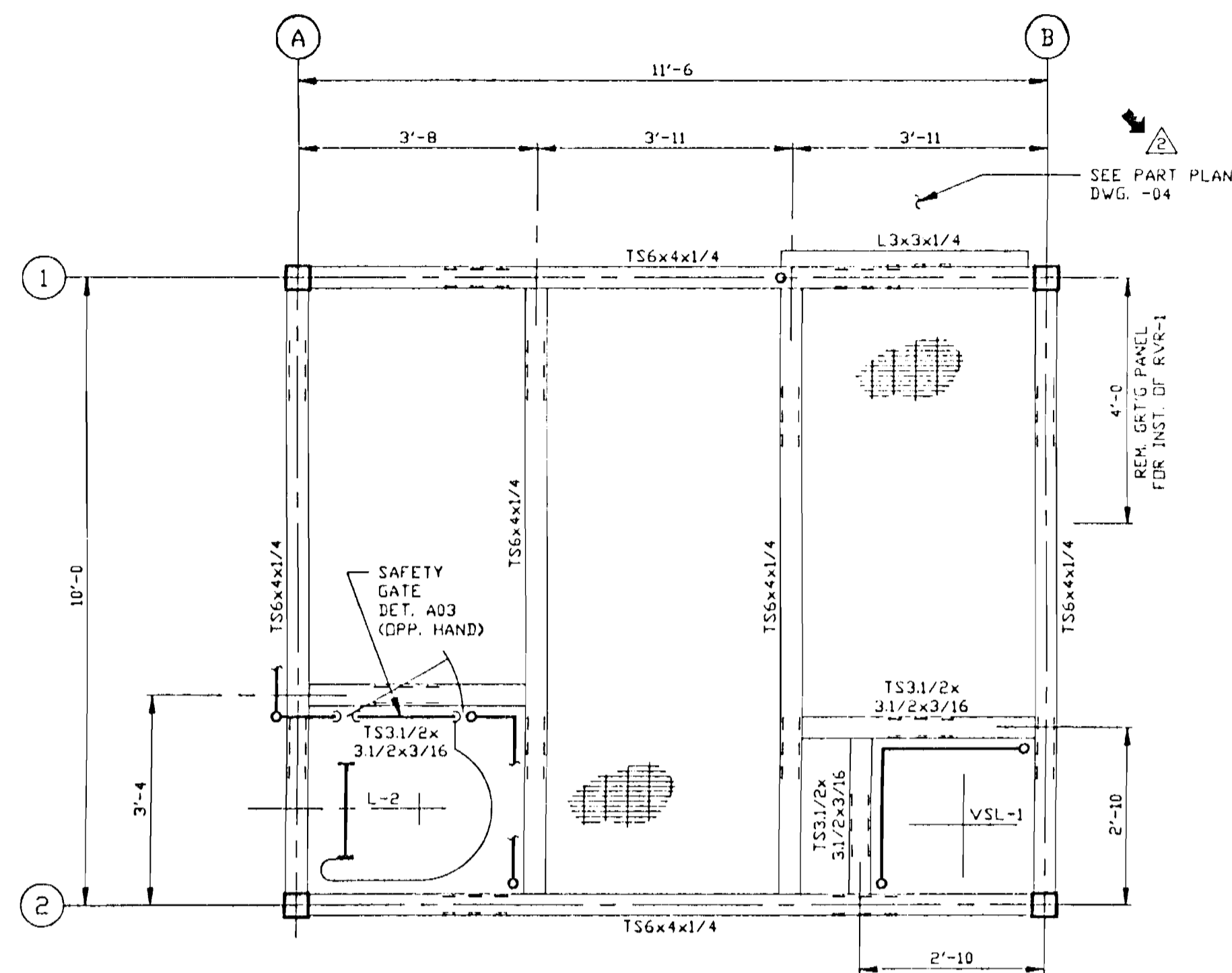
Review Cancelled/Overruled

Review is provided based on review for ALL of the information under the P&ID system. This review does not constitute an endorsement or approval of the design or construction of the equipment shown on the drawings. The manufacturer's instructions, specifications, and drawings are the primary reference for the equipment shown on the drawings.

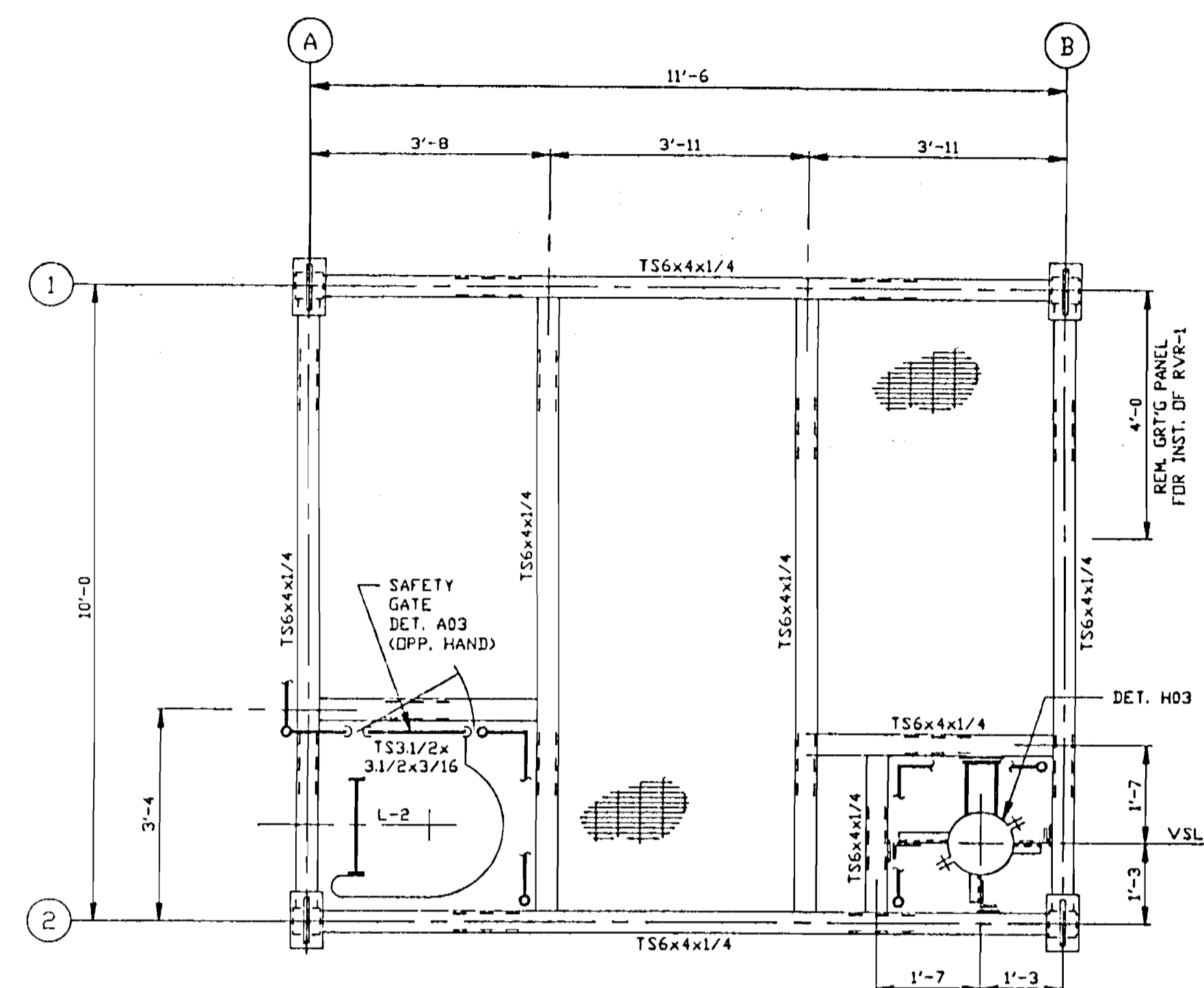
DATE 6-18-97



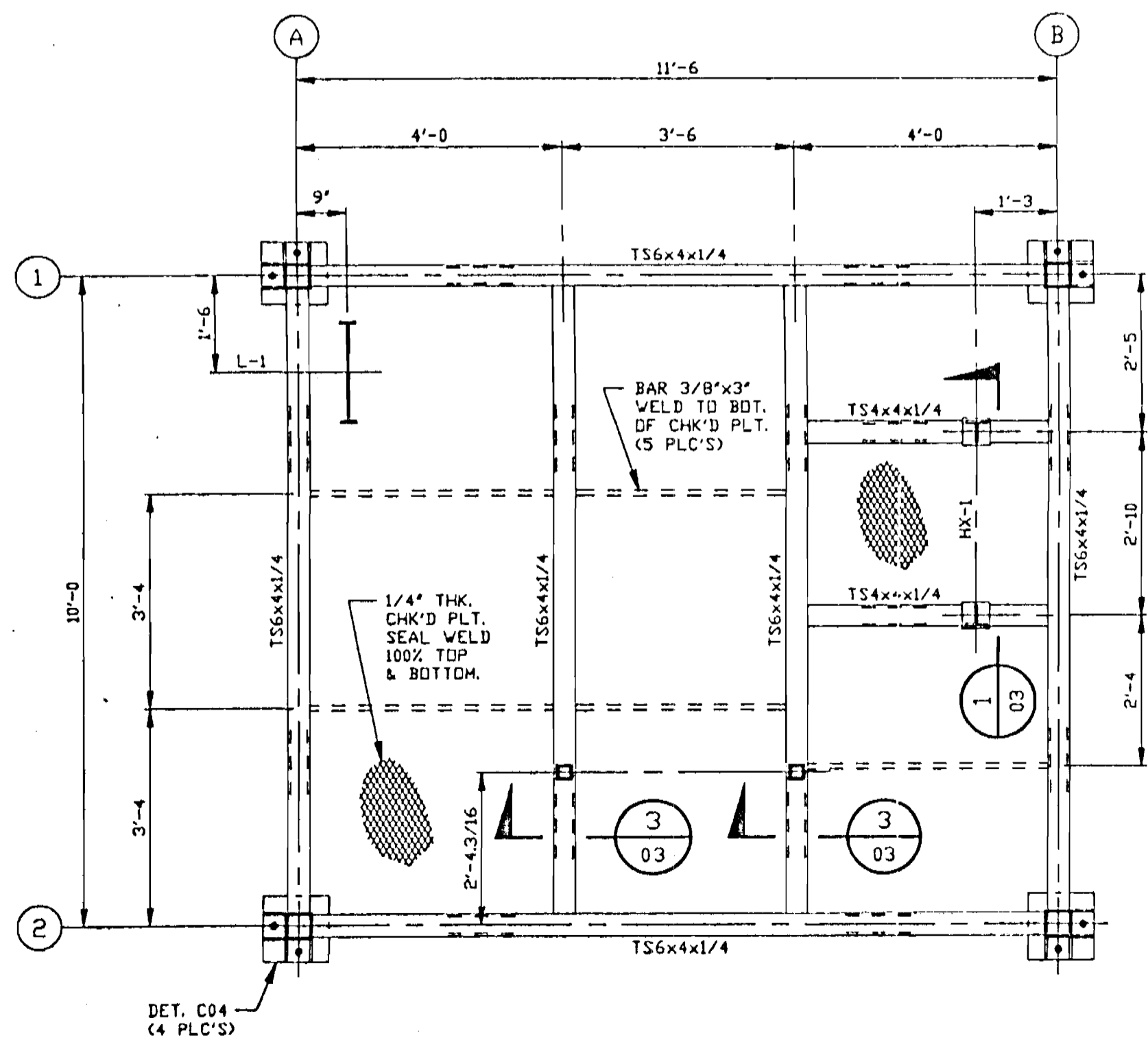
PLAN @ EL. 120'-0 T/GRT'G  
(T/S -1')



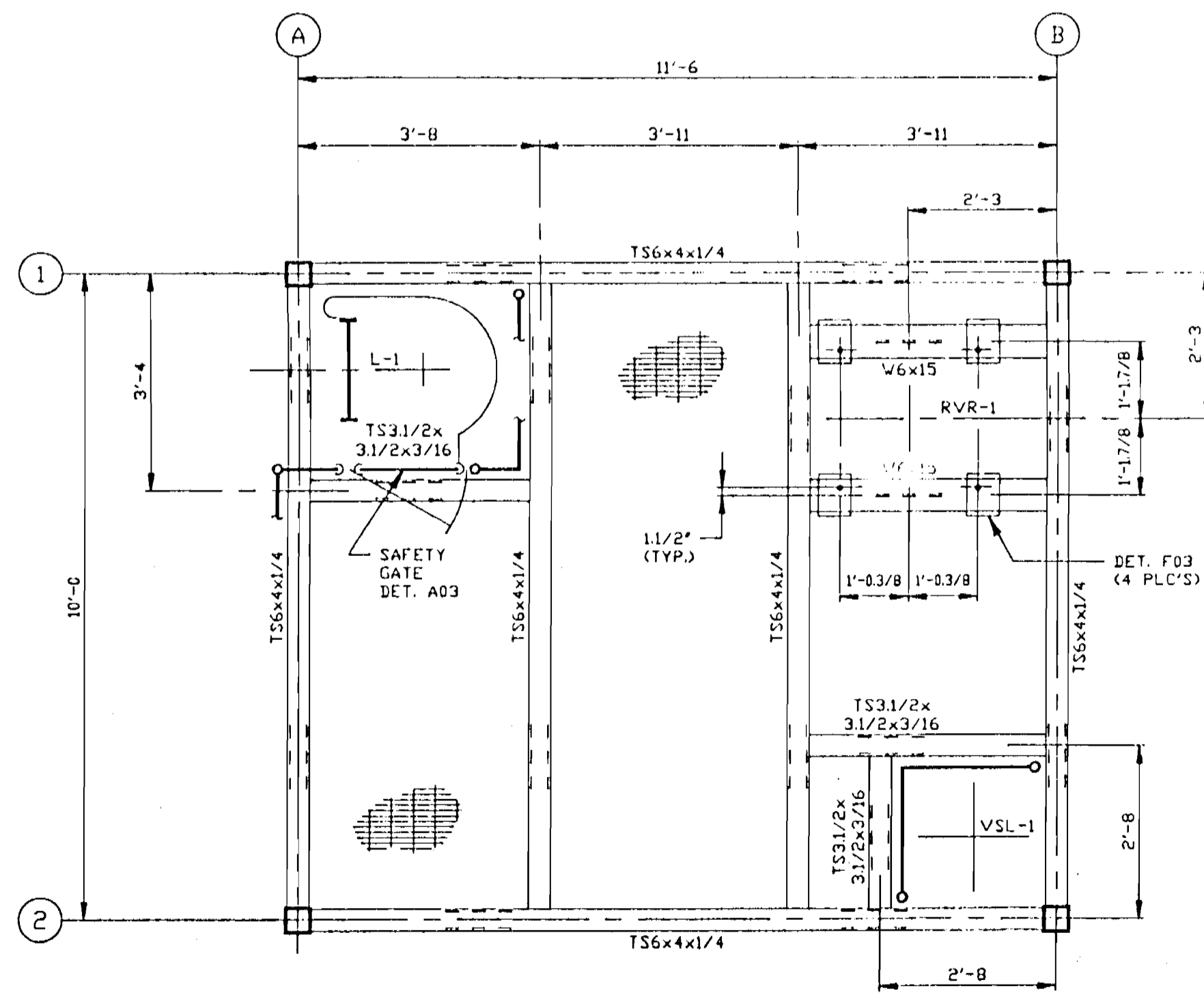
PLAN @ EL. 132'-0 T/GRT'G  
(T/S -1')



PLAN @ EL. 141'-0 T/GRT'G  
(T/S -1')



PLAN @ EL. 100'-0 T/CHK'D PLT.  
(T/S -1/4')



PLAN @ EL. 110'-0 T/GRT'G  
(T/S -1')

NOTES:

- FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE DWG. D-7877-07-02

SAN DIEGO, CALIFORNIA		REV
DRAWING NO.		
553586-D-7877-07-01		4
B & V PROJECT 15637		
15637.62.3401		

APPROVED FOR  
CONSTRUCTION  
BY SELL DATE JUN 04 1993  
GLITSCH PACKAGE PLANTS

SYMBOL	DESCRIPTION	DATE	APPROV
2	REV. TITLE BLOCK - ADD PART PLAN @ EL. 132'-0	06/03/93	JPA
1	GENERAL REVISION.	04/19/93	JA

REVISIONS

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**GLITSCH, INC.**  
Package Plants Division

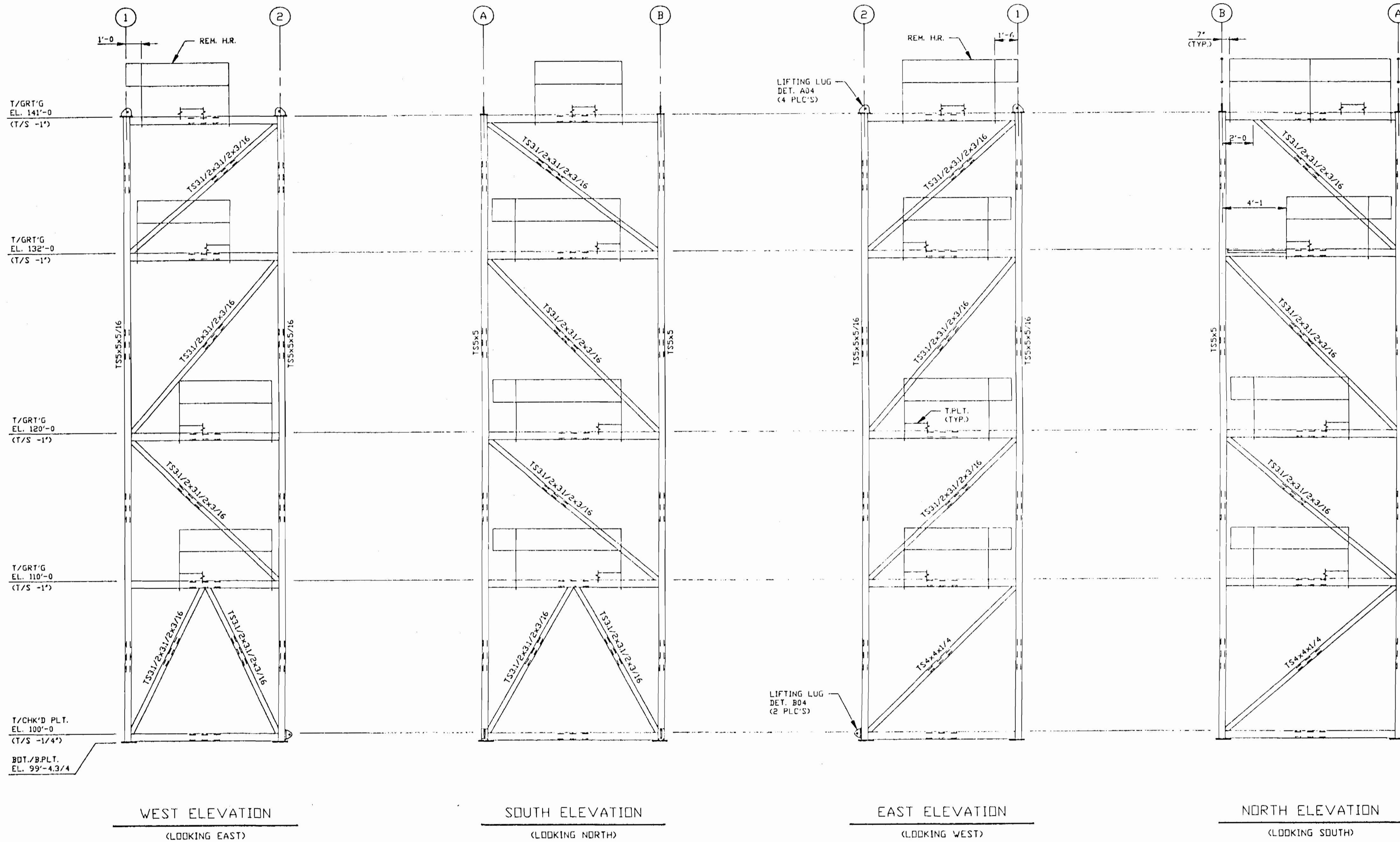
CEDAR BAY  
GENERATING CO.  
PYROPOWER  
SAN DIEGO, CA

SKID  
PLANS

SCALE	1/2" = 1'-0"	JOB No.	6J-7877 / 1193
DRAWN	DL	DATE	03/24/93
CHECK	JA	DATE	03/24/93
ENGR.		DATE	
DRAWING No.			REV.
D-7877-07-01			2

AHLSTROM	
SELLER DOCUMENT REVIEW STATUS	
<input type="checkbox"/>	Check Sales Proposed, No Exceptions Requested
<input type="checkbox"/>	Check Sales Proposed Subject to Incorporation of Changes Indicated
<input type="checkbox"/>	Check Sales Proposed, Ready for Issuance
<input type="checkbox"/>	Check Sales Proposed, Revised Not Required
<input type="checkbox"/>	Revised Contract Drawings
Date: <u>6/18/93</u> Initials: <u>[Signature]</u>	

19



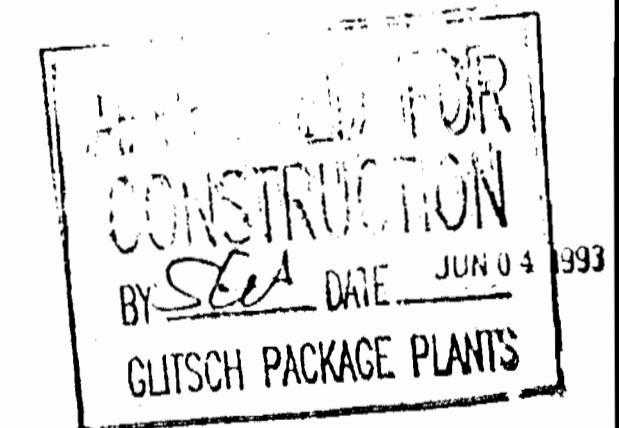
GENERAL NOTES:

1. FOR ADDITIONAL REQUIREMENTS SEE GLITSCH STD-008 'STRUCTURAL STEEL FABRICATION'.
2. STEEL SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST SPECIFICATIONS, ASD, OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, UNLESS OTHERWISE NOTED.
3. STEEL TUBING SHALL BE ASTM A500 GR. B.
4. STEEL SHAPES AND PLATES SHALL BE ASTM A36.
5. WELDING SHALL CONFORM TO THE LATEST EDITION OF THE STRUCTURAL WELDING CODE AWS D11.
6. ELECTRODES SHALL BE CLASS E70XX.
7. HANDRAILING SHALL BE 2" NOM. DIA. PIPE ASTM A53 GRADE B, SCHEDULE 40. HANDRAIL SHALL BE HOT DIP GALVANIZED.
8. GRATING SHALL BE BORDEN TYPE W/B SIZE 4 OR EQUAL, MADE W/1"x3/16" BEARING BARS AT 1.3/16" O.C. AND TWISTED CROSS BARS AT 4" O.C. MATERIAL SHALL BE A569 STEEL OR APPROVED EQUAL. GRATING SHALL BE HOT DIP GALVANIZED.
9. TUBING AND SHAPES SHALL NOT BE SPLICED UNLESS APPROVED BY GLITSCH INC.
10. BOLTED CONNECTION SHALL BE 3/4" DIA. BOLTS ASTM A-325 IN 1.3/16" HOLES, U.D.N.
11. ALL OPEN ENDS OF STRUCTURAL TUBING SHALL BE CAPPED WITH 1/4" THK. PLATE U.D.N.
12. ALL ATTACHMENT FOR EQUIPMENT SUPPORT SHALL BE WELDED TO MAIN STEEL WITH BEVEL WELD OR 3/16" FILLET WELD ALL AROUND U.D.N.
13. ALL STRUCTURAL STEEL SHALL BE SHOP PRIME PAINTED WITH THE PRIMER SPECIFIED IN SECTION 1B OF CONTRACT 62.3401.

REFERENCE DRAWINGS:

1. GENERAL ARRANGEMENT DRAWING: D-7877-02-01
2. WORK THIS DRAWING WITH DWGS: D-7877-07-01, -03 & -04

SAN DIEGO, CALIF. OFFICE	
DRAWING NO.	REV.
55-586-D-7877-07-02	5
B & V PROJECT 15637	
15637.62.3401	



SYMBOL	DESCRIPTION	DATE	APP'D
2	REV. TITLE BLOCK.	06/03/93	JF
1	GENERAL REVISION.	04/19/93	JA

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**GLITSCH, INC.**  
Package Plants Division



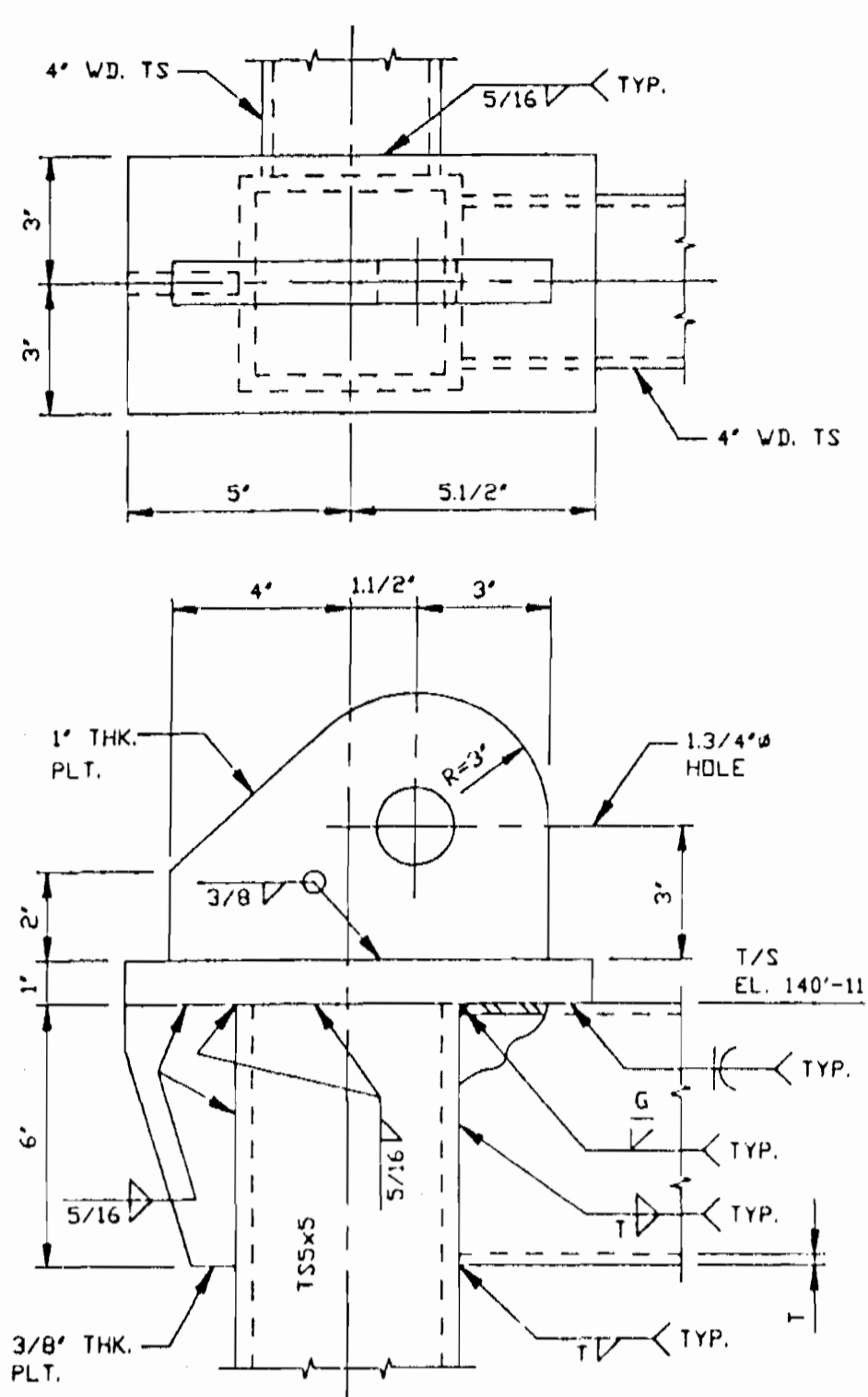
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		SKID ELEVATIONS	
SCALE	1/4" = 1'-0"	JOB No.	6J-7877 / 1193
DRAWN	DL DATE 03/24/93	DRAWING No.	REV.
CHECK	JA DATE 03/24/93	D-7877-07-02	2
ENGR.	DATE		

AHLSTROM DOCUMENT REVIEW STATUS	
7	DATE 6/10/93

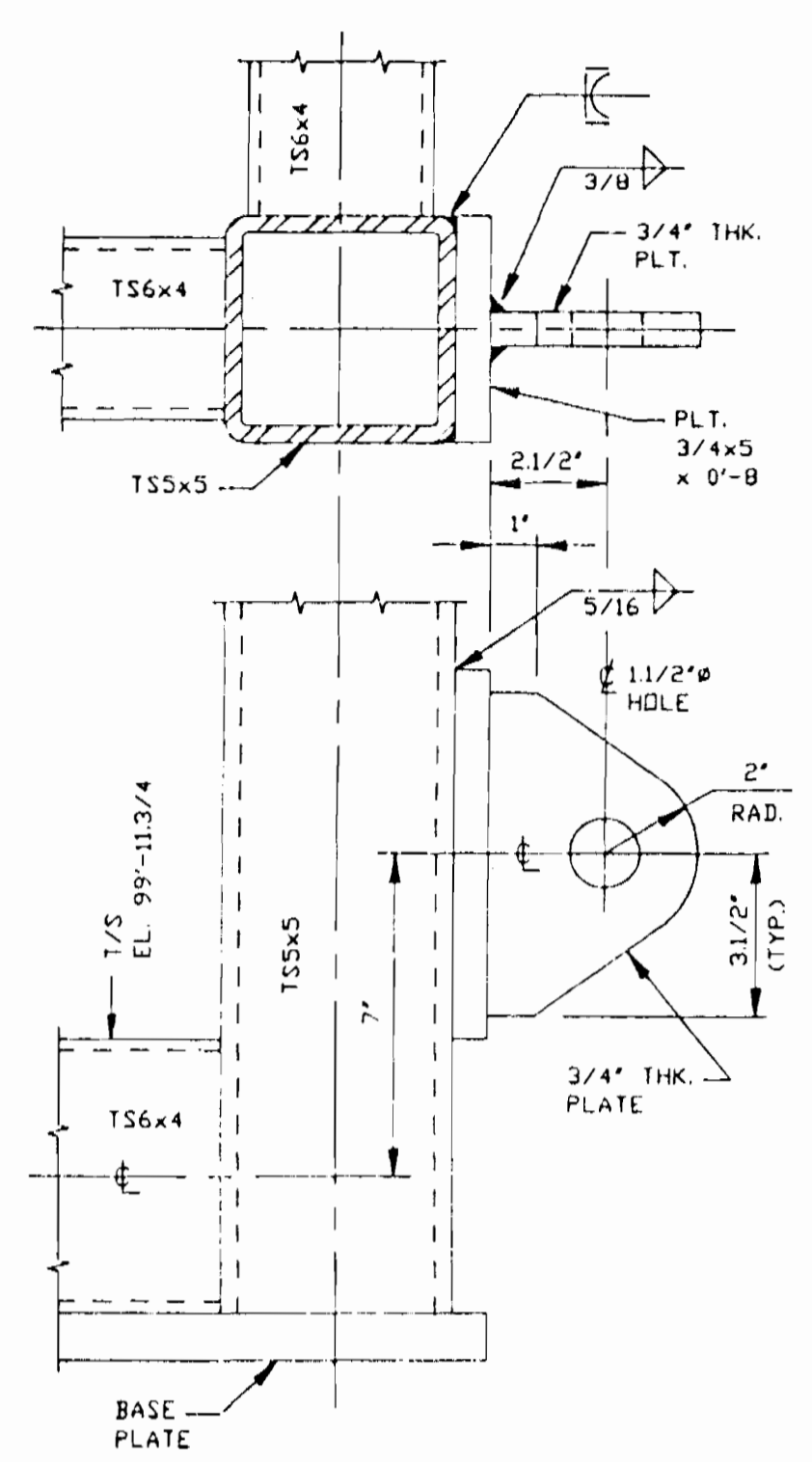
8-26-93 REV 5



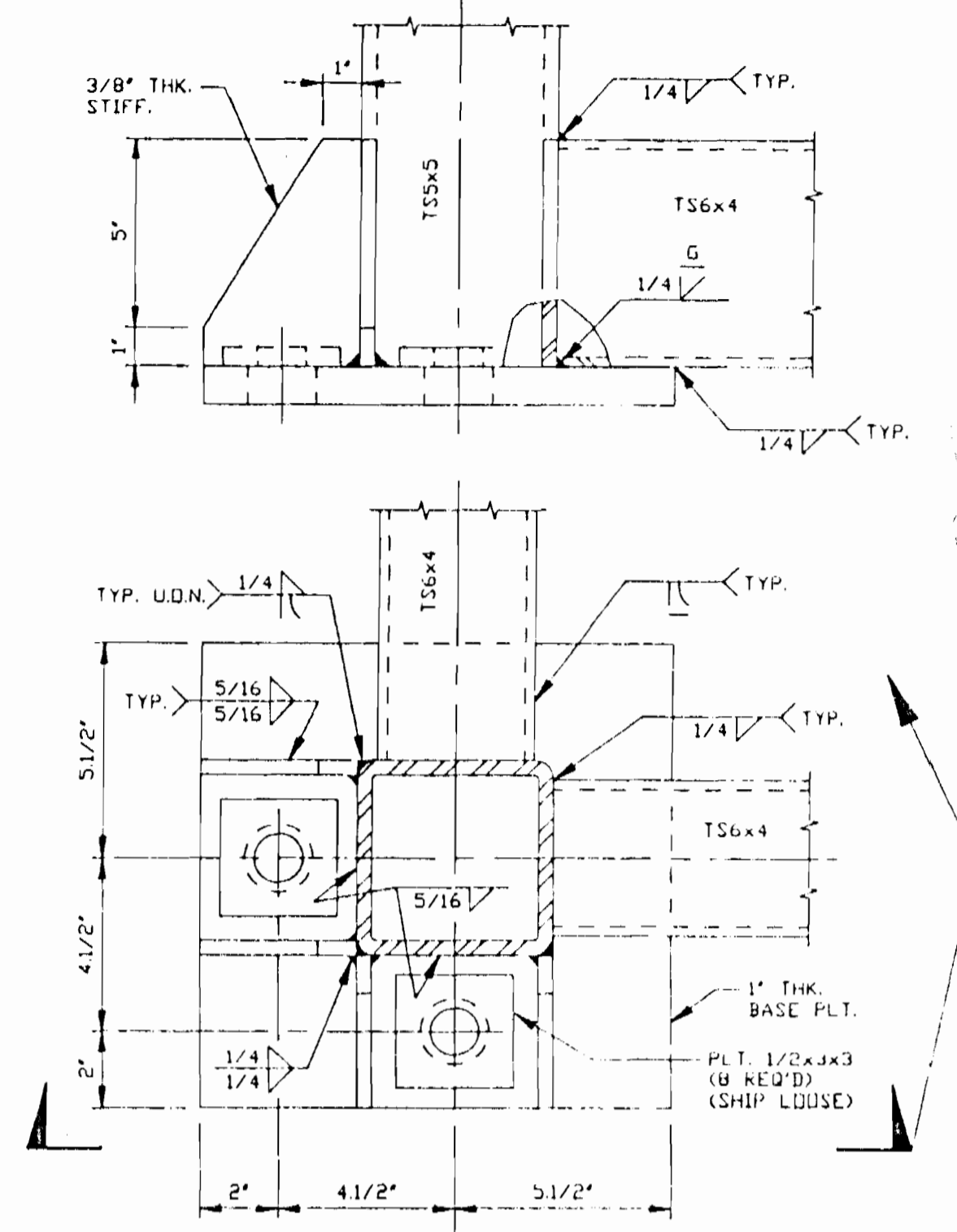




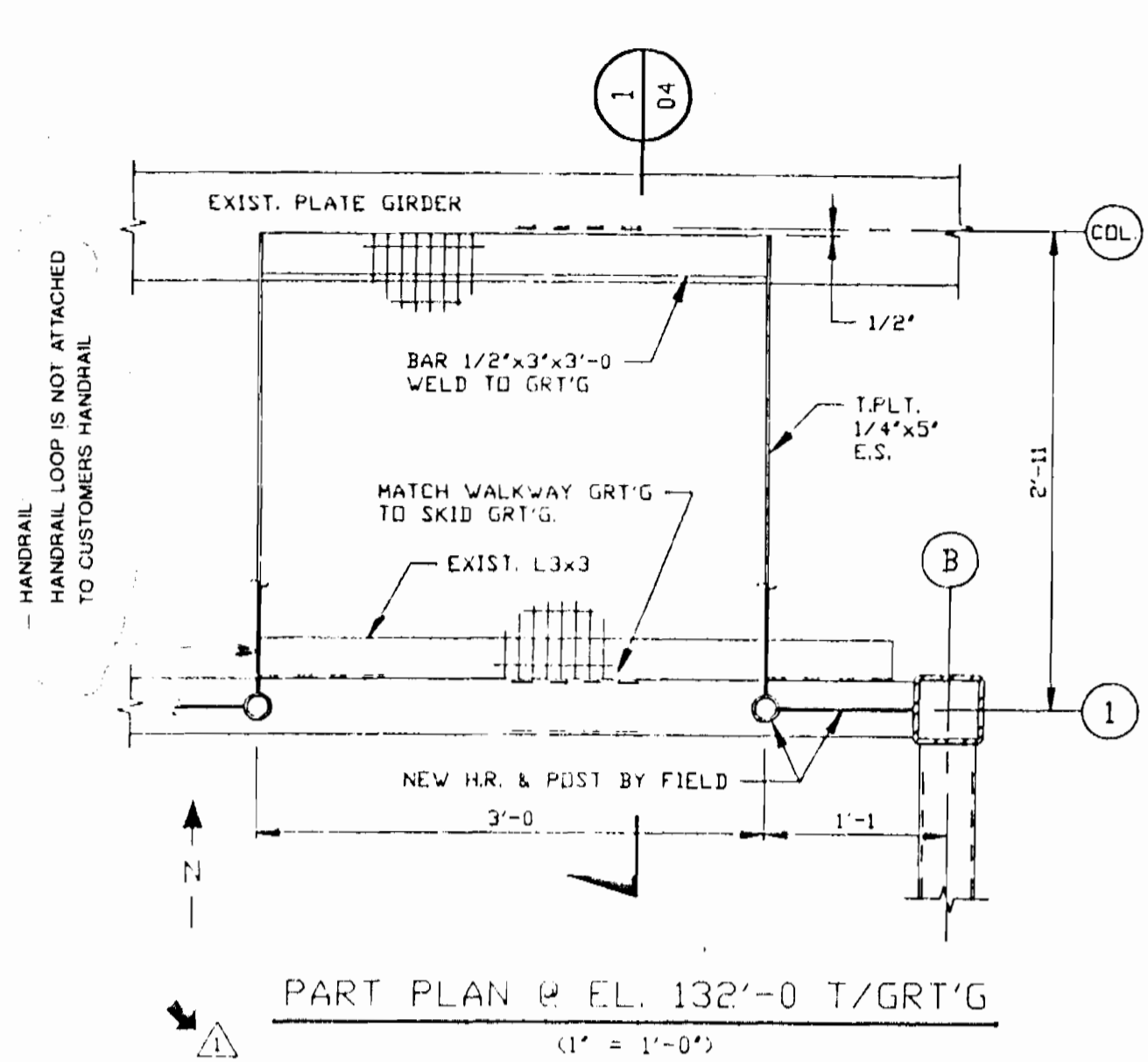
DETAIL A04  
(3' = 1'-0") (07-02)



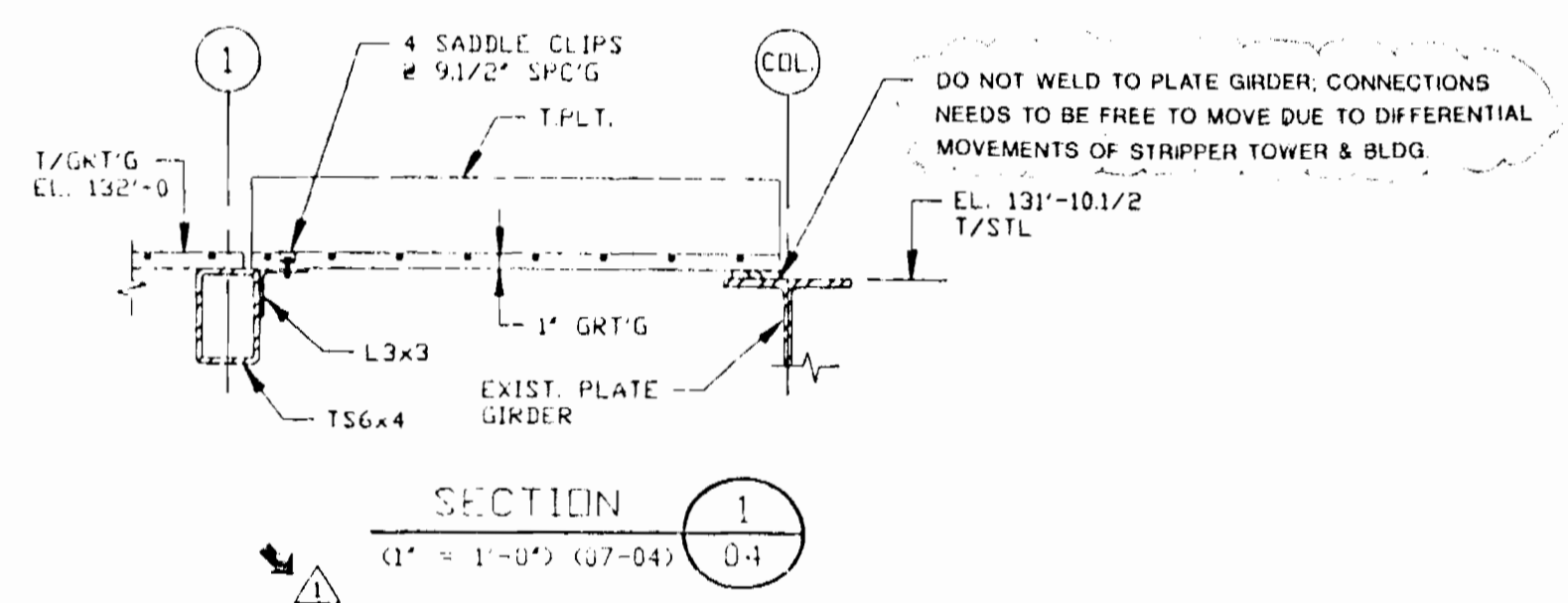
DETAIL B04  
(3' = 1'-0") (07-02)



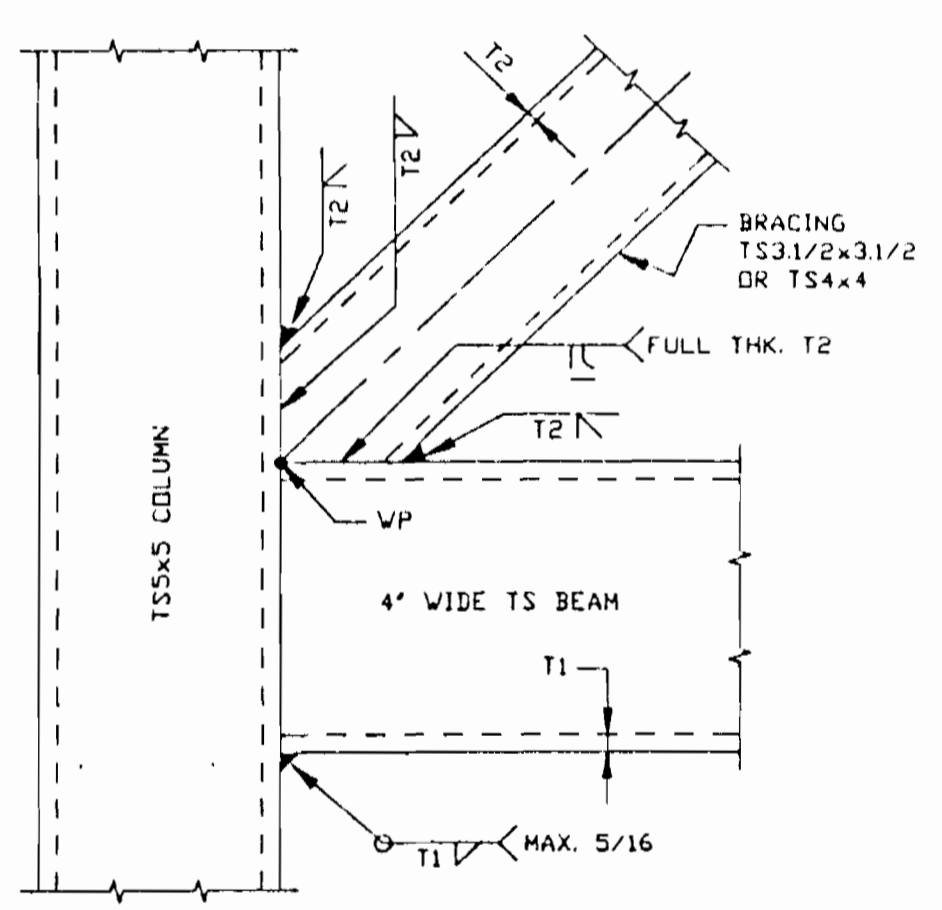
DETAIL C04  
(3' = 1'-0") (07-01)  
(TYP. 4 PLACES)



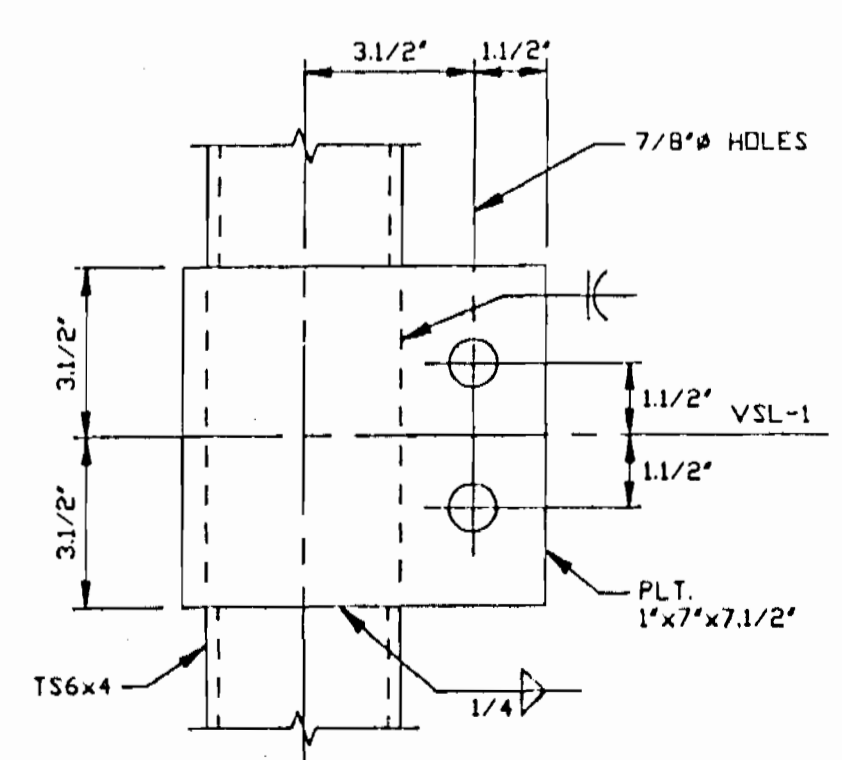
PART PLAN @ EL. 132'-0 T/GRT'G  
(1' = 1'-0")



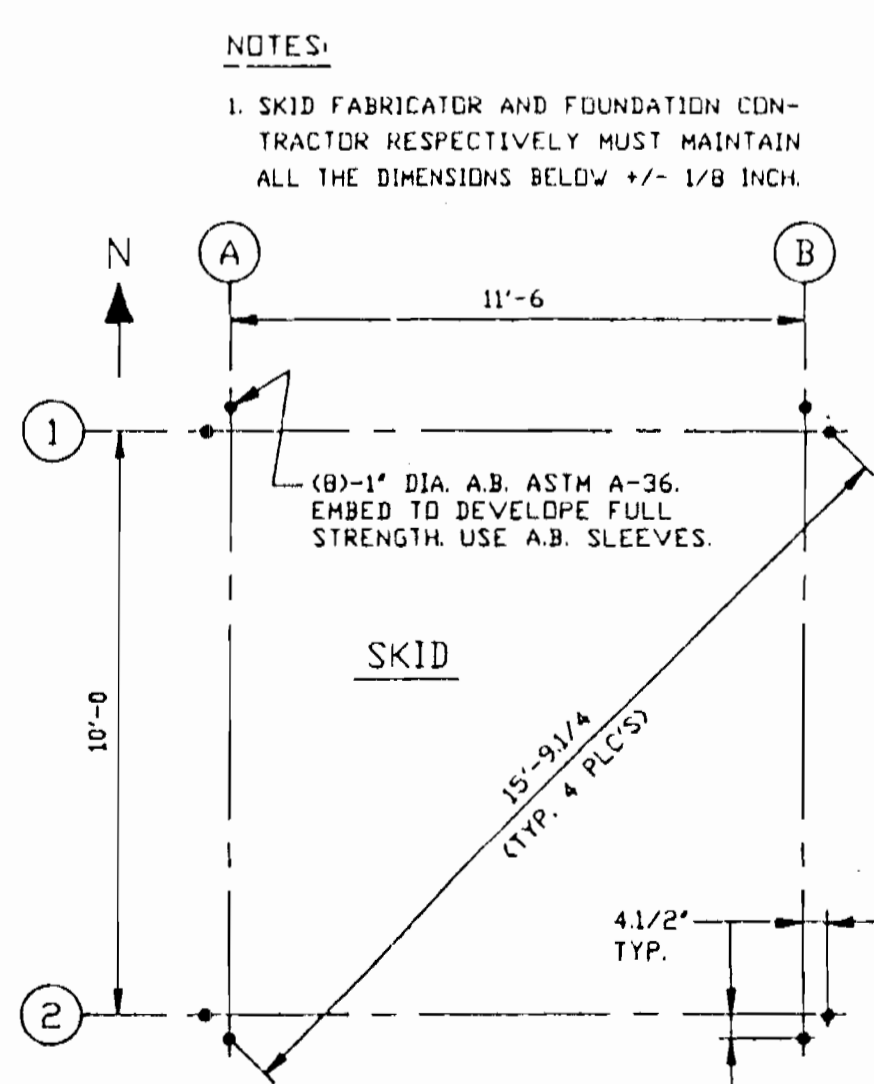
SECTION 1  
(1' = 1'-0") (07-04)



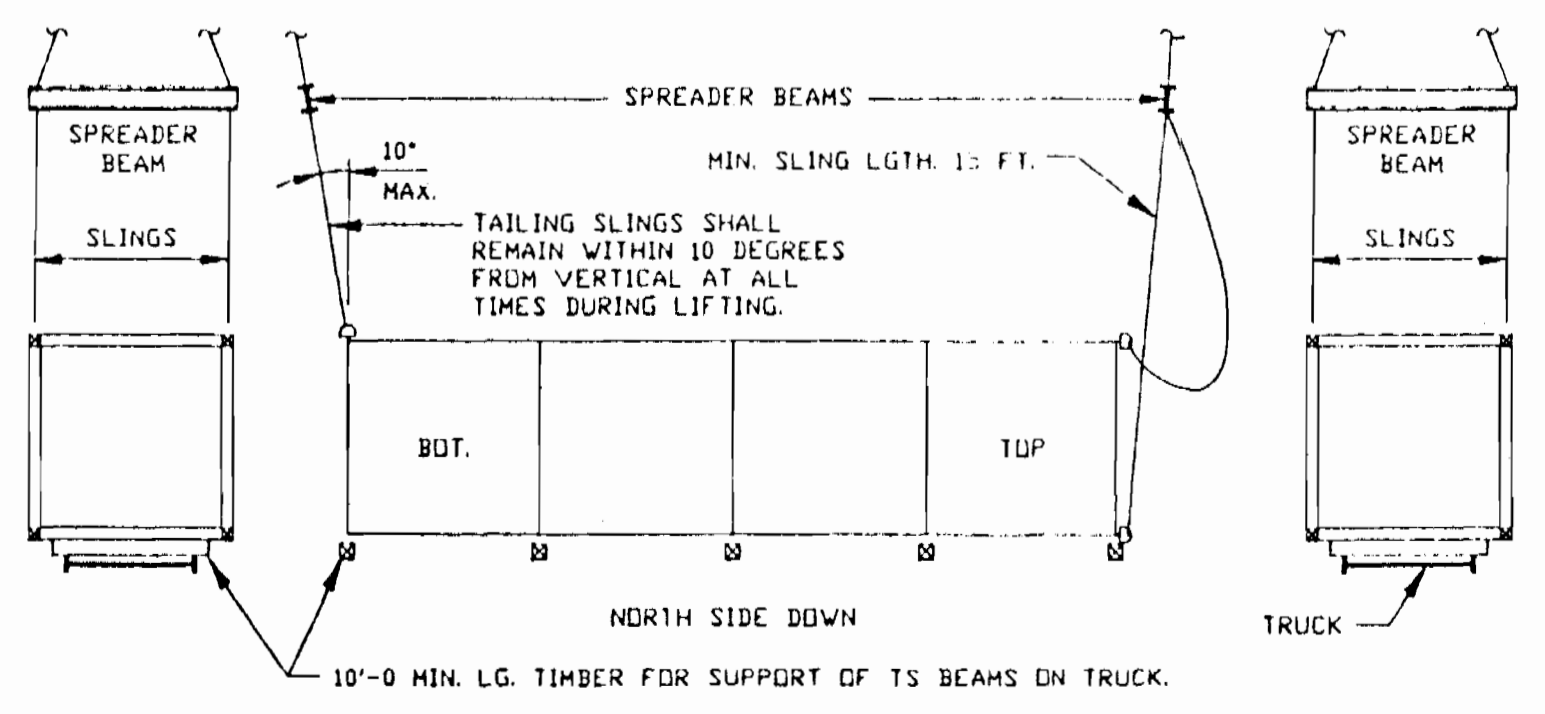
TS TO TS CONNECTION  
(3' = 1'-0") (TYPICAL U.D.N.)



DETAIL D04  
(3' = 1'-0") (07-01)



PLAN OF ANCHOR BOLTS AND BASE PLATE HOLES



LIFTING OF SKID & SUPPORT ON TRUCK  
(TOTAL SHIPPING WEIGHT APPROX. 32,000 LBS)

NOTES:

1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE DWG. D-7877-07-02

NOTES:

1. SKID FABRICATOR AND FOUNDATION CONTRACTOR RESPECTIVELY MUST MAINTAIN ALL THE DIMENSIONS BELOW +/- 1/8 INCH

<b>PYROPOWER</b>	
SAN DIEGO, CALIFORNIA	
DRAWING NO.	REV
552536-D-7877-07-04	4
B & V PROJECT 15637	
15637.62.3401	

APPROVED FOR CONSTRUCTION  
BY *SKL* JUN 04 1993  
GLITSCH PACKAGE PLANTS

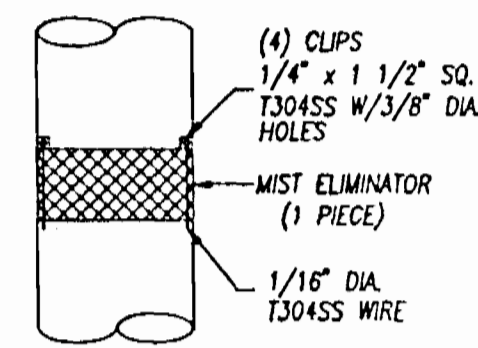
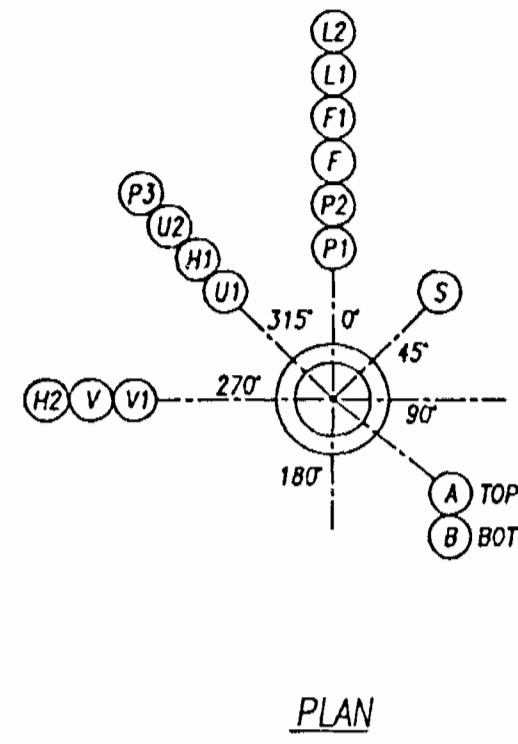
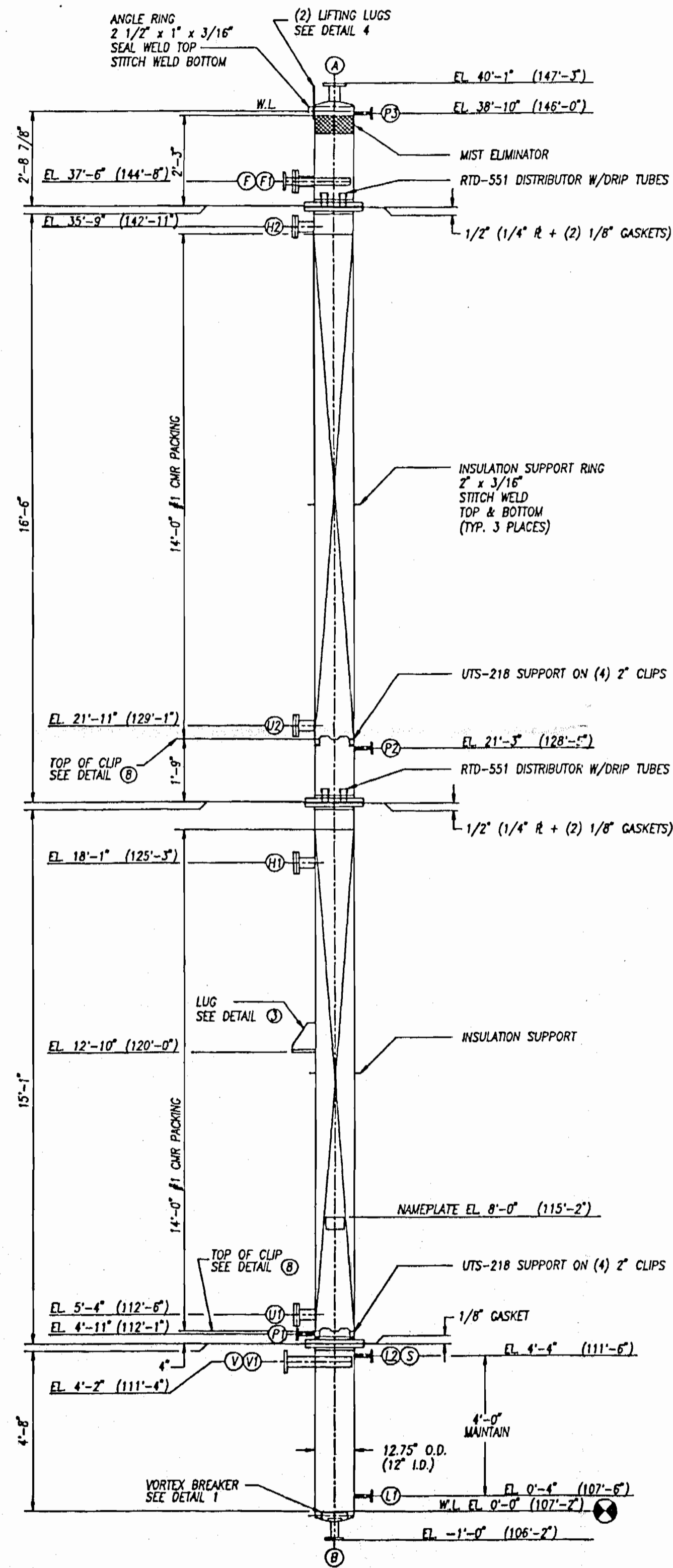
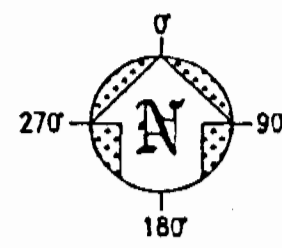
1	REV. B04 - ADD PART PLAN & 1/04	06/03/03	JR
SYMBOL	DESCRIPTION	DATE	APP'D
REVISIONS			

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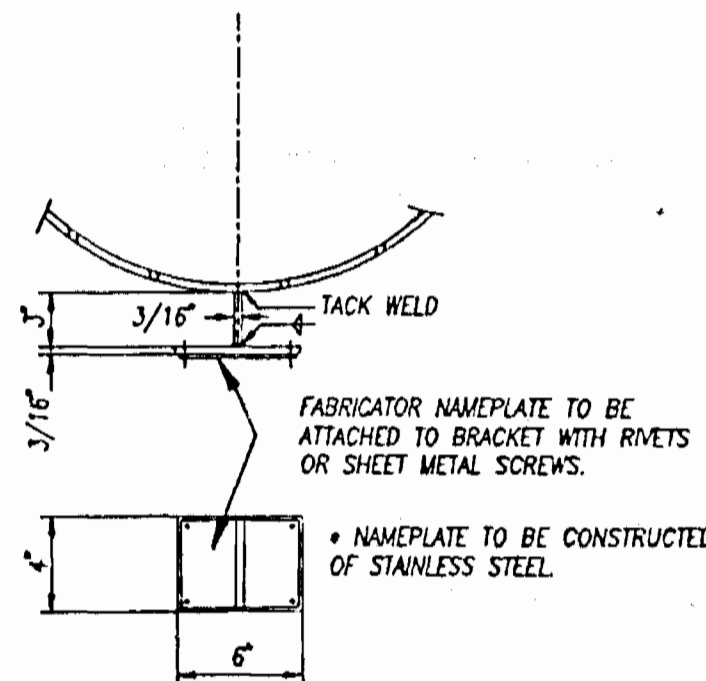
<b>GLITSCH, INC.</b>		<b>SKID SECTIONS &amp; DETAILS</b>	
Package Plants Division			
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		JOB No. 6J-7877 / 1193	
SCALE AS NOTED	DRAWN DL	DATE 03/24/93	CHECK JA
	ENGR.	DATE	REV.
			D-7877-07-04 1

<b>AHLSTROM</b>	
SELLER DOCUMENT REVIEW STATUS	
<input type="checkbox"/> A	Must be Present, As Specified
<input type="checkbox"/> B	Must be Present, As Specified (Optional)
<input type="checkbox"/> C	Must be Present, As Specified
<input type="checkbox"/> D	Must be Present, As Specified
<input type="checkbox"/> E	Must be Present
<input type="checkbox"/> F	Must be Present
<input type="checkbox"/> G	Must be Present
<input type="checkbox"/> H	Must be Present
<input type="checkbox"/> I	Must be Present
<input type="checkbox"/> J	Must be Present
<input type="checkbox"/> K	Must be Present
<input type="checkbox"/> L	Must be Present
<input type="checkbox"/> M	Must be Present
<input type="checkbox"/> N	Must be Present
<input type="checkbox"/> O	Must be Present
<input type="checkbox"/> P	Must be Present
<input type="checkbox"/> Q	Must be Present
<input type="checkbox"/> R	Must be Present
<input type="checkbox"/> S	Must be Present
<input type="checkbox"/> T	Must be Present
<input type="checkbox"/> U	Must be Present
<input type="checkbox"/> V	Must be Present
<input type="checkbox"/> W	Must be Present
<input type="checkbox"/> X	Must be Present
<input type="checkbox"/> Y	Must be Present
<input type="checkbox"/> Z	Must be Present
Signature of <i>Am</i>	Date <i>6/26/03</i>

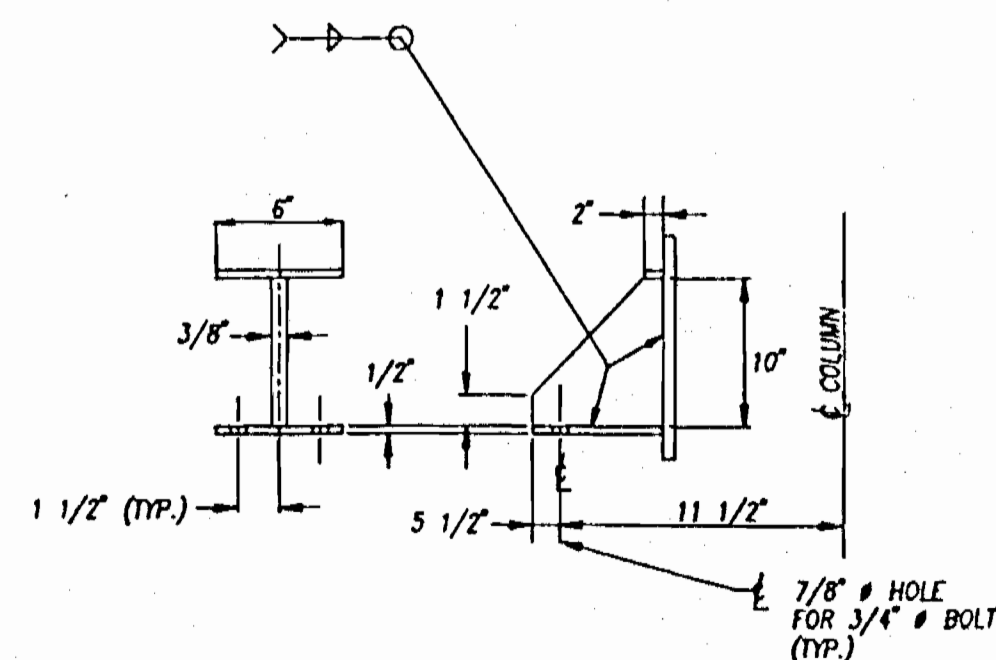




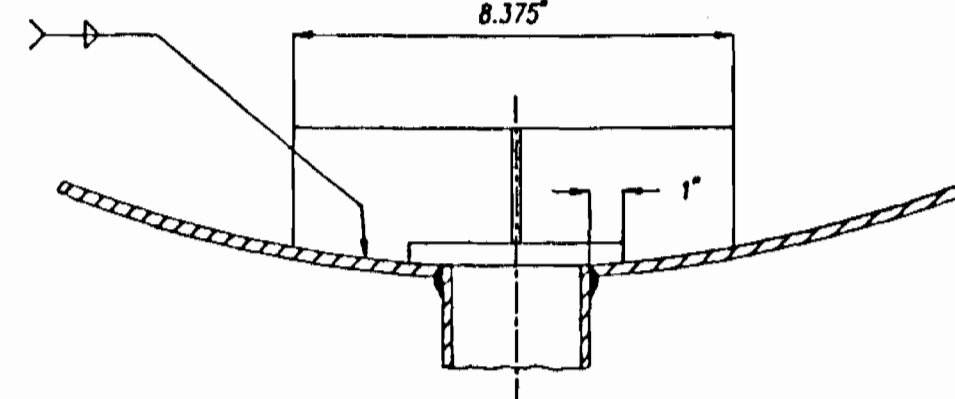
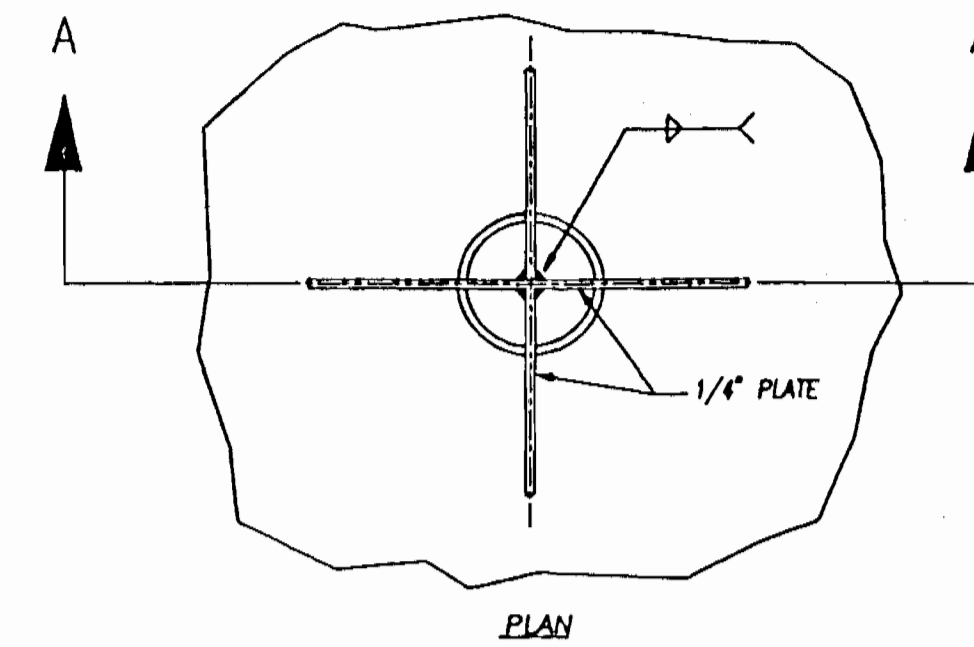
6 MIST ELIMINATOR DETAIL



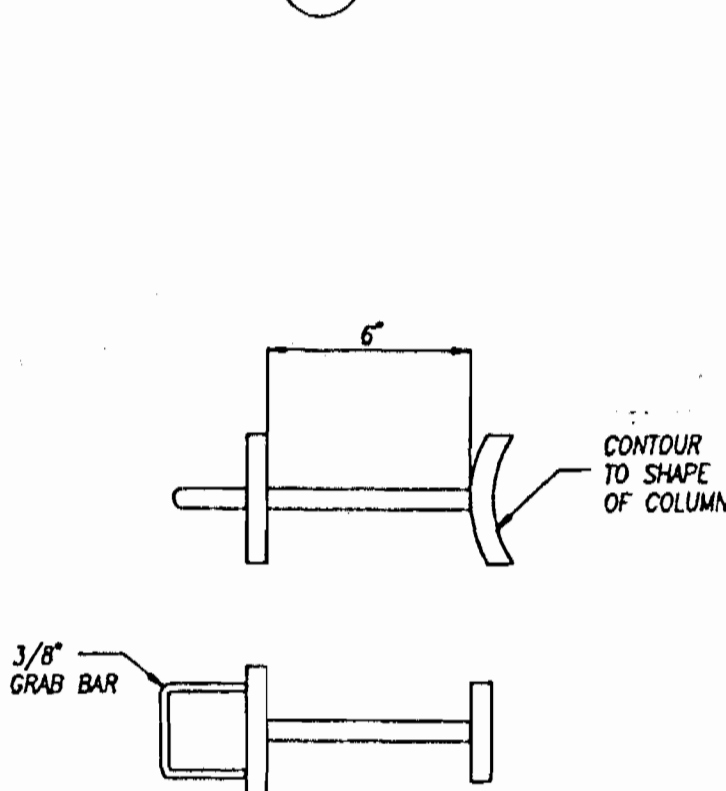
2 NAMEPLATE BRACKET DETAIL (LOCATE @ 315°)



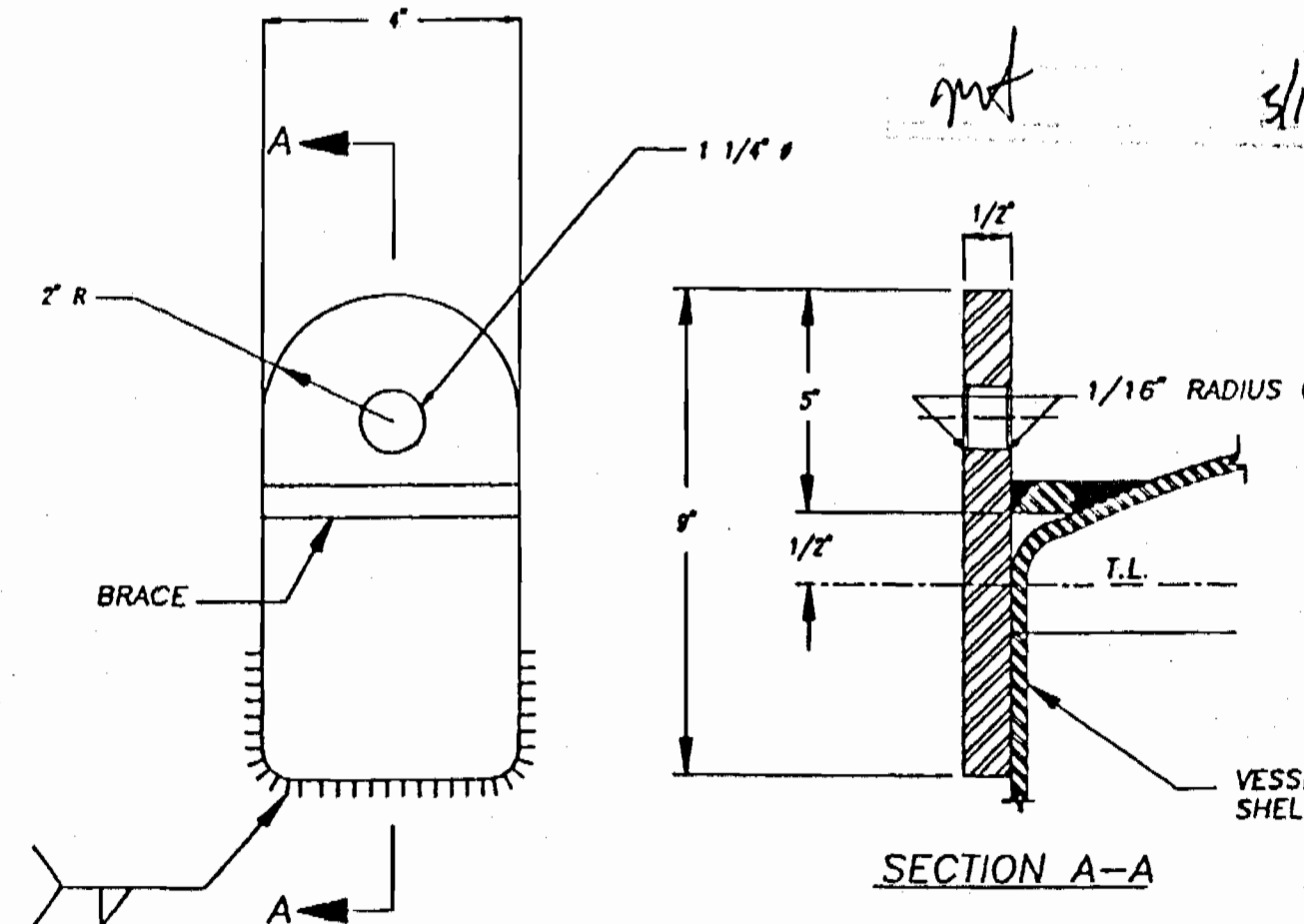
3 LUG DETAIL (4) REQ'D. (LOCATE @ 0°, 90°, 180°, 270°)



1 VORTEX DETAIL



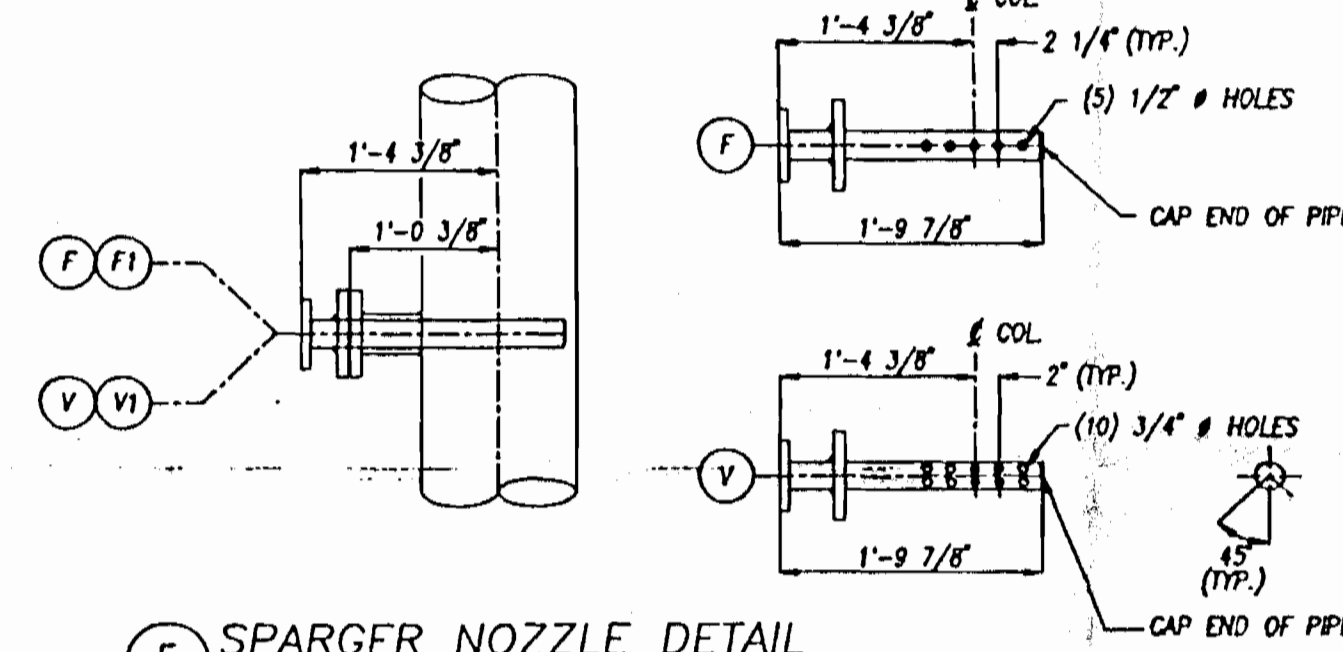
7 HANDHOLE/UNLOADING NOZZLE



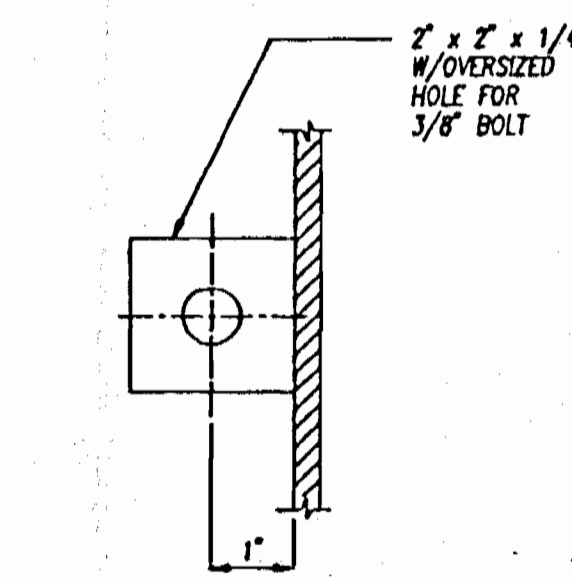
4 LIFTING LUG DETAIL (2) REQ'D. MATERIAL: C'STL. (LOCATE @ 45°, 225°)

NOTES:

- 1) CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST ASME CODE SECTION VIII, DIV. 1, ENGR. STD - 004. ASME CODE STAMP REQUIRED.
- 2) LOCATE ALL WELD SEAMS TO CLEAR NOZZLES AND SUPPORTS.
- 3) ALL BOLT HOLES STRADDLE CENTERLINES UNLESS OTHERWISE NOTED.
- 4) ALL NOZZLES SHALL PROJECT 6" FROM OUTSIDE OF EQUIPMENT TO FACE OF FLANGE, UNLESS OTHERWISE NOTED, AND SHALL BE MOUNTED TRUE TO CENTERLINES.
- 5) VENDOR TO FURNISH BOLTS, NUTS AND GASKETS WHERE MATING FLANGES ARE SUPPLIED. ALLOY STEEL STUD BOLTS, ZINC PLATED, THREADED ENTIRE LENGTH, ASTM A193-B7, WITH ZINC PLATED HEAVY HEX NUTS ASTM A194-2H.
- 6) ALL WELDING SHALL BE FULL, CONTINUOUS AND FREE FROM SLAG, POROSITY AND OTHER DEFECTS.
- 7) ALL FLANGES SHALL NOT BE WARPED, BUT SHALL BE TRUE AND GASKET SMOOTH AFTER WELDING.
- 8) NO BACKING RINGS ALLOWED.
- 9) INTERNAL SURFACES OF COLUMN TO BE SMOOTH.
- 10) WHEN WELDING DISSIMILAR METALS, THE HIGHER ALLOY SHALL GOVERN THE TYPE OF WELD ROD TO BE USED.
- 11) COLUMN I.D. TO BE MAINTAINED AND NOT TO EXCEED CODE TOLERANCES.
- 12) FABRICATOR TO MINIMIZE GIRTH SEAMS ON PACKED SECTION OF COLUMN.
- 13) INTERNALS SUPPLIED AND INSTALLED BY OTHERS.
- 14) GASKETS - 1/8" SLIT TYPE IFE ENVELOPE MIN. WIDTH 1" W/NON-ASBESTOS FILLER GARLOCK BLUECARD OR EQUAL.
- 15) FABRICATOR TO SUPPLY GASKETS FOR HYDROTEST.
- 16) PAINTING: SURFACE PREPARATION: COMMERCIAL BLAST PER SSPC-SP 6-63. PRIMER: INORGANIC ZINC PRIMER, GRAY 2.5 MILS. MIN. DRY FILM THICKNESS. CARBOLINE - CARBO ZINC 11
- 17) FABRICATOR RESPONSIBILITIES: A - SUPPLY DETAILS OF THE FOLLOWING: LIFTING LUGS AND EQUIPMENT SUPPORTS. B - SPECIFY ALL SHELL, HEAD, NOZZLE AND SUPPORT THICKNESSES. C - WHERE DETAILS ARE SHOWN, FABRICATOR TO VERIFY THICKNESSES.
- 18) ELEVATIONS SHOWN IN (XXX-XX) CORRESPOND TO PLANT ELEVATIONS.



5 SPARGER NOZZLE DETAIL



8 CLIP DETAIL (8) REQUIRED MATERIAL: 304SS

DESIGN DATA

22

HORIZONTAL TYPE SUPPORT	SADDLE	VERTICAL LEGS	X	LUGS	X	SKIRT
PAINT EXT. CARBON STEEL: NOTE 16						
INSULATION RINGS: YES, FOR 2 1/2" THK. INSULATION						
ESTIMATED WEIGHT						
EMPTY: 3,000 LBS	W/PACKING	3,500 LBS	FULL	6,500 LBS	NOTES	
CAPACITY						
DIAMETER 12" STD. WALL						
LENGTH 41'-1" O.A.L.						
BASIC MATERIAL C.S.						
INSIDE FINISH NOTE 9						
DESIGN TEMP. 400°F						
DESIGN PRESS. 150 PSIG						
CORROSION ALLOWANCE 1/8"						
HYDROSTAT						
CONSTRUCTION CODE NOTE 1						
HEAT TREATMENT -						
RADIOGRAPHY NONE						
TYPE HEADS PIPE CAPS						
GASKETS NOTE 14						
HARDWARE NOTE 5						
AGITATOR -						
SPECIAL TESTS						
JOINT EFFICIENCY SHELL						
HEADS						
NOZZLE SCHEDULE						
ITEM	SIZE	RATING / PIPE SCH.	SERVICE			
A	3"	150# R.F.S.O.	VAPOR OUT			
B	2"	150# R.F.S.O.	LIQUID OUT			
F	2"	150# R.F.S.O.	FEED IN			
F1	3"	150# R.F.S.O.	SLEEVE FOR NOZ. F			
H1,H2	6"	150# R.F.S.O.	HAND HOLE W/BLIND			
L1,L2	3/4"	150# R.F.S.O.	LEVEL TRANSMITTER			
P1-P3	3/4"	150# R.F.S.O.	PRESSURE TRANSMITTER			
S	1"	150# R.F.S.O.	SPARE W/BLIND			
U1,U2	6"	150# R.F.S.O.	UNLOADING W/BLIND			
V	3"	150# R.F.S.O.	STEAM IN			
V1	4"	150# R.F.S.O.	SLEEVE FOR NOZ. V			

APPROVED FOR CONSTRUCTION  
BY *SGH* DATE MAY 11 1993  
GLITSCH PACKAGE PLANTS

2	AS BUILT	4-26-93	SCH
1	ADDED DET. 8, REV. DET. 5, LOCATED N.P., LIFTING LUGS, & LUGS.	3-10-93	SCH
0	APPROVED FOR CONSTRUCTION	3-3-93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPROV'D

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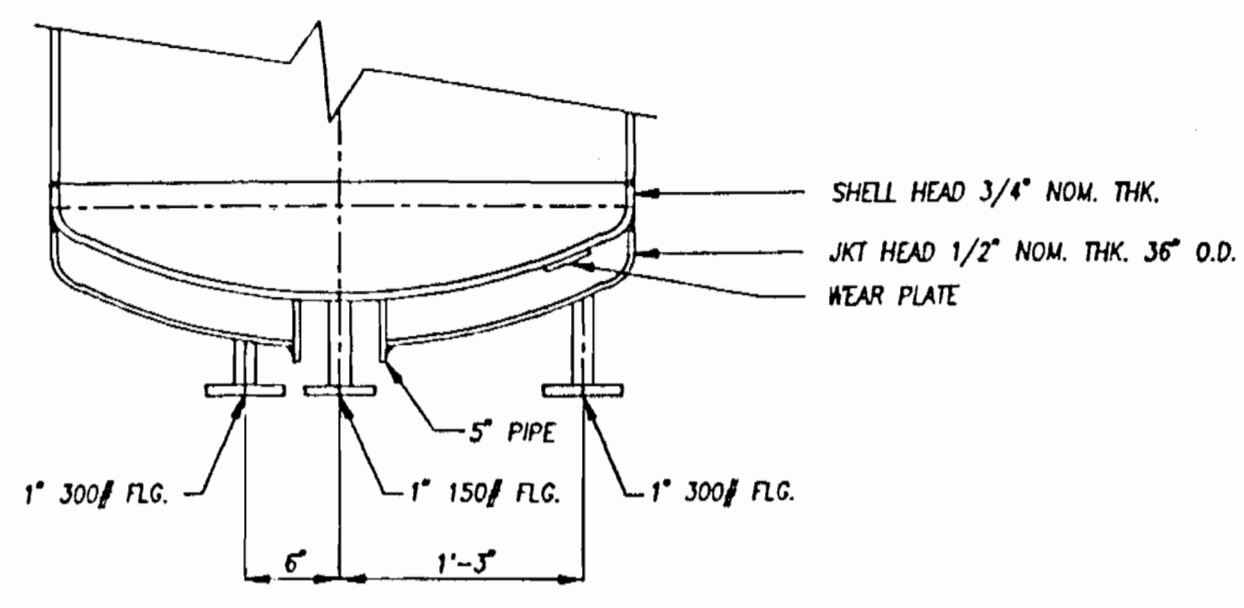
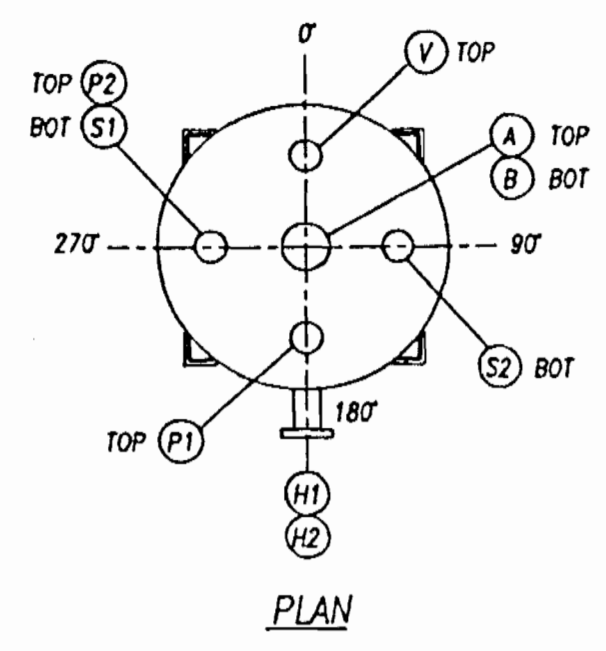
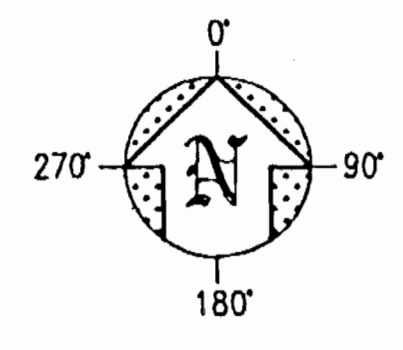
GLITSCH, INC. Package Plants Division

CEDAR BAY GENERATING CO. PIROPOWER SAN DIEGO, CA  
1CCF-VSL-1 AMMONIA STRIPPER

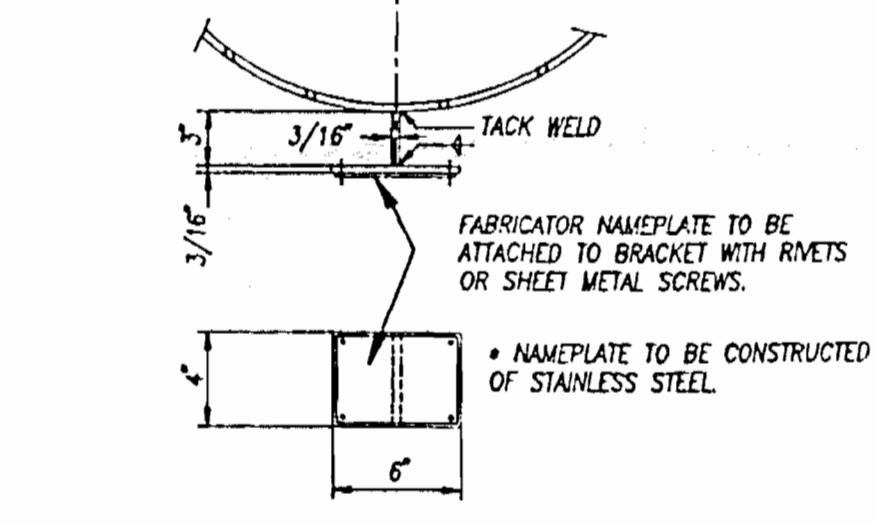
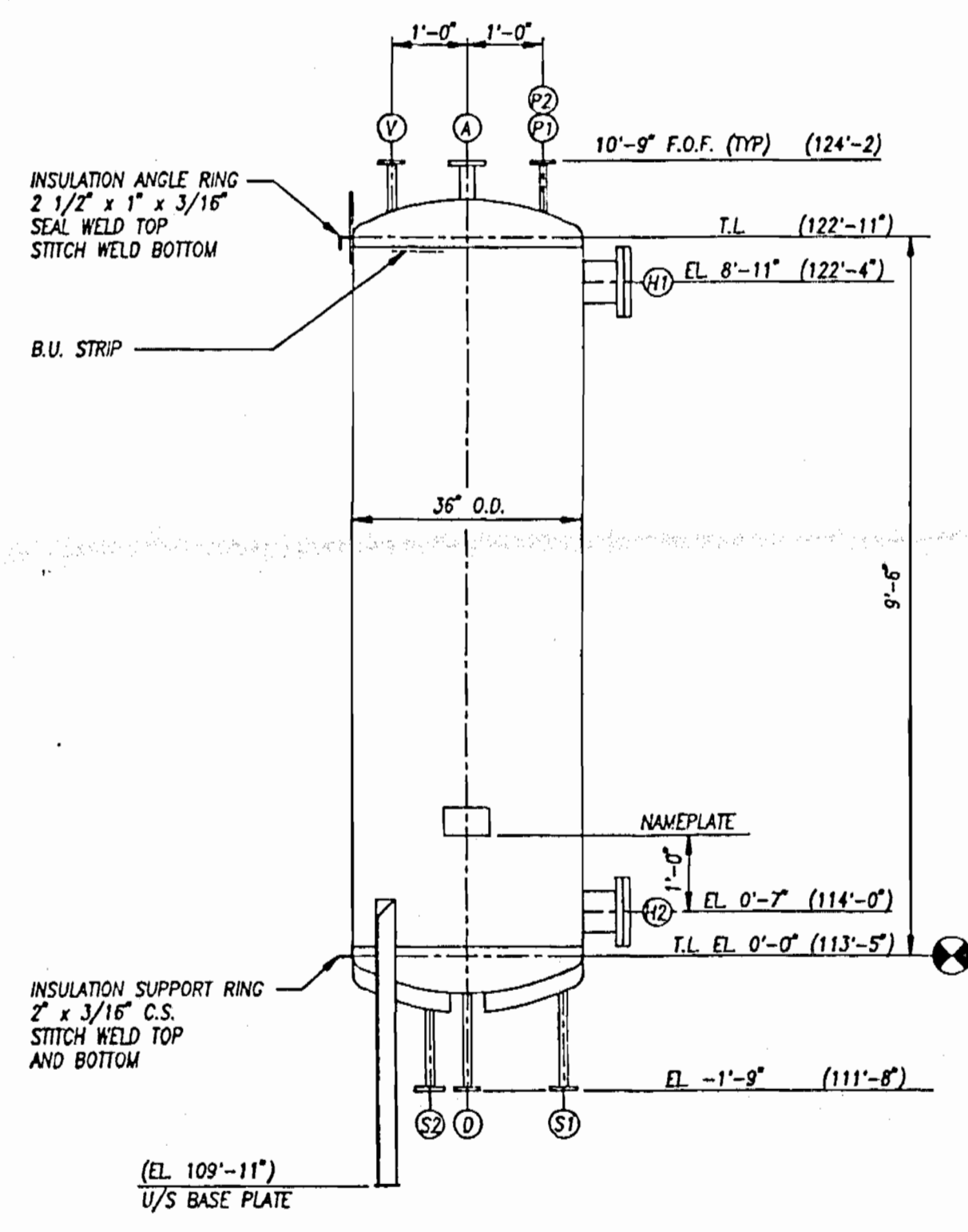
SCALE	3/8" = 1'-0"	JOB NO.	6J-7877
DRAWN	DP	DATE	1-22-93
CHECK	DATE	DRAWING NO.	
ENGR.	DATE	D-7877-08-01	2

552586-D-7877-08-01 4  
15037 04/04 04 58079

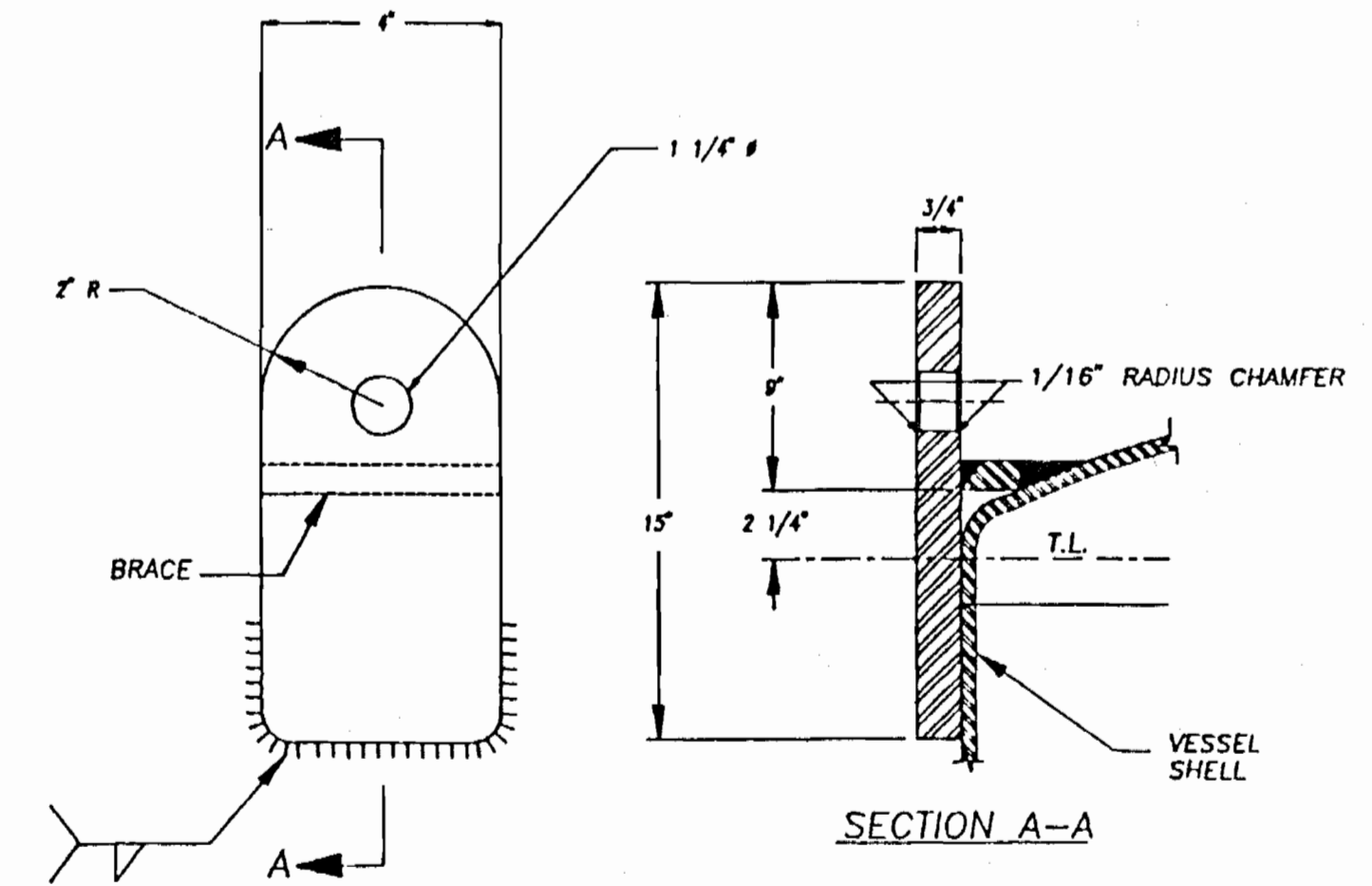




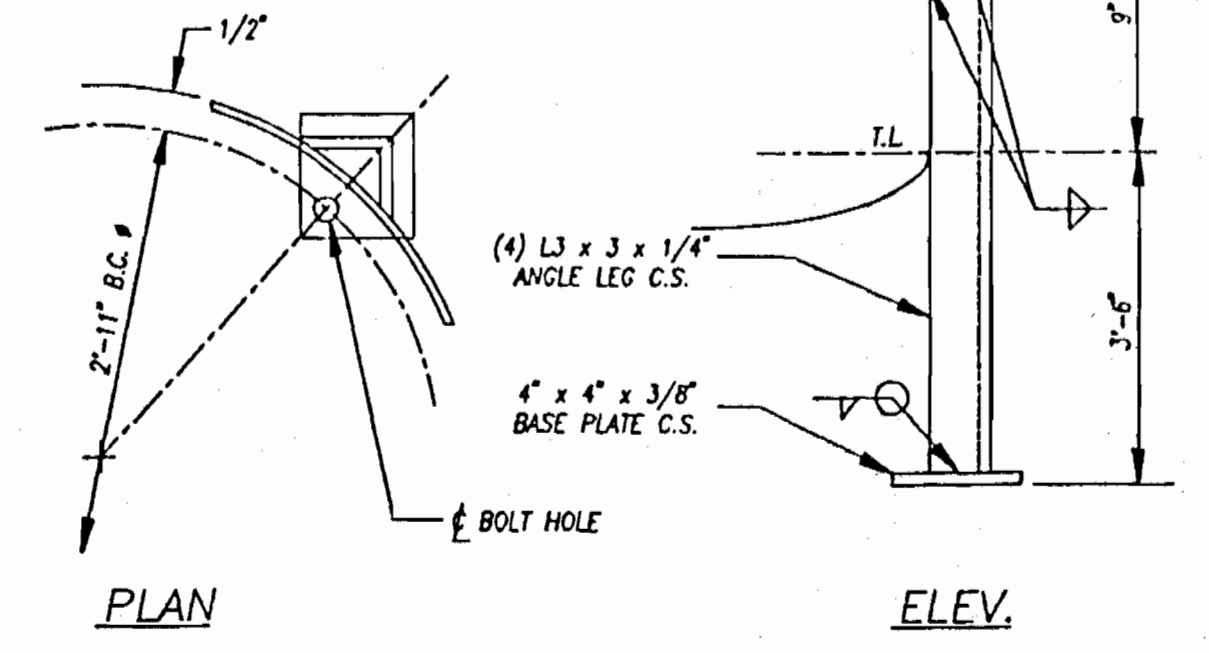
4 JACKET DETAIL



2 NAMEPLATE BRACKET DETAIL  
(LOCATE @ 180°)



3 LIFTING LUG DETAIL  
(2) REQ'D. MATERIAL: C'STL.  
LOCATE @ 45, 225



1 SUPPORT LEG DETAIL  
(4) REQUIRED

- NOTES:
- CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST ASME CODE SECTION VIII, DIV. 1, ENGR. STD - 004. ASME CODE STAMP REQUIRED.
  - LOCATE ALL WELD SEAMS TO CLEAR NOZZLES AND SUPPORTS.
  - ALL BOLT HOLES STRADDLE CENTERLINES UNLESS OTHERWISE NOTED.
  - ALL NOZZLES SHALL PROJECT 6" FROM OUTSIDE OF EQUIPMENT TO FACE OF FLANGE, UNLESS OTHERWISE NOTED, AND SHALL BE MOUNTED TRUE TO CENTERLINES.
  - VENDOR TO FURNISH BOLTS, NUTS AND GASKETS WHERE MATING FLANGES ARE SUPPLIED. ALLOY STEEL STUD BOLTS, ZINC PLATED, THREADED ENTIRE LENGTH, ASTM A193-B7, WITH ZINC PLATED HEAVY HEX NUTS ASTM A194-2H.
  - ALL WELDING SHALL BE FULL CONTINUOUS AND FREE FROM SLAG, POROSITY AND OTHER DEFECTS.
  - ALL FLANGES SHALL NOT BE WARPED, BUT SHALL BE TRUE AND GASKET SMOOTH AFTER WELDING.
  - WHEN WELDING DISSIMILAR METALS, THE HIGHER ALLOY SHALL GOVERN THE TYPE OF WELD ROD TO BE USED.
  - GASKETS - 1/8" SLIT TYPE IFE ENVELOPE MIN. WIDTH 1 1/4" W/NON-ASBESTOS FILLER GARLOCK BLUEGARD OR EQUAL.
  - FABRICATOR TO SUPPLY GASKETS FOR HYDROTEST.
  - PAINTING:  
SURFACE PREPARATION: COMMERCIAL BLAST PER SSPC-SP 6-63.  
PRIMER: INORGANIC ZINC PRIMER, GRAY  
2.5 MILS. MIN. DRY FILM THICKNESS.  
CARBOLINE - CARBO ZINC 11
  - FABRICATOR RESPONSIBILITIES:  
A - SUPPLY DETAILS OF THE FOLLOWING:  
LIFTING LUGS AND EQUIPMENT SUPPORTS.  
B - SPECIFY ALL SHELL HEAD, NOZZLE AND SUPPORT THICKNESSES.  
C - WHERE DETAILS ARE SHOWN, FABRICATOR TO VERIFY THICKNESSES.
  - ELEVATIONS SHOWN IN (XXX-XX) CORRESPOND TO PLANT ELEVATIONS.

DESIGN DATA (23)

HORIZONTAL TYPE SUPPORT	SADDLE	VERTICAL LEGS	X	LUGS	X	SKIRT	
PAINT EXT. CARBON STEEL: NOTE 11							
INSULATION RINGS: YES, FOR 2 1/2" INSULATION							
EMPTY: 2,500 LBS				FULL 7,300 LBS			
ESTIMATED WEIGHT							
VESSEL				NOTES			
CAPACITY	500 GAL						
DIAMETER	36" O.D.						
LENGTH	9'-6" T/T						
BASIC MATERIAL	C.S.						
INSIDE FINISH							
DESIGN TEMP.	500°F			JACKET 500°F			
DESIGN PRESS.	150 PSIG			JACKET 200 PSIG			
CORROSION ALLOWANCE	1/8"						
HYDROSTAT	235 PSIG			JACKET 300 PSIG			
CONSTRUCTION CODE				NOTE 1			
HEAT TREATMENT							
RADIOGRAPHY	NONE						
TYPE HEADS	ASME F & D						
GASKETS				NOTE 9			
HARDWARE				NOTE 5			
AGITATOR							
SPECIAL TESTS							
JOINT EFFICIENCY	SHELL						
	HEADS						
NOZZLE SCHEDULE							
ITEM	SIZE	RATING / PIPE SCH.	SERVICE				
A	3"	150# R.F.S.O.	VAPOR IN/OUT				
D	1"	150# R.F.S.O.	DRAIN				
H1,H2	6"	150# R.F.S.O.	HANDHOLE				
P1	3/4"	150# R.F.S.O.	PRESSURE GAUGE				
P2	3/4"	150# R.F.S.O.	PRESSURE TRANSMITTER				
V	1"	150# R.F.S.O.	VAPOR RELIEF				
S1	1"	300# R.F.S.O.	STEAM IN				
S2	1"	300# R.F.S.O.	CONDENSATE OUT				

APPROVED FOR CONSTRUCTION  
BY Set DATE MAY 11 1993  
GLITSCH PACKAGE PLANTS

2	AS BUILT	4-26-93	SCH
1	REVISED DETAIL 1 & EL. OF NOZ. S1, S2, D,	3-19-93	SCH
0	APPROVED FOR CONSTRUCTION	3-3-93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPROV

REVISIONS

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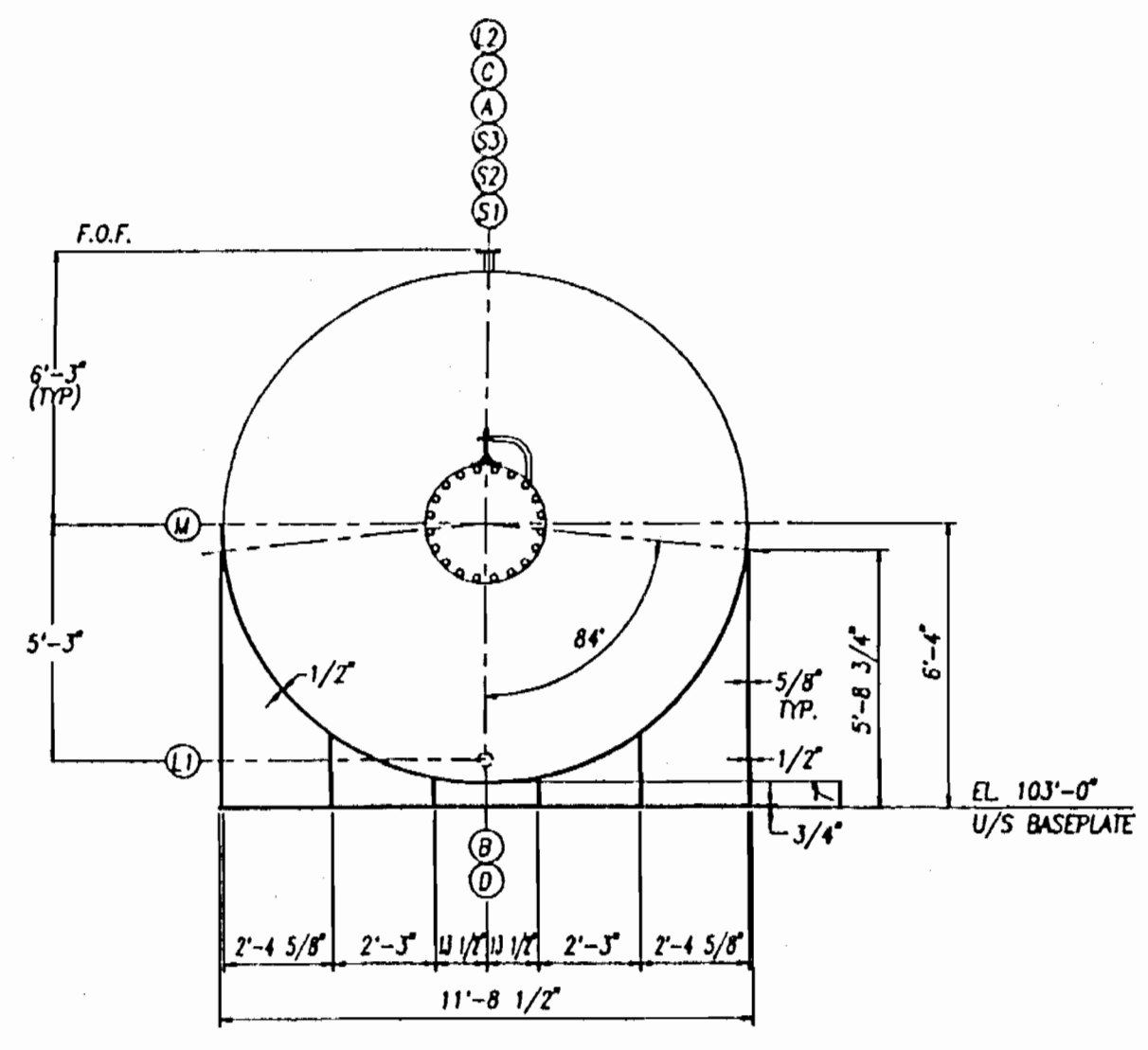
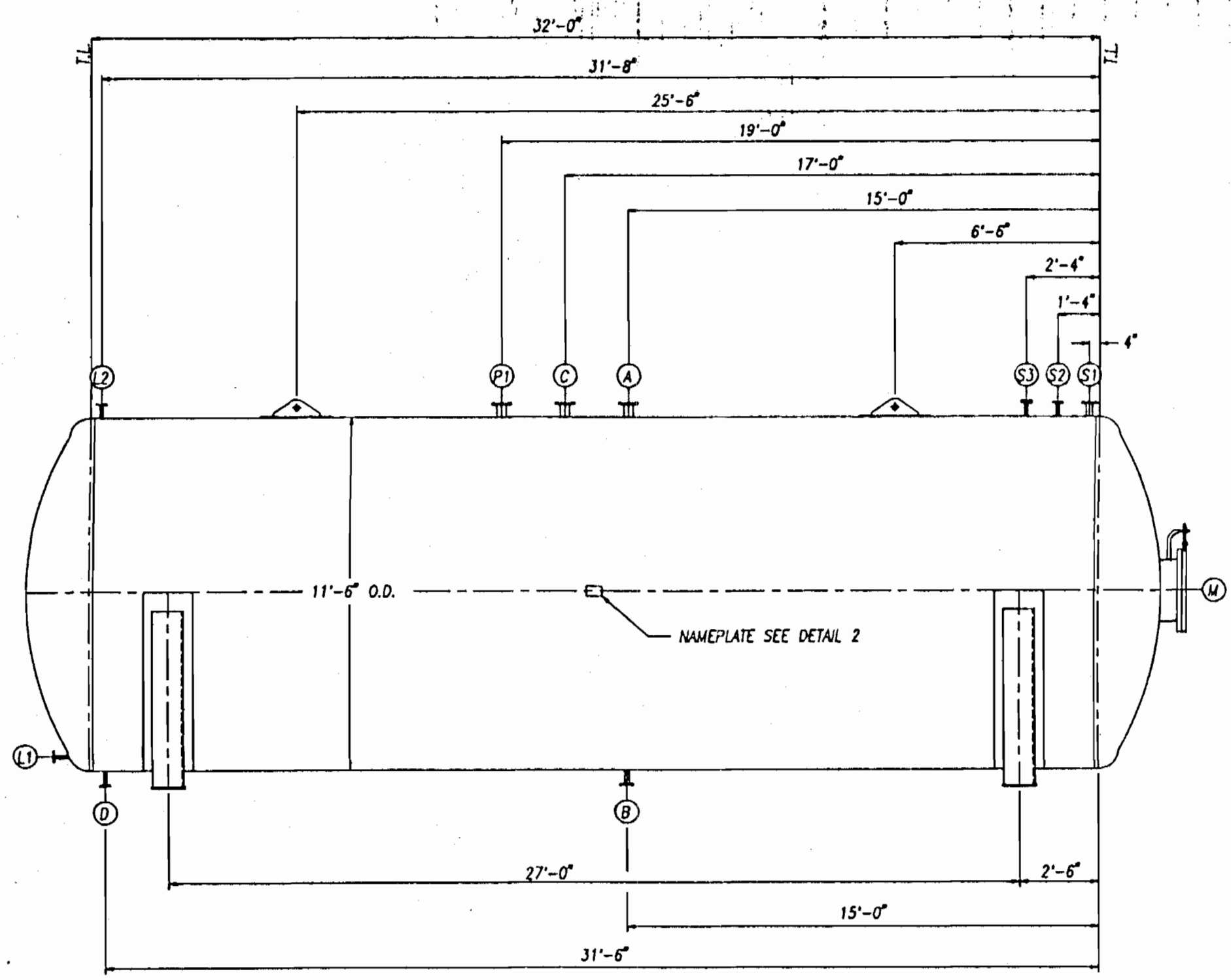
GLITSCH, INC.

Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		1CCF-RVR-1 VAPOR RESERVOIR	
SCALE 1/2" = 1'-0"			
DRAWN	DP	DATE 1-22-93	JOB NO. 6J-7877
CHECK	DATE	DRAWING NO.	REV.
ENGR.	DATE	D-7877-09-01	2

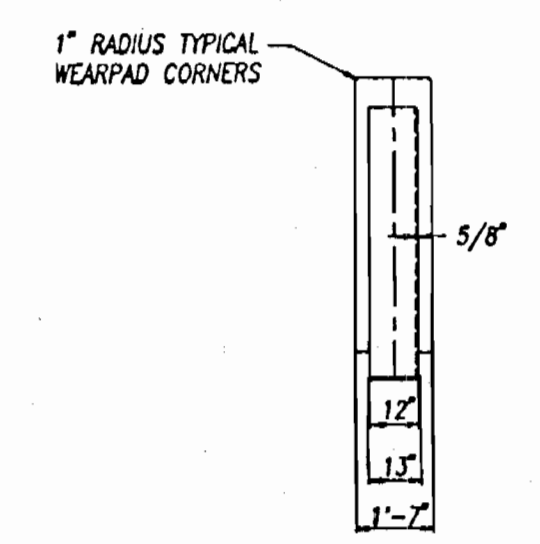
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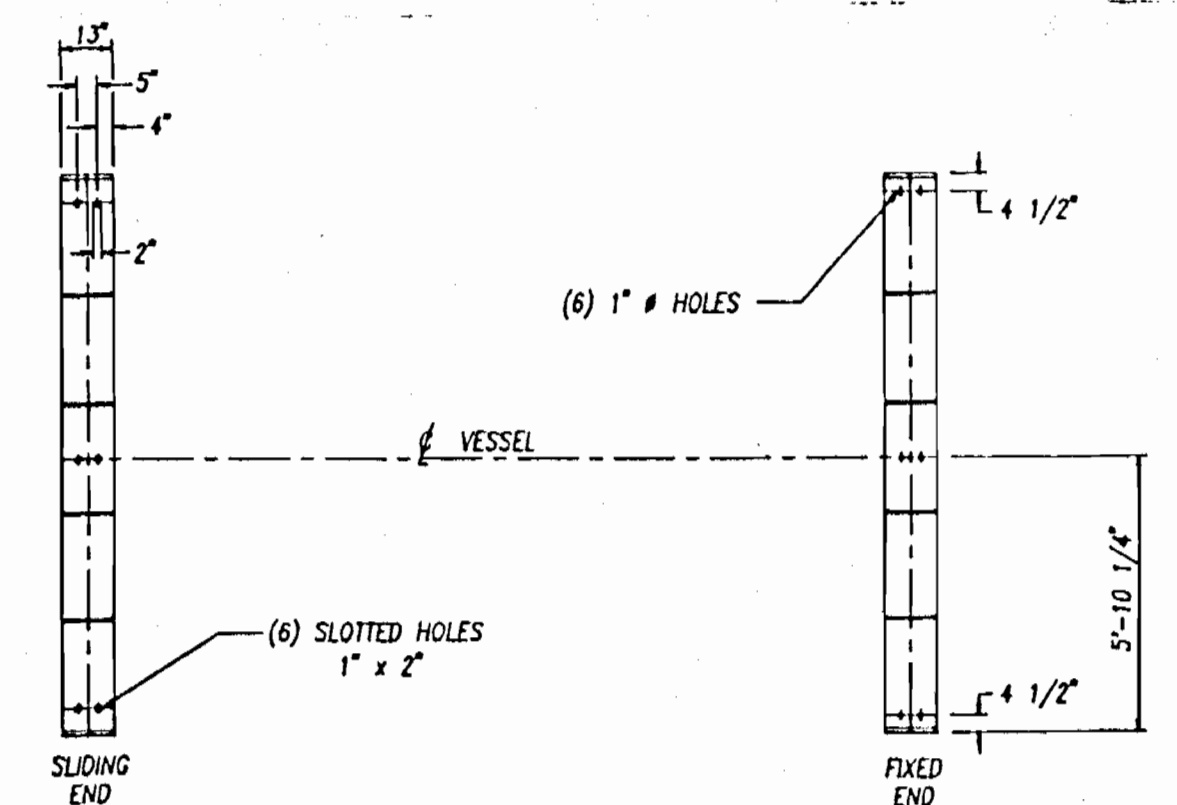


- NOTES:
- CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST ASME CODE SECTION VIII, DIV. 1, ENGR. STD - 004. ASME CODE STAMP REQUIRED.
  - LOCATE ALL WELD SEAMS TO CLEAR NOZZLES AND SUPPORTS.
  - ALL BOLT HOLES STRADDLE CENTERLINES UNLESS OTHERWISE NOTED.
  - ALL NOZZLES SHALL PROJECT 6" FROM OUTSIDE OF EQUIPMENT TO FACE OF FLANGE, UNLESS OTHERWISE NOTED, AND SHALL BE MOUNTED TRUE TO CENTERLINES.
  - VENDOR TO FURNISH BOLTS, NUTS AND GASKETS WHERE MATING FLANGES ARE SUPPLIED. ALLOY STEEL STUD BOLTS, ZINC PLATED, THREADED ENTIRE LENGTH, ASTM A193-B7, WITH ZINC PLATED HEAVY HEX NUTS ASTM A194-2H.
  - ALL WELDING SHALL BE FULL, CONTINUOUS AND FREE FROM SLAG, POROSITY AND OTHER DEFECTS.
  - ALL FLANGES SHALL NOT BE WARPED, BUT SHALL BE TRUE AND GASKET SMOOTH AFTER WELDING.
  - NO BACKING RINGS ALLOWED.
  - DELETED
  - WHEN WELDING DISSIMILAR METALS, THE HIGHER ALLOY SHALL GOVERN THE TYPE OF WELD ROD TO BE USED.
  - GASKETS - 1/16" THICK GARLOCK GRAPH - LOCK STYLE 3125-55
  - FABRICATOR TO SUPPLY GASKETS FOR HYDROTEST.
  - PAINTING:  
SURFACE PREPARATION: COMMERCIAL BLAST PER SSPC-SP 6-63.  
PRIMER: POLYAMIDE-EPOXY ZINC RICH PRIMER  
2.5 MILS. MIN. DRY FILM THICKNESS.  
GLIDDEN NO. 5526/27/28 (OR APPROVED EQUAL).  
SECOND COAT: POLYAMIDE-EPOXY  
4.0 MILS. MIN. DRY FILM THICKNESS  
GLIDDEN NO. 5430/34 (OR APPROVED EQUAL)  
COLOR: WHITE  
THIRD COAT: POLYAMIDE-EPOXY  
3.0 MILS. MIN. DRY FILM THICKNESS  
GLIDDEN 5250/42 (OR APPROVED EQUAL)  
COLOR: WHITE
  - FABRICATOR RESPONSIBILITIES:  
A - SUPPLY DETAILS OF THE FOLLOWING:  
LIFTING LUGS AND EQUIPMENT SUPPORTS.  
B - SPECIFY ALL SHELL, HEAD, NOZZLE AND SUPPORT THICKNESSES.  
C - WHERE DETAILS ARE SHOWN, FABRICATOR TO VERIFY THICKNESSES.
  - FABRICATOR TO LOCATE LIFTING LUGS AND SADDLE SUPPORTS.

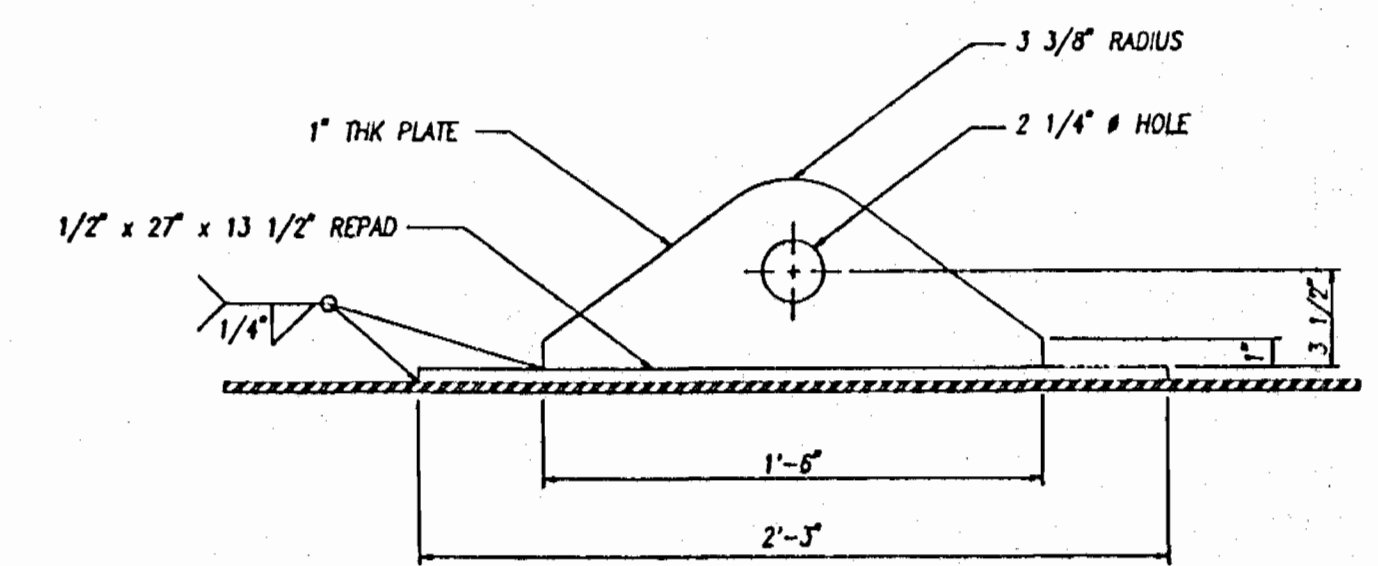
DESIGN DATA		(24)	
HORIZONTAL TYPE SUPPORT	X	VERTICAL	
SADDLE X LEGS LUGS SKIRT			
PAINT EXT. CARBON STEEL: NOTE 13			
INSULATION RINGS:			
EMPTY: 18,900 LBS		ESTIMATED WEIGHT	
FULL: 242,100 LBS			
CAPACITY	25,000 GAL.	NOTES	
DIAMETER	11'-6" O.D.		
LENGTH	32'-0" T/T		
BASIC MATERIAL	C.S.		
INSIDE FINISH			
DESIGN TEMP.	300°F		
DESIGN PRESS.	25 PSIG		
CORROSION ALLOWANCE	1/16"		
HYDROSTAT			
CONSTRUCTION CODE		NOTE 1	
HEAT TREATMENT			
RADIOGRAPHY	NONE		
TYPE HEADS	ASME F & D		
GASKETS		NOTE 11	
HARDWARE		NOTE 9	
AGITATOR			
SPECIAL TESTS			
JOINT EFFICIENCY	SHELL		
	HEADS		
NOZZLE SCHEDULE			
ITEM	SIZE	RATING / PIPE SCH.	SERVICE
A	3"	150# R.F.S.O.	LIQUID IN
B	1 1/2"	150# R.F.S.O.	LIQUID OUT
C	3"	150# R.F.S.O.	EQUALIZING TO TRUCK
D	1"	150# R.F.S.O.	DRAIN
L1,L2	1"	150# R.F.S.O.	LEVEL TRANSMITTER
P1	1"	150# R.F.S.O.	PRESSURE SWITCH
M	24"	150# R.F.S.O.	MANWAY
S1	2"	150# R.F.S.O.	PRESSURE RELIEF
S2	1"	150# R.F.S.O.	AIR PRESSURE IN
S3	1"	150# R.F.S.O.	SPARE W/BLIND



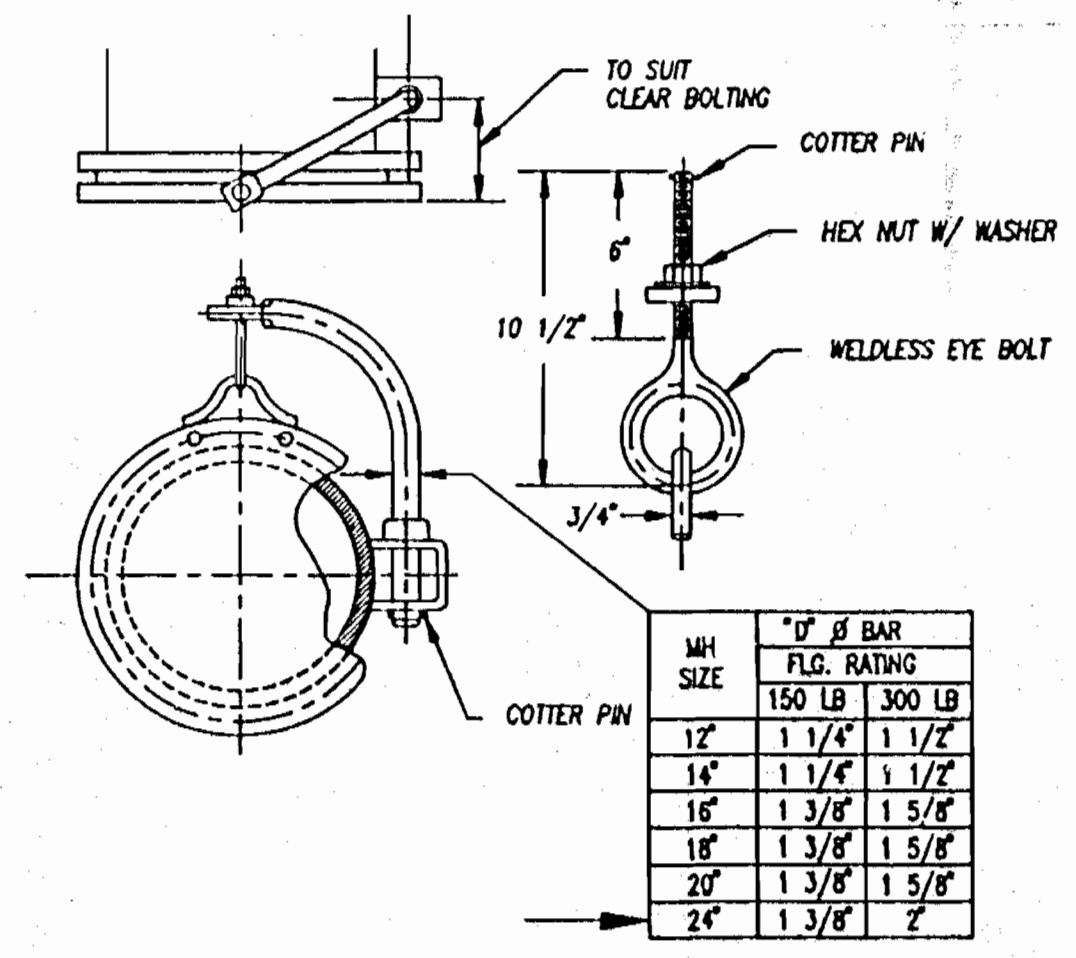
2 NAMEPLATE BRACKET DETAIL



3 SADDLE DETAIL



4 LIFTING LUG DETAIL



1 MANWAY DETAIL

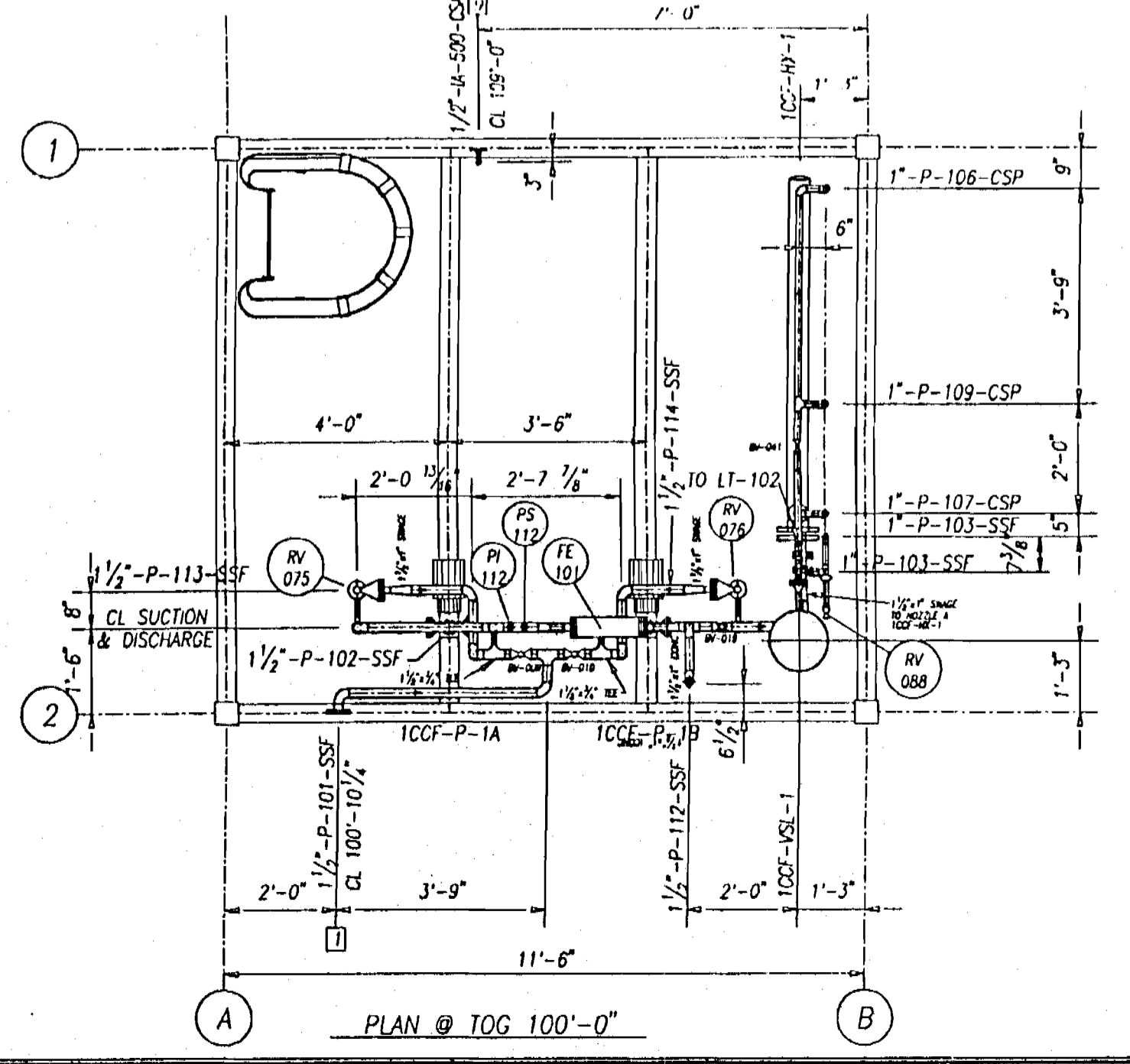
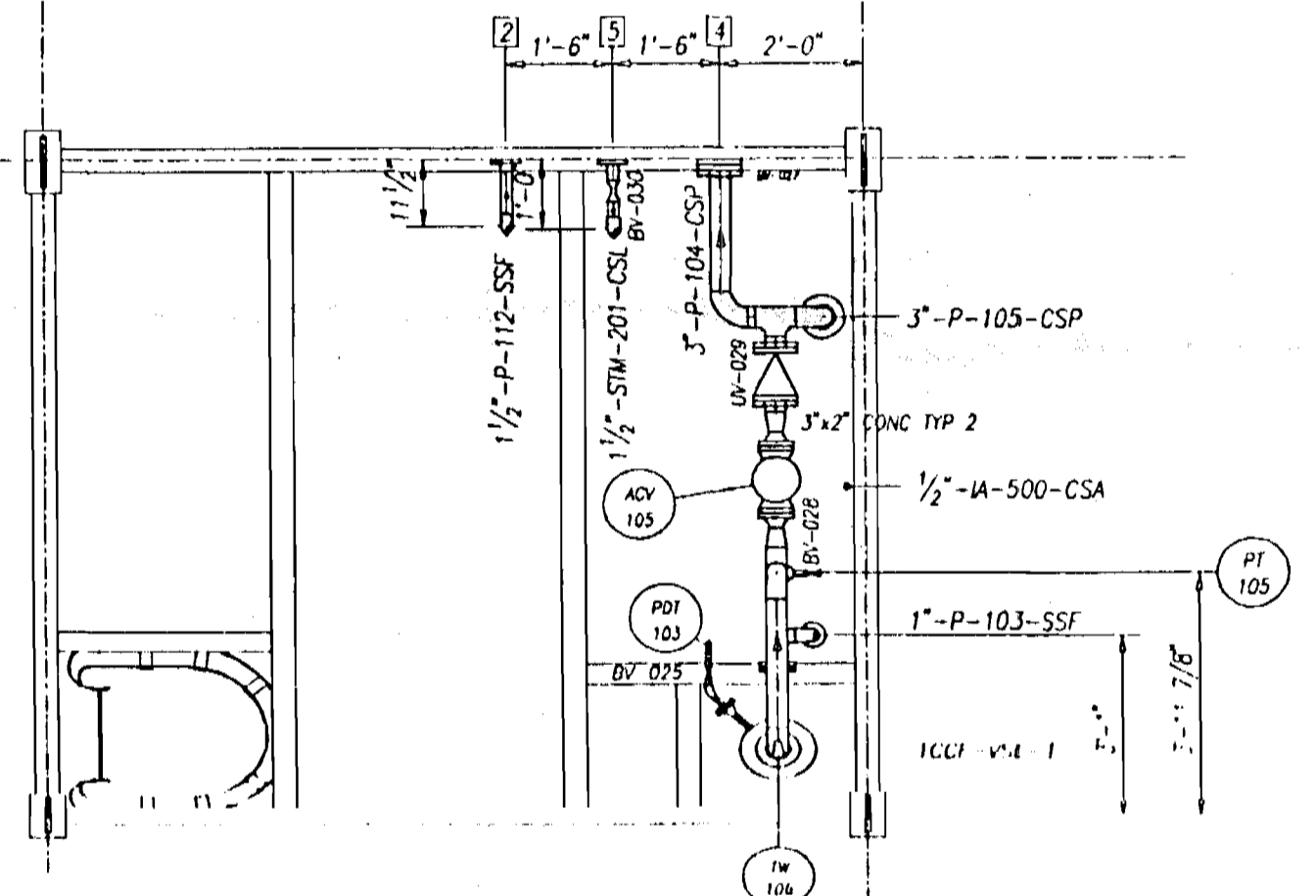
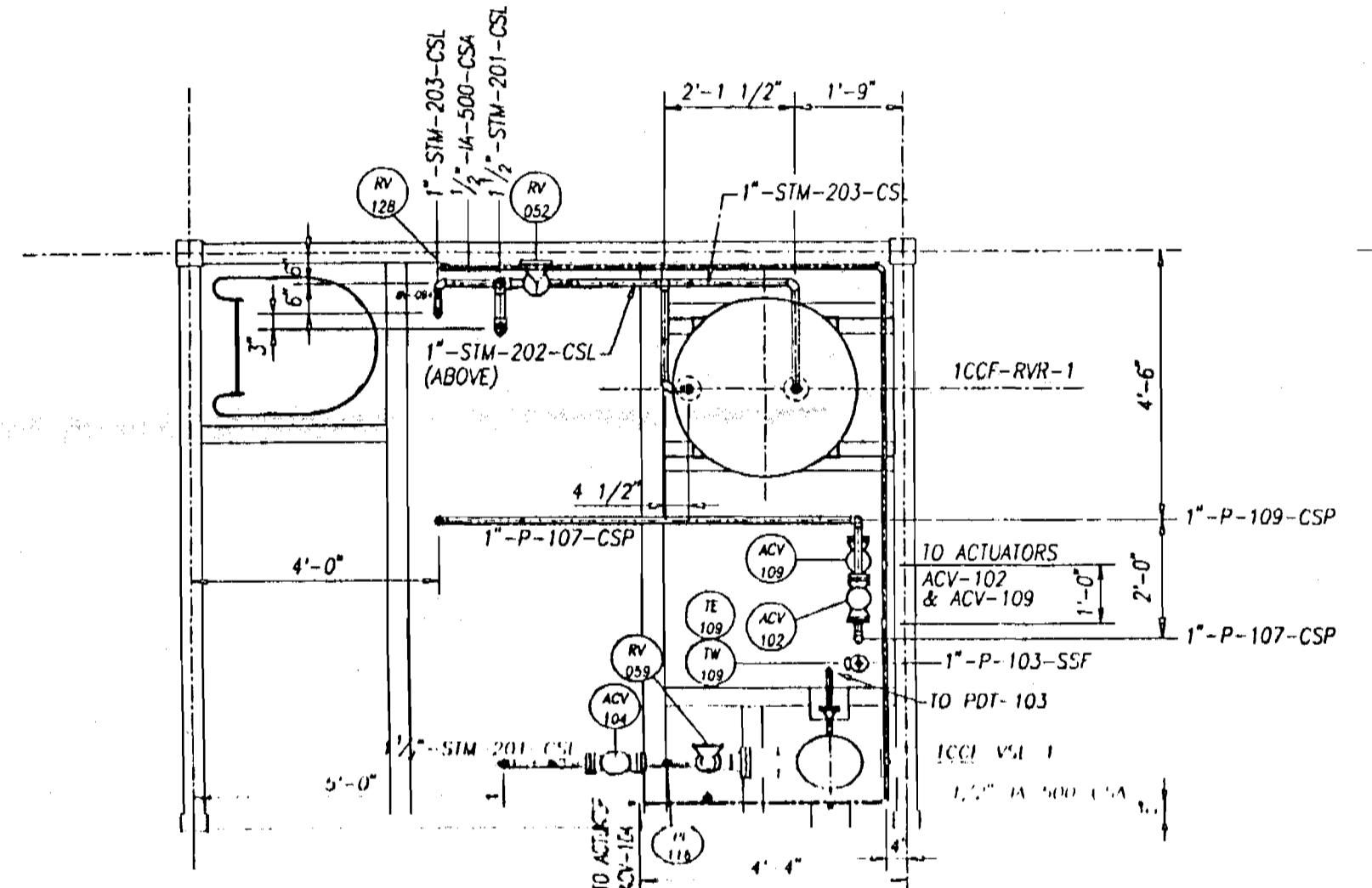
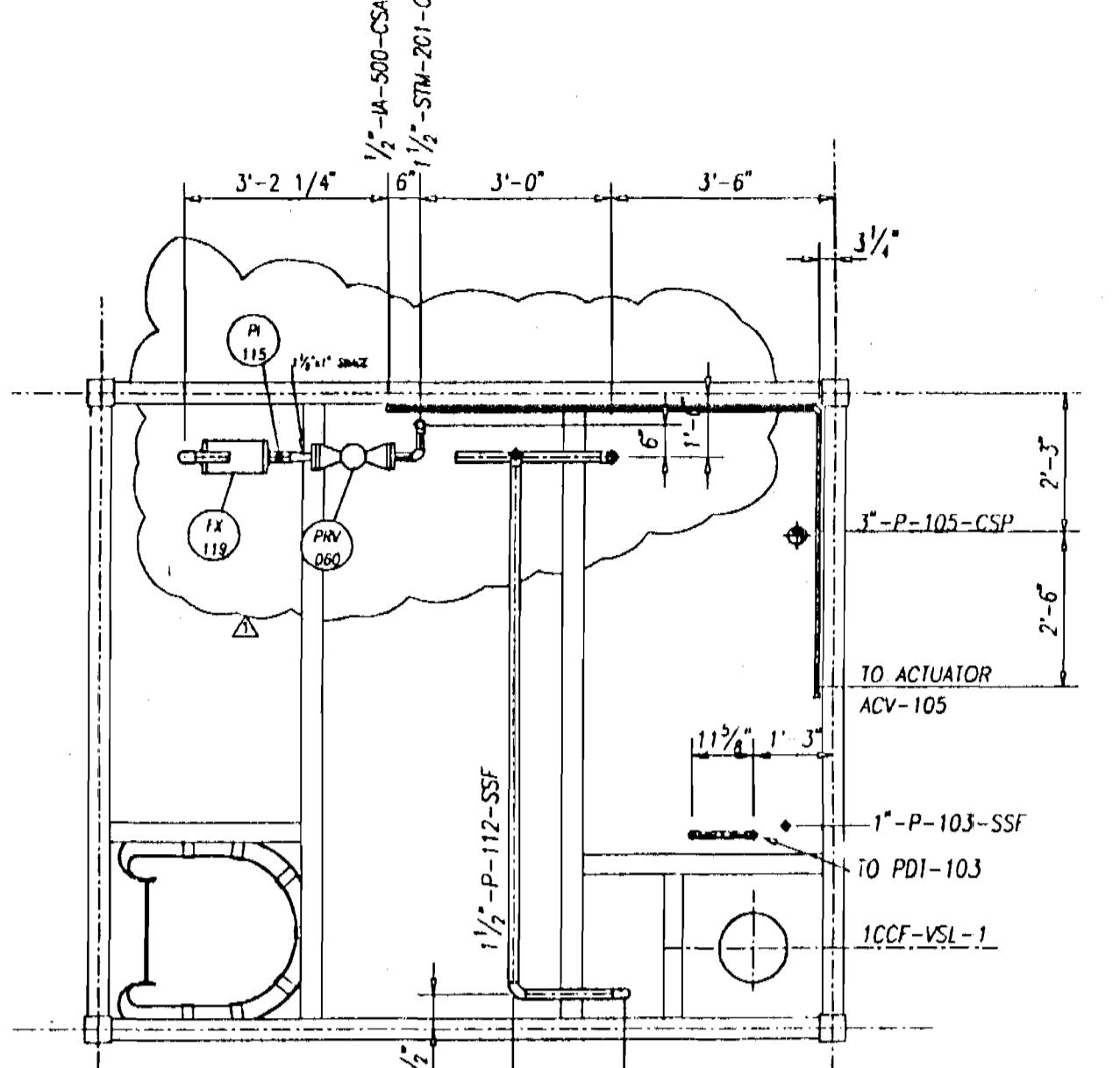
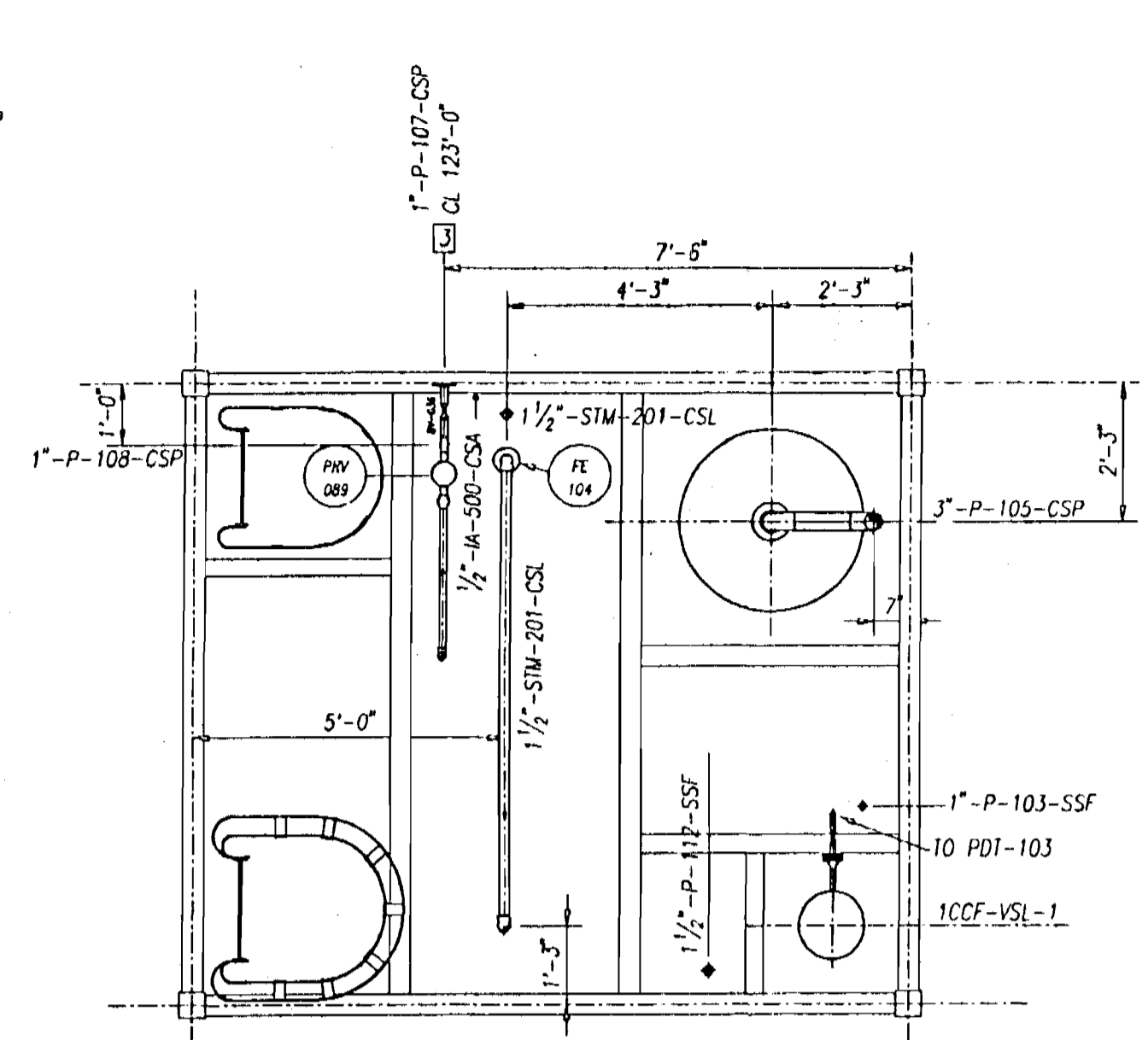
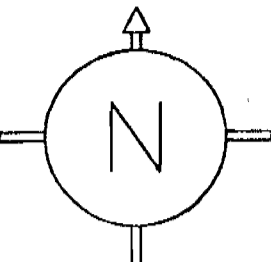
MH SIZE	1/2" β BAR FLG. RATING	300 LB
12"	1 1/4"	1 1/2"
14"	1 1/4"	1 1/2"
16"	1 3/8"	1 5/8"
18"	1 3/8"	1 5/8"
20"	1 3/8"	1 5/8"
24"	1 3/8"	2"

552586-D-7877-09-02 4  
05 58081

APPROVED FOR CONSTRUCTION  
BY *Sch* DATE MAY 11 1993  
GLITSCH PACKAGE PLANTS

1	AS BUILT	4-28-93	SCH
0	APPROVED FOR CONSTRUCTION	3-3-93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPROV
REVISIONS			
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GLITSCH, INC.			
Package Plants Division		1CCF-TNK-1 AQUEOUS AMMONIA STORAGE TANK	
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		SCALE 1/4" = 1'-0"	
DRAWN DP	DATE 1-22-93	JOB NO. 61-7877	
CHECK	DATE	DRAWING NO.	REV.
ENGR.	DATE	D-7877-09-02	1





**APPROVED FOR CONSTRUCTION**  
BY *[Signature]* DATE *6-28-93*  
GLITSCH PACKAGE PLANTS

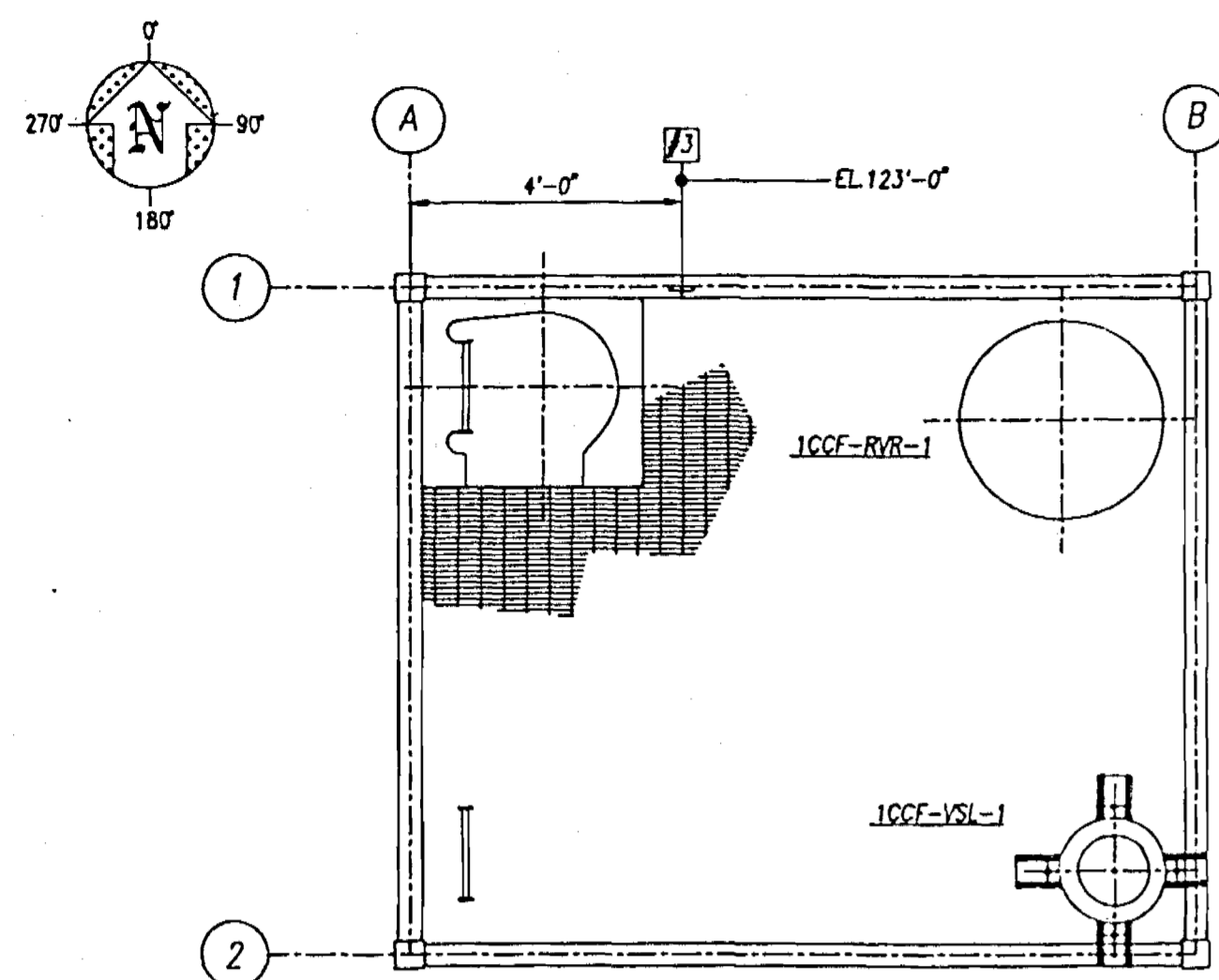
**CERTIFIED**  
BY *[Signature]* DATE *6-22-93*

REVIEWED BY: *[Signature]* DATE: *6-28-93*

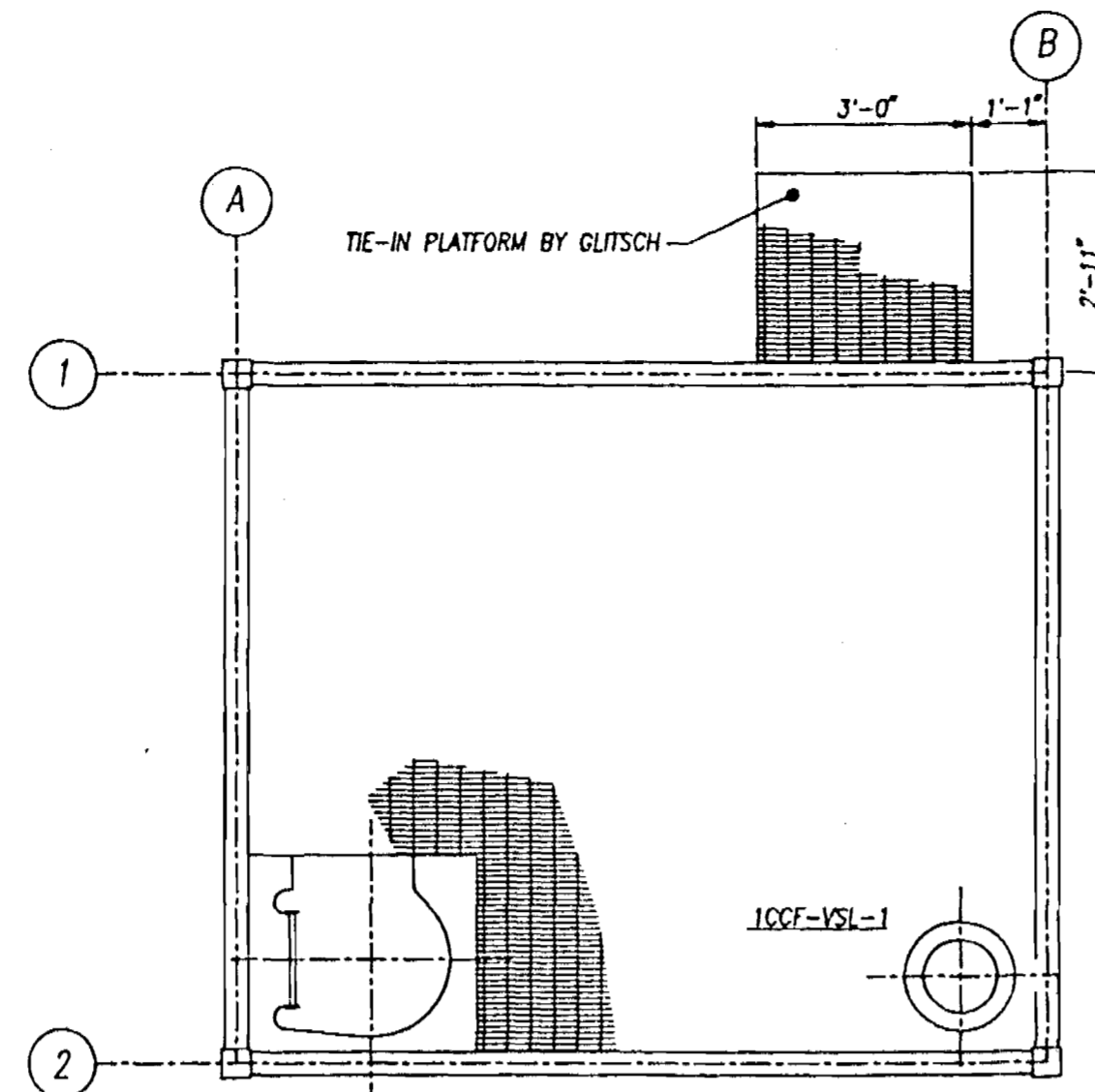
**PyroPOWER**  
SAN DIEGO, CALIFORNIA

DRAWING NO.	REV
552586-03-01	2
B & V PROJECT 15637	
15637.62.3401	

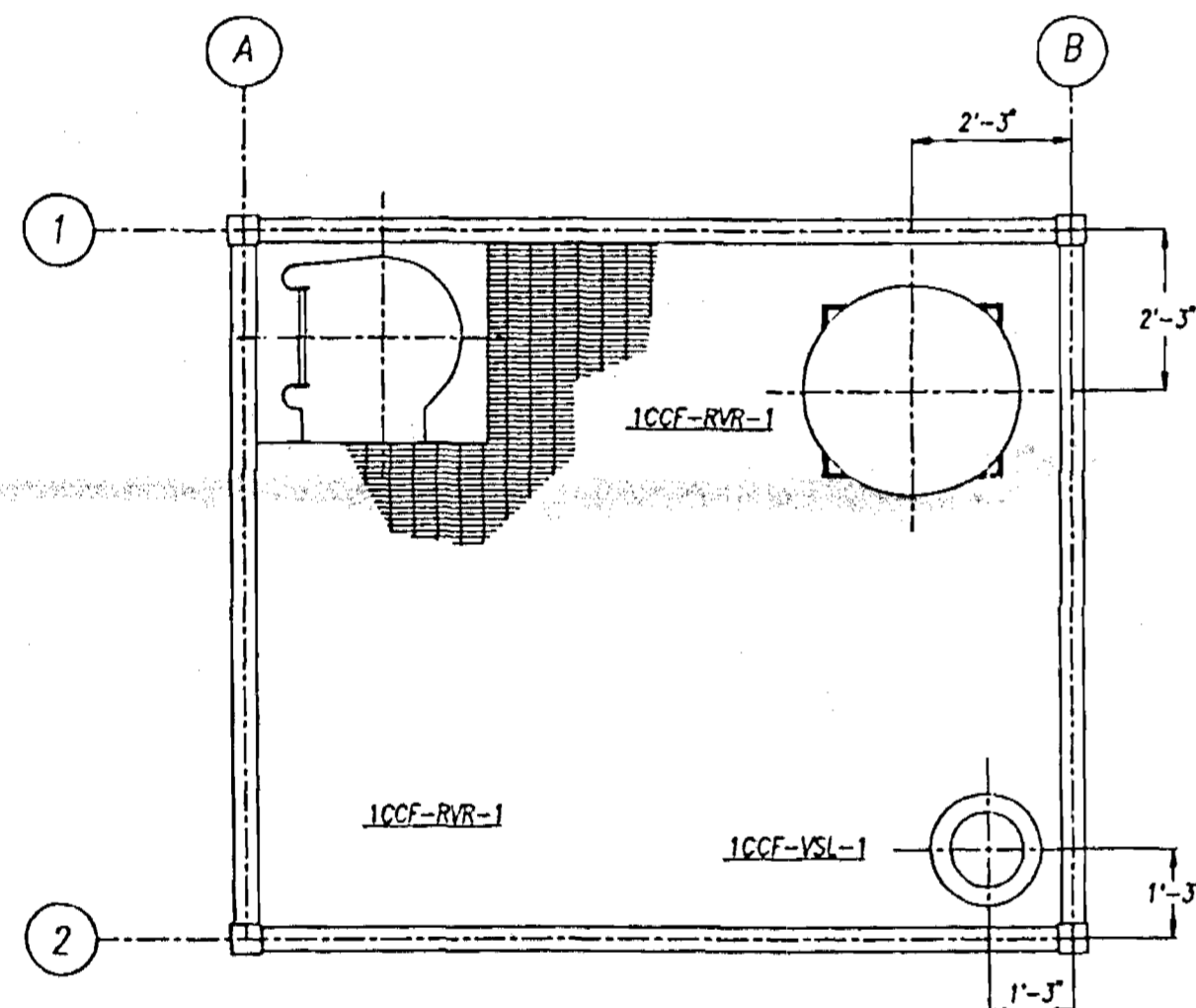
1	CHANGED LINE STW-201	6/18/93	
SYMBOL	DESCRIPTIONS	DATE	APP'D
REVISIONS			
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<b>GLITSCH, INC.</b>		<b>PIPING PLANS</b>	
Package Plants Division			
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		JOB NO. 6J-7877	
SCALE	3/8"=1'-0"		
DRAWN	DG	DATE	4/29/93
CHECK		DATE	
ENGR.		DATE	
		DRAWING NO.	REV.
		D-7877-03-01	1



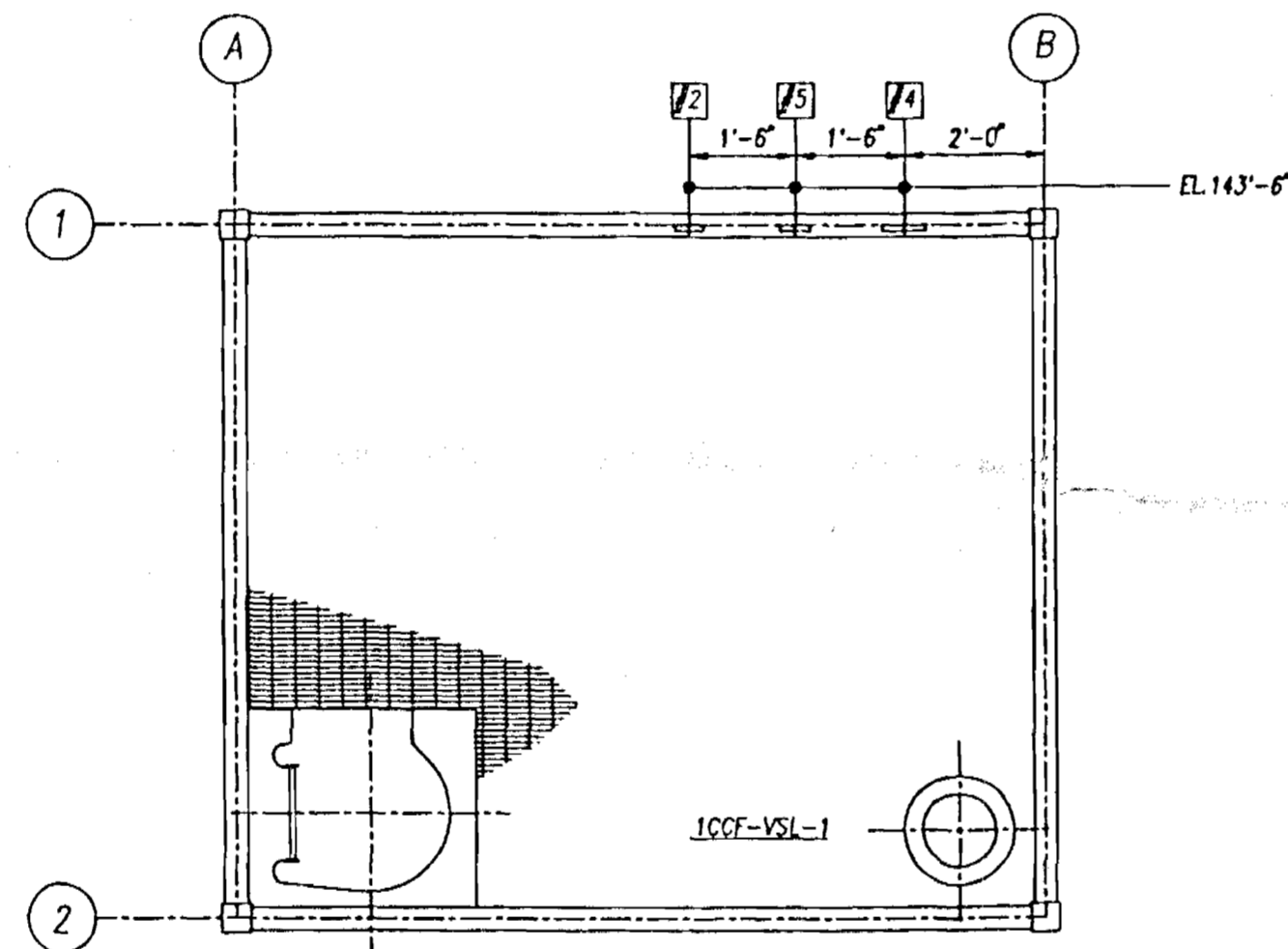
PLAN @ T.O.G. EL.120'-0"



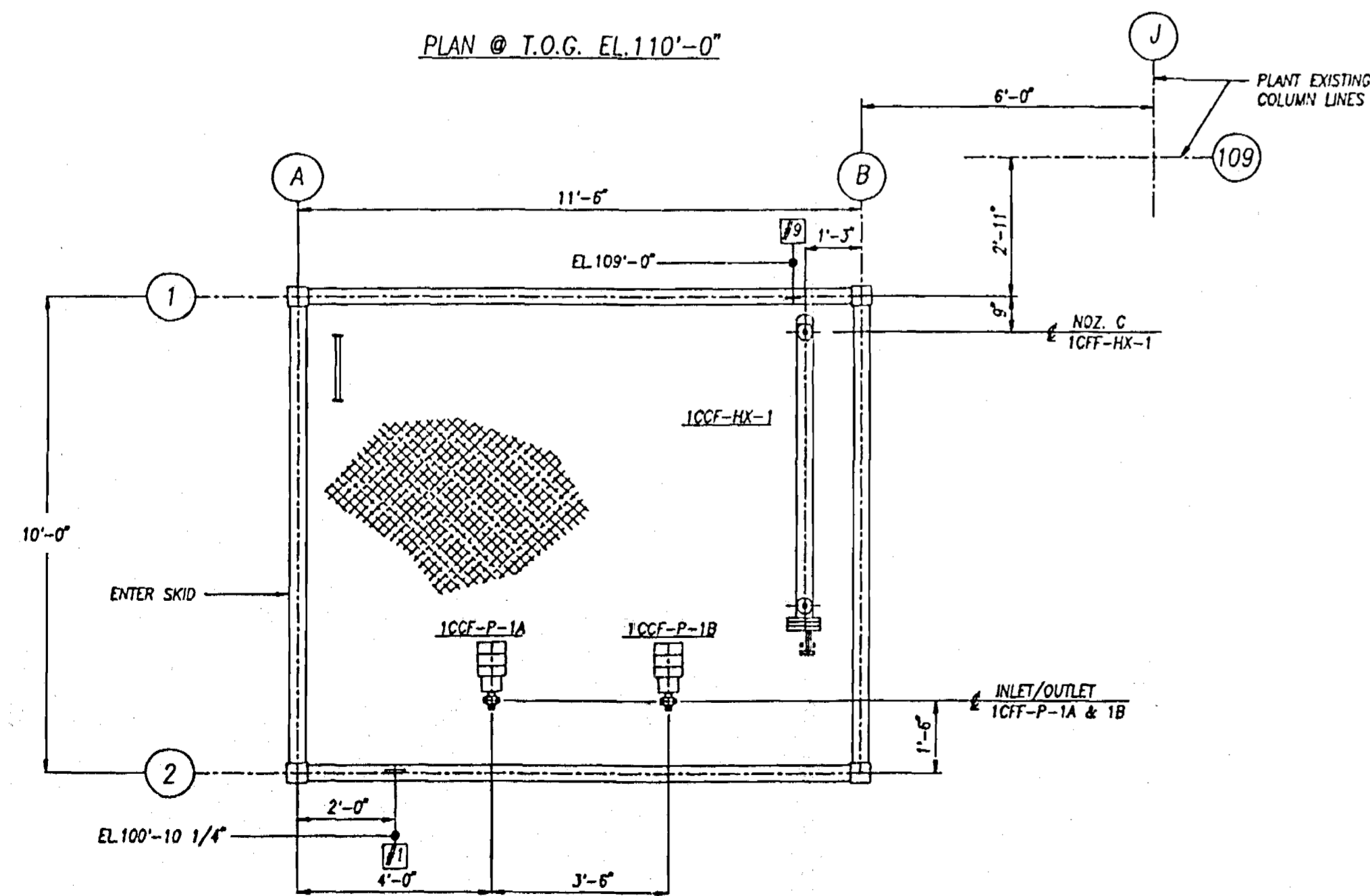
PLAN @ T.O.G. EL.132'-0"



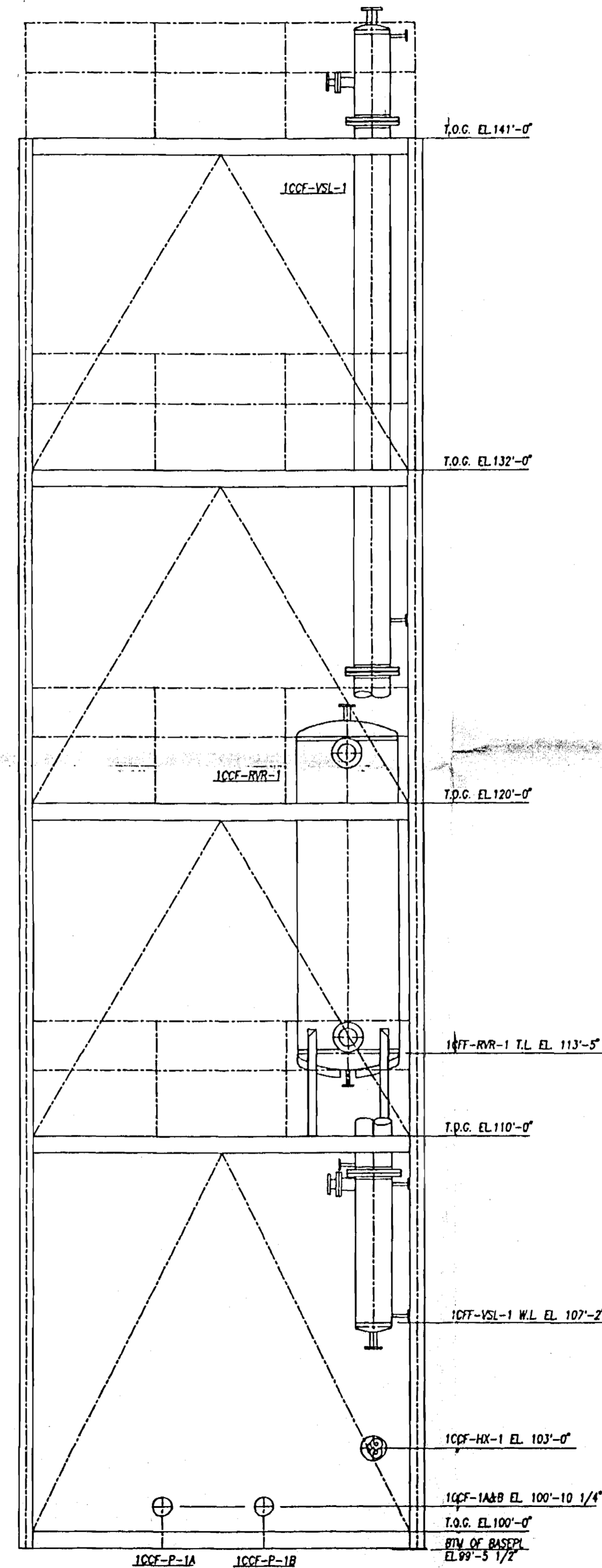
PLAN @ T.O.G. EL.110'-0"



PLAN @ T.O.G. EL.141'-0"



PLAN @ T.O.C.P. EL.100'-0"



SOUTH ELEVATION  
LOOKING NORTH

NOZZLE TIE-INS	CONNECTIONS
#1 FEED INLET	1 1/2" - 150# LAP JOINT FLG.
#2 LIQUID AMMONIA TO BOILER	1 1/2" - 150# LAP JOINT FLG.
#3 EFFLUENTS OUTLET	1" - 150# R.F. FLG.
#4 AMMONIA/STEAM VAPOR OUTLET	5" - 150# R.F. FLG.
#5 REGULATED STEAM INLET	1 1/2" - 300# R.F. FLG.
#9 INSTRUMENT AIR INLET	1/2" - 150# R.F. FLG.

552586 D-7877-D2-01 3  
05 58078

APPROVED FOR  
CONSTRUCTION  
BY *[Signature]* DATE MAY 11 1993  
GLITSCH PACKAGE PLANTS

SYMBOL	DESCRIPTIONS	DATE	APP'D
1	PUMP ELEVATION, ADDED EXISTING COLS. & TIE-IN PLATFORM	4-26-93	SCH
0	APPROVED FOR CONSTRUCTION	3-18-93	SCH

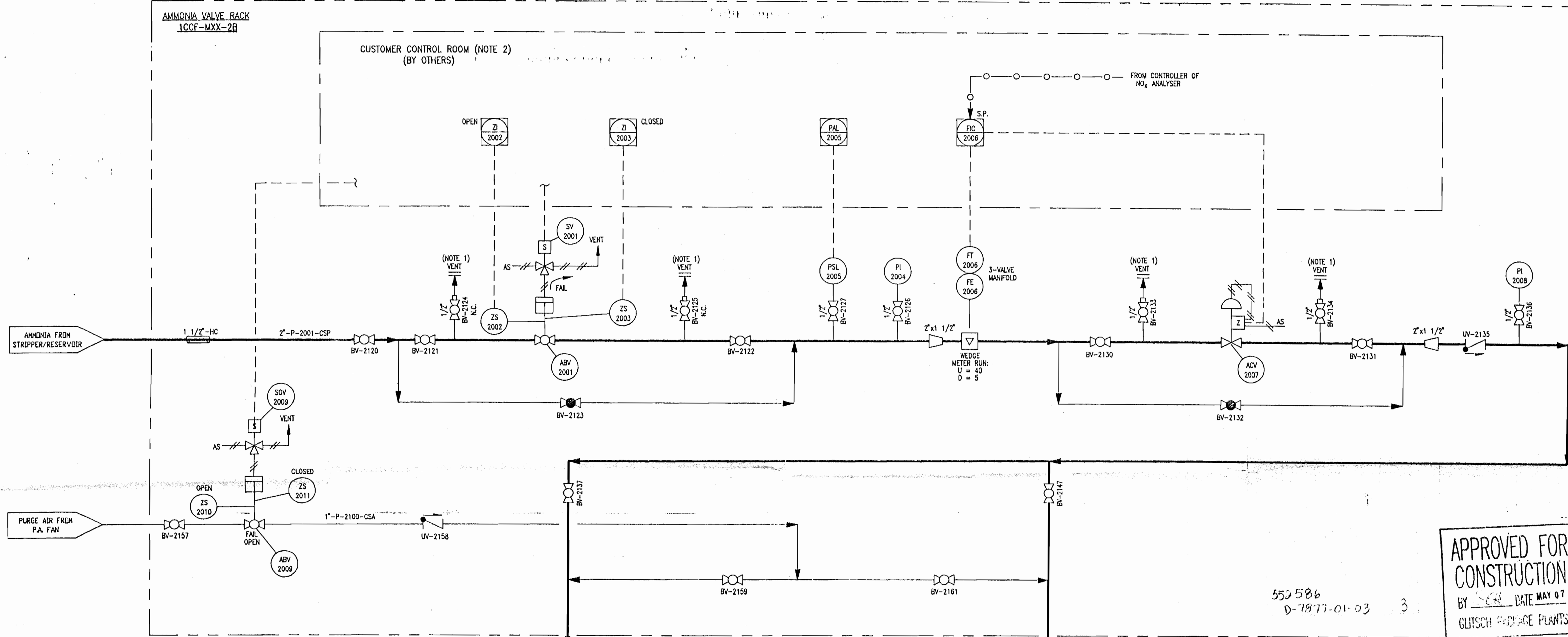
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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA	GENERAL ARRANGEMENT AMMONIA STRIPPER
---	---

SCALE 3/8" = 1'-0"

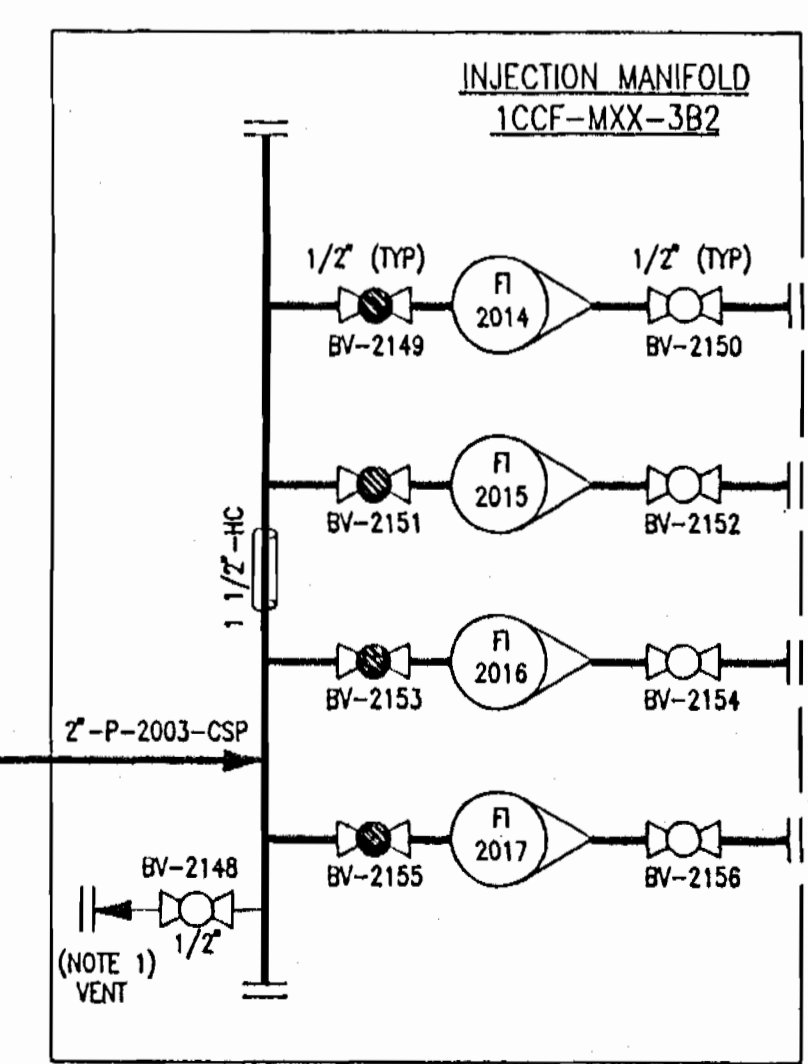
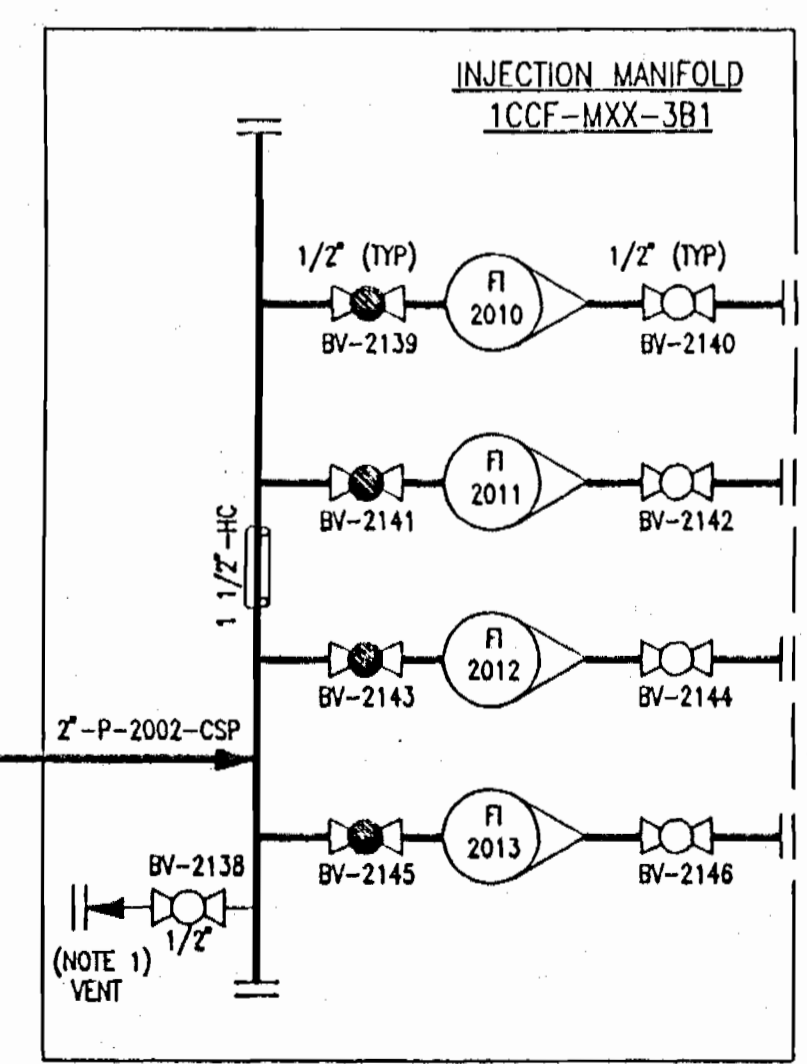
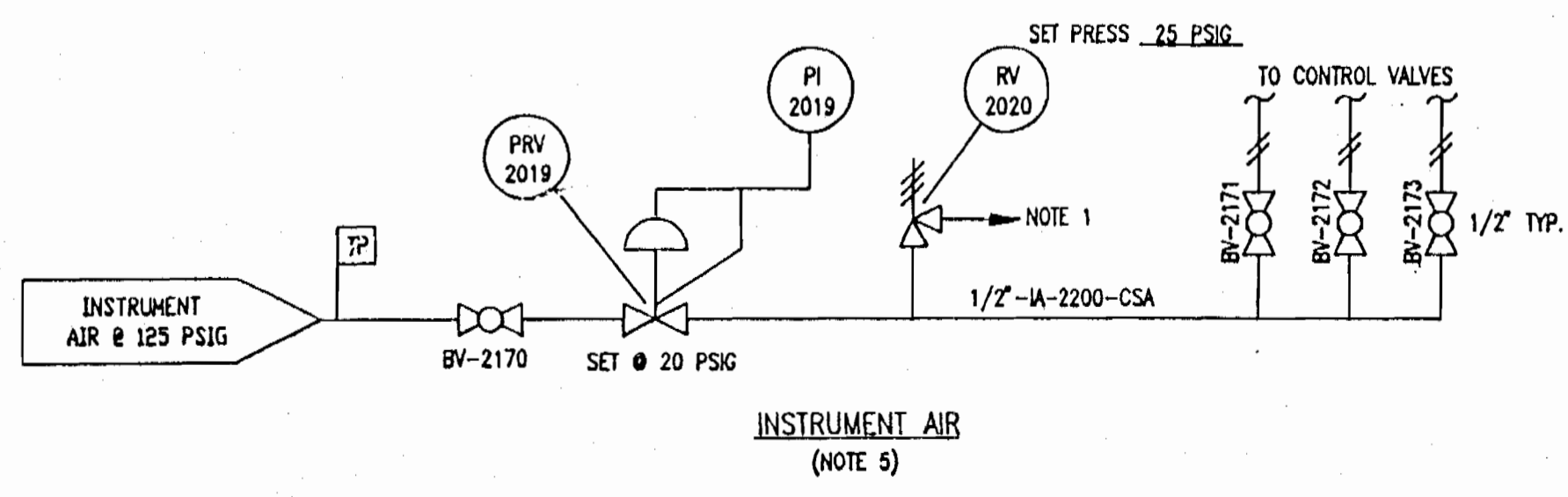
DRAWN DP	DATE 1-25-93	JOB NO. 6J-7877	REV.
CHECK	DATE	DRAWING NO.	REV.
ENGR.	DATE	D-7877-02-01	1



APPROVED FOR CONSTRUCTION  
 BY SCM DATE MAY 07 1993  
 GLITSCH PACKAGE PLANTS

552586  
 D-7877-01-03 3

- NOTES:
1. VENT TO SAFE LOCATION BY CUSTOMER.
  2. GLITSCH IS NOT RESPONSIBLE FOR CONTROL OF EQUIP. OUTSIDE OF GLITSCH SCOPE OF SUPPLY. CONTROL SHOWN OUTSIDE OF GLITSCH'S SCOPE IS ONLY A SUGGESTED METHOD.
  3. ALL TAG NUMBERS ARE TO BE PRECEDED BY 1CCF.
  4. STEAM TRAP AND VALVES SHOWN ARE BY OTHERS.
  5. INSTRUMENT AIR LINE IS SKID MOUNTED.



SYMBOL	DESCRIPTIONS	DATE	APPVD
2	ABV-2001, -2009, ACV-2007	4/26/93	SCH
1	REVISED ABV-2009	4/5/93	SCH
0	APPROVED FOR CONSTRUCTION	2/26/93	SCH

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**GLITSCH, INC.**  
 Package Plants Division

CEDAR BAY GENERATING CO.  
 PYROPOWER  
 SAN DIEGO, CA

P&ID  
 AMMONIA VALVE RACK AND  
 INJECTION MANIFOLD  
 FOR BOILER 1B

SCALE: NONE

DRAWN: BENDEROTH DATE: 1-25-93

CHECK: DATE:

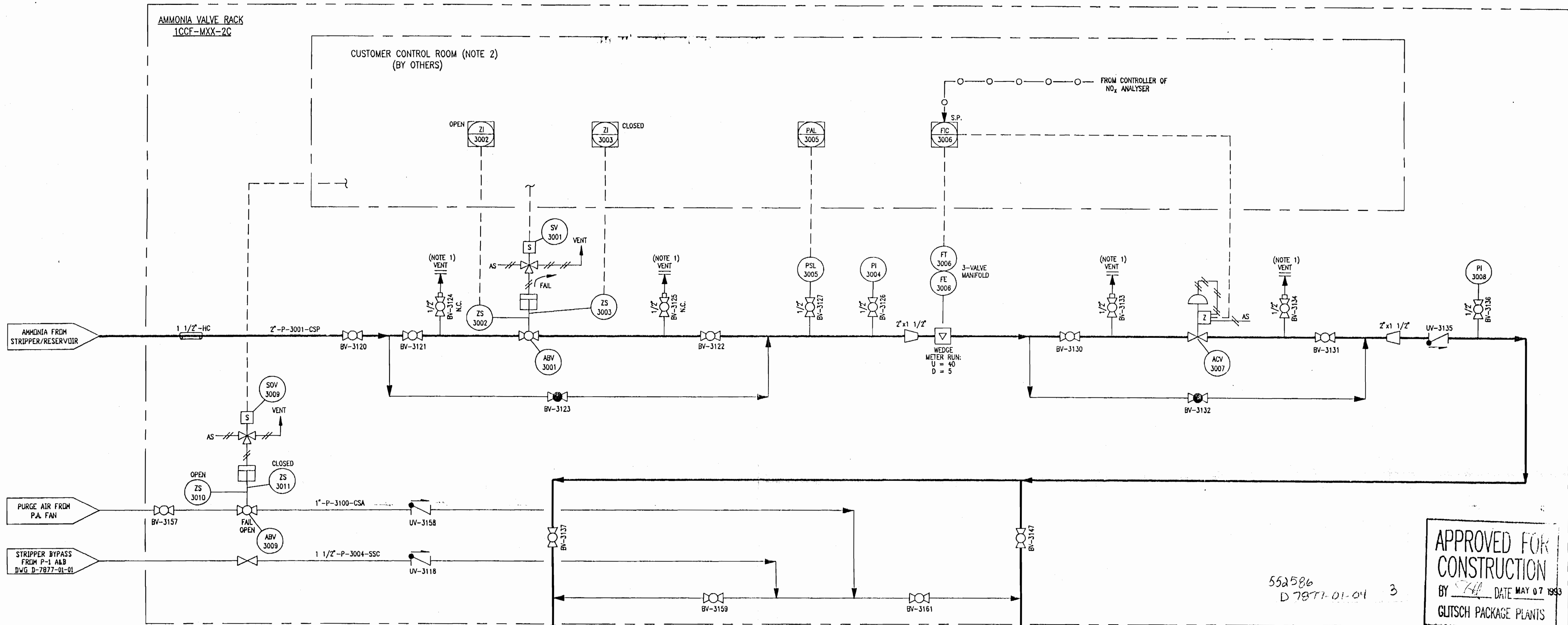
ENGR: DATE:

JOB NO. 6J-7877

DRAWING NO. D-7877-01-03

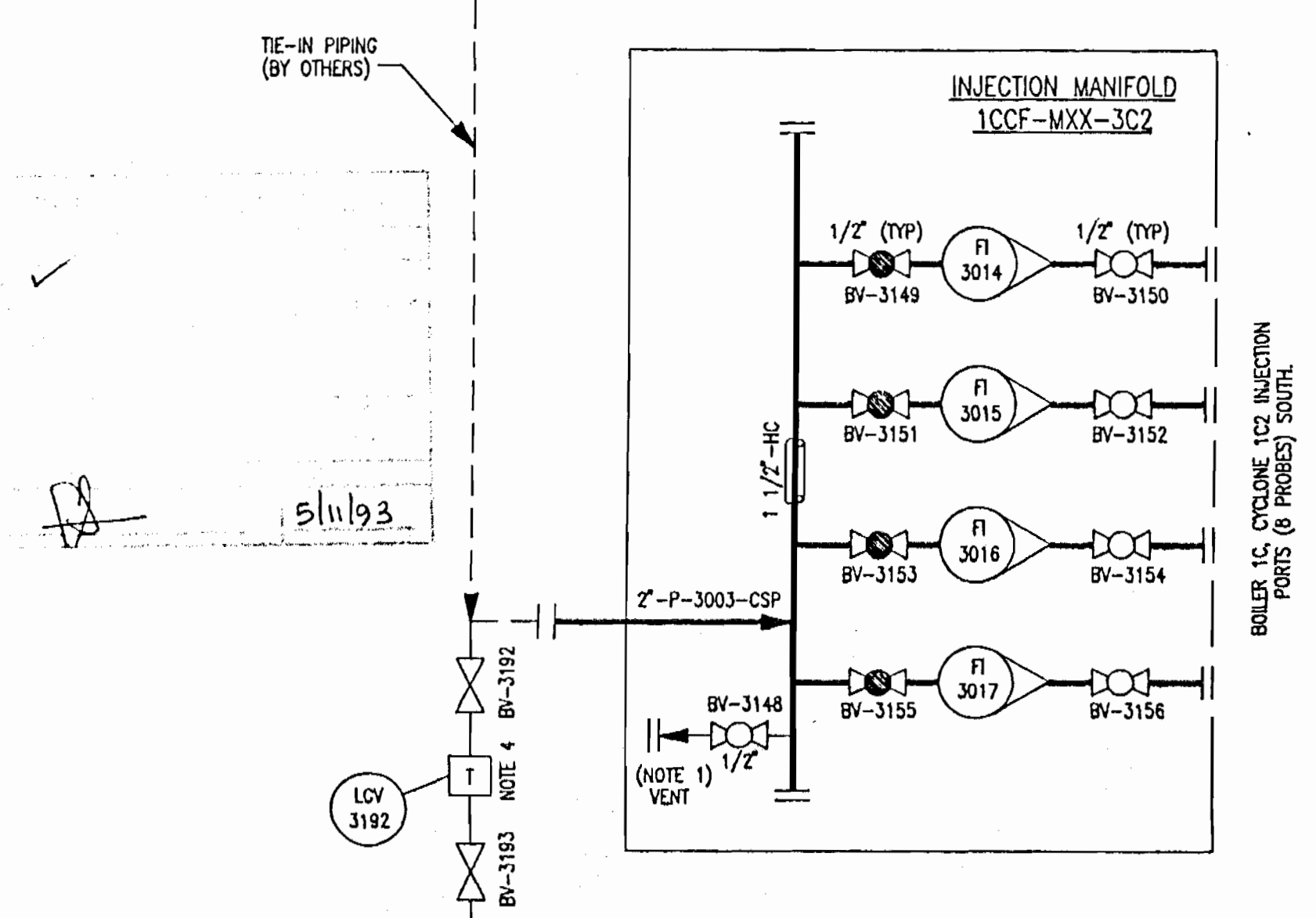
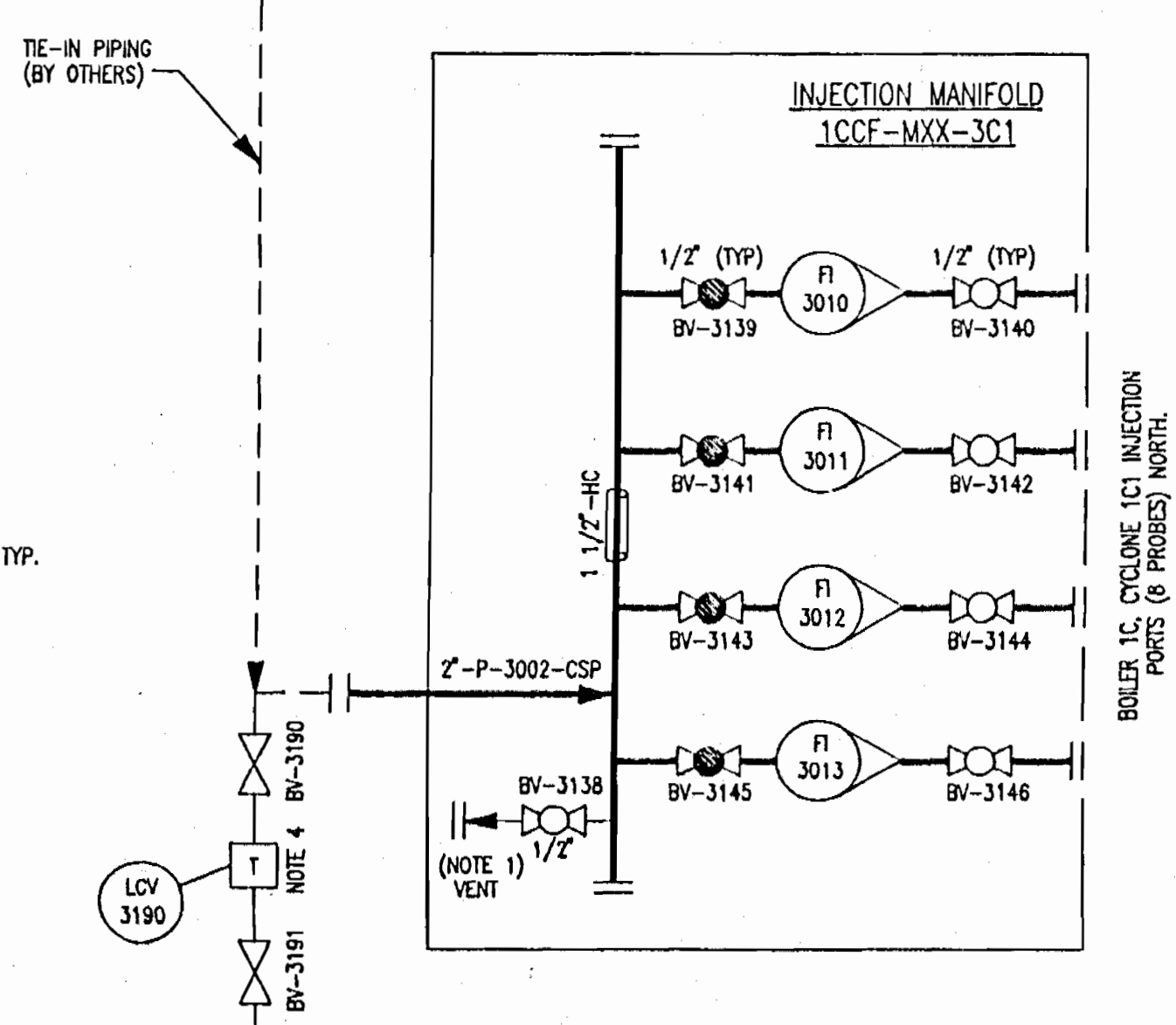
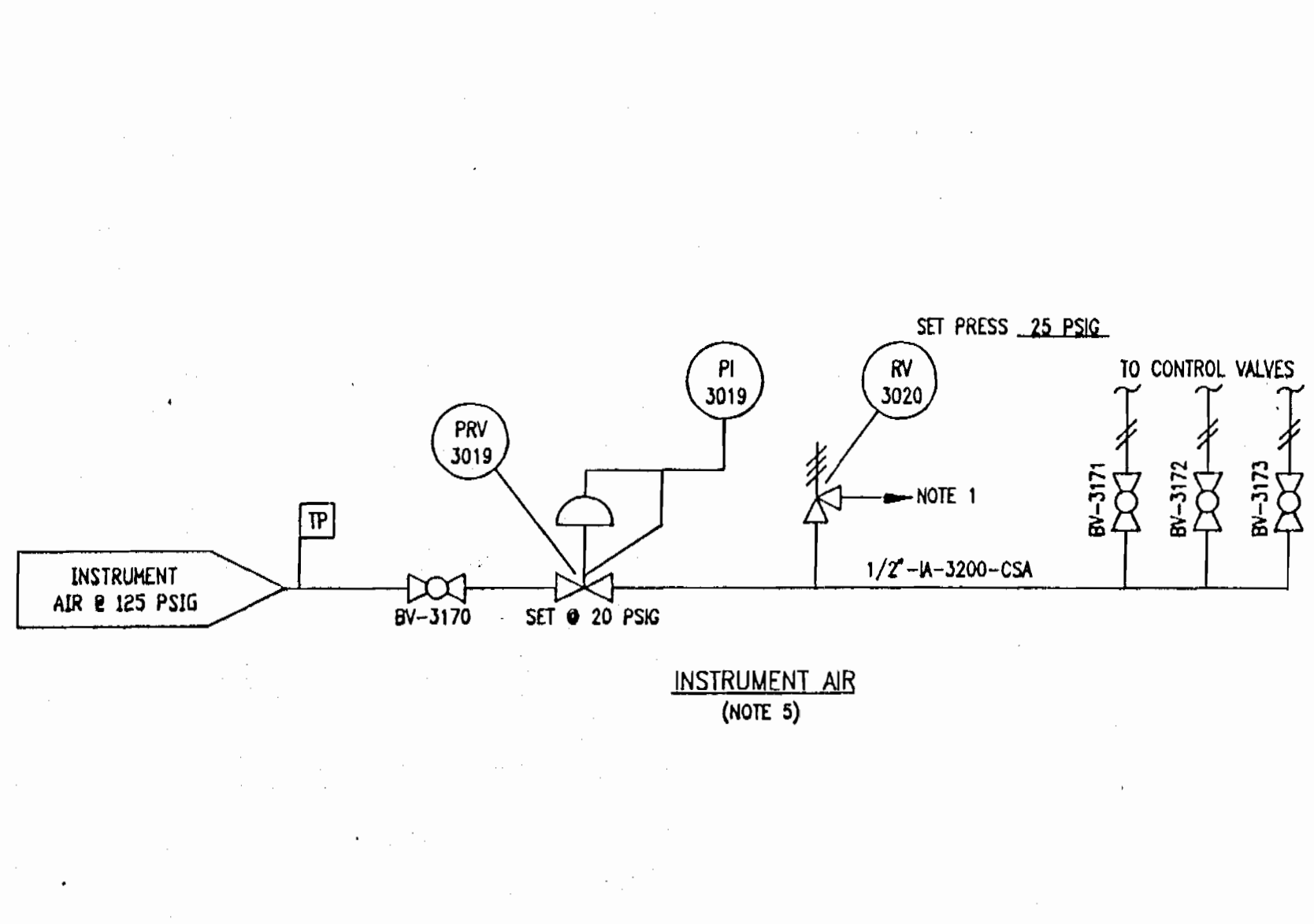
REV. 2





APPROVED FOR CONSTRUCTION  
 BY *[Signature]* DATE MAY 07 1993  
 GLTSCHE PACKAGE PLANTS

552586  
 D 7877-01-04 3



- NOTES:
1. VENT TO SAFE LOCATION BY CUSTOMER.
  2. GLTSCHE IS NOT RESPONSIBLE FOR CONTROL OF EQUIP. OUTSIDE OF GLTSCHE SCOPE OF SUPPLY. CONTROL SHOWN OUTSIDE OF GLTSCHE'S SCOPE IS ONLY A SUGGESTED METHOD.
  3. ALL TAG NUMBERS ARE TO BE PRECEDED BY 1CCF.
  4. STEAM TRAP AND VALVES SHOWN ARE BY OTHERS.
  5. INSTRUMENT AIR LINE IS SKID MOUNTED.

SYMBOL	DESCRIPTIONS	DATE	APP'D
2	ABV-3001, -3009, ACV-3007	4/26/93	SCH
1	REVISED ABV-3009, DELETED INSUL. ON LINE 3004-SSC	4/5/93	SCH
0	APPROVED FOR CONSTRUCTION	2/26/93	SCH

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**GLTSCHE, INC.**  
 Package Plants Division

CEDAR BAY GENERATING CO.  
 PYROPOWER  
 SAN DIEGO, CA

P&ID  
 AMMONIA VALVE RACK AND  
 INJECTION MANIFOLD  
 FOR BOILER 1C

SCALE: NONE

DRAWN: *[Signature]* DATE: 1-25-93

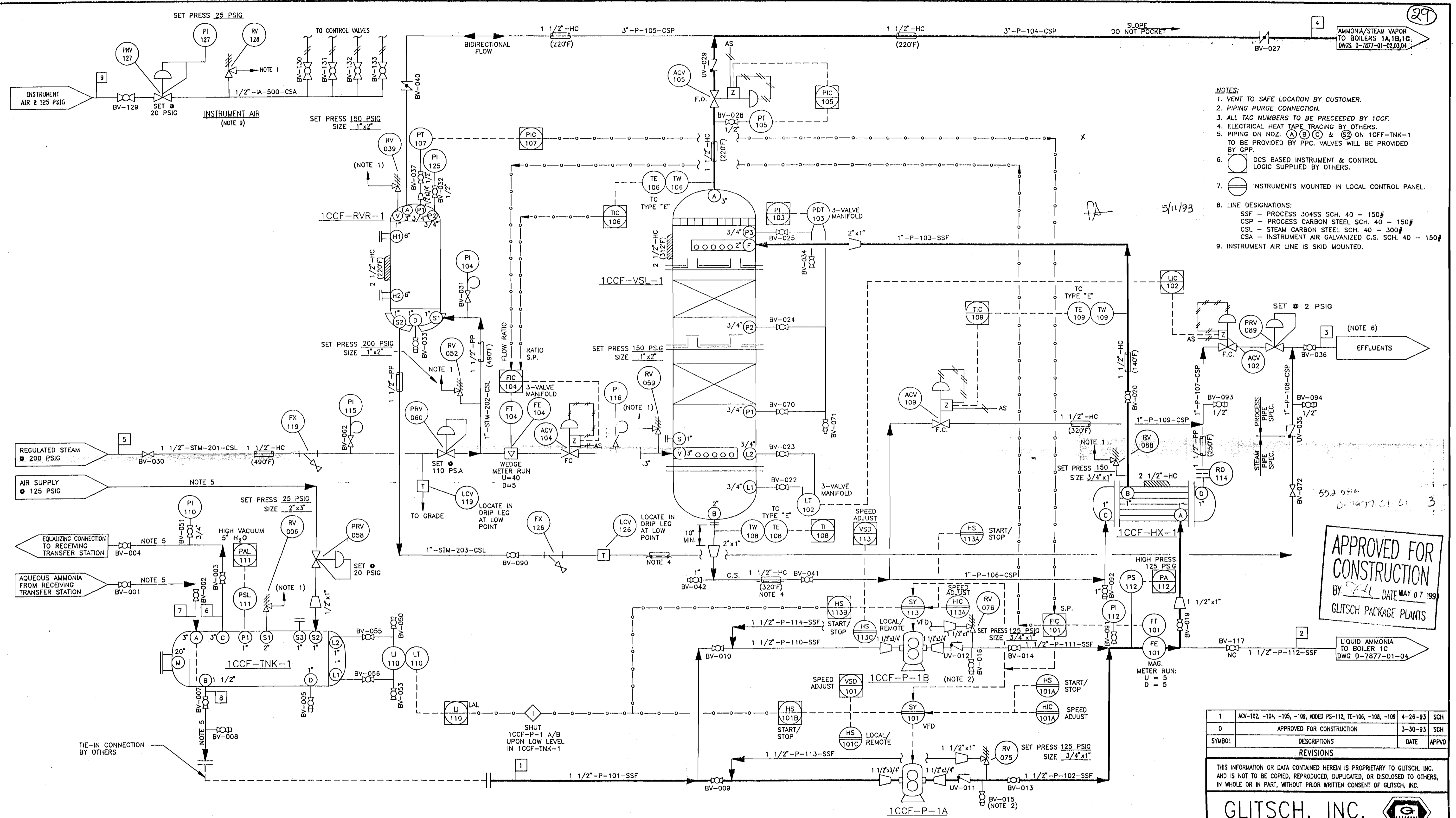
CHECK: DATE:

ENGR: DATE:

JOB NO.: 6J-7877

DRAWING NO.: D-7877-01-04

REV.: 2



- NOTES:
1. VENT TO SAFE LOCATION BY CUSTOMER.
  2. PIPING PURGE CONNECTION.
  3. ALL TAG NUMBERS TO BE PRECEDED BY 1CCF.
  4. ELECTRICAL HEAT TAPE TRACING BY OTHERS.
  5. PIPING ON NOZ. (A) (B) (C) & (D) ON 1CCF-TNK-1 TO BE PROVIDED BY PPC. VALVES WILL BE PROVIDED BY GPP.
  6. DCS BASED INSTRUMENT & CONTROL LOGIC SUPPLIED BY OTHERS.
  7. INSTRUMENTS MOUNTED IN LOCAL CONTROL PANEL.
  8. LINE DESIGNATIONS:  
 SSF - PROCESS 304SS SCH. 40 - 150#  
 CSP - PROCESS CARBON STEEL SCH. 40 - 150#  
 CSL - STEAM CARBON STEEL SCH. 40 - 300#  
 CSA - INSTRUMENT AIR GALVANIZED C.S. SCH. 40 - 150#
  9. INSTRUMENT AIR LINE IS SKID MOUNTED.

5/11/93

APPROVED FOR CONSTRUCTION  
 BY [Signature] DATE MAY 07 1993  
 GLITSCH PACKAGE PLANTS

**1CCF-TNK-1**  
 AQUEOUS AMMONIA STORAGE TANK  
 CAPACITY (NOM.): 25,000 GALS.  
 11'-6" O.D. x 32'-0" T/T  
 SHELL: C.S.  
 DES. PRESS: 25 PSIG  
 DES. TEMP: 300°F

**1CCF-VSL-1**  
 AMMONIA STRIPPER  
 12.75" O.D. x 39'-0" T/T  
 SHELL: C.S.  
 DES. PRESS: 150 PSIG  
 DES. TEMP: 400°F  
 INTERNALS:  
 #1-CMR PACKING

**1CCF-RVR-1**  
 VAPOR RESERVOIR  
 CAPACITY (NOM.): 500 GALS.  
 36" O.D. x 9'-6" T/T  
 SHELL: C.S.  
 DES. PRESS: 150 PSIG  
 DES. TEMP: 300°F

**1CCF-HX-1**  
 FEED AND BOTTOMS EXCHANGER  
 TYPE: BEU HORIZONTAL  
 A = 9 FT<sup>2</sup>  
 Q = 204,878 BTU/HR.  
 SHELL: 4.5" O.D.  
 MATL: 304 SS  
 DES. PRESS: 150 PSIG  
 DES. TEMP: 400°F

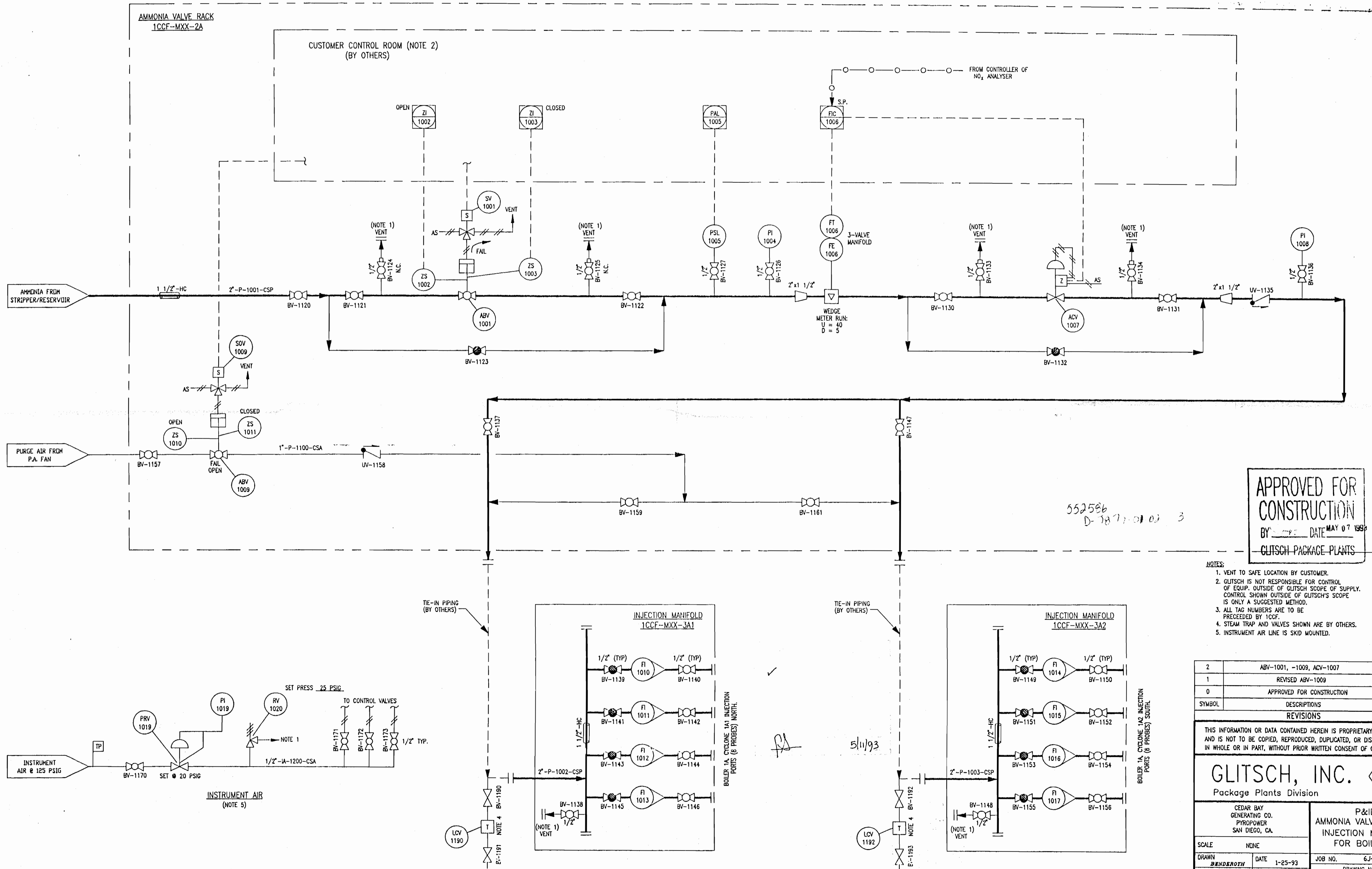
**1CCF-P-1 A&B**  
 FEED PUMP W/EXCHANGER  
 TYPE: GEAR PUMP  
 SIZE: GM-6 3/4" 150# R.F. FLG.  
 8.5 GPM (DESIGN) @ 242' TDH  
 MATL: 304 SS  
 DRIVE: 1 1/2 HP / 1750 RPM MOTOR  
 TEFC VARIABLE SPEED DRIVE

1	ACV-102, -104, -105, -108, ADDED PS-112, TE-106, -108, -109	4-26-93	SCH
0	APPROVED FOR CONSTRUCTION	3-30-93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPROV
REVISIONS			

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**GLITSCH, INC.**  
 Package Plants Division

CEDAR BAY GENERATING CO. PROPOWER SAN DIEGO, CA		PROCESS AND INSTRUMENTATION DIAGRAM AMMONIA STRIPPING SYSTEM	
SCALE: NONE	DATE: 1-26-93	JOB NO.: 6J-7877	
DRAWN: BENDEROTH	CHECK: DATE	DRAWING NO.:	REV.
ENGR. DATE		D-7877-01-01	1



APPROVED FOR CONSTRUCTION  
BY DATE MAY 07 1993  
GLITSCH PACKAGE PLANTS

- NOTES:
1. VENT TO SAFE LOCATION BY CUSTOMER.
  2. GLITSCH IS NOT RESPONSIBLE FOR CONTROL OF EQUIP. OUTSIDE OF GLITSCH SCOPE OF SUPPLY. CONTROL SHOWN OUTSIDE OF GLITSCH'S SCOPE IS ONLY A SUGGESTED METHOD.
  3. ALL TAG NUMBERS ARE TO BE PRECEDED BY 1CCF.
  4. STEAM TRAP AND VALVES SHOWN ARE BY OTHERS.
  5. INSTRUMENT AIR LINE IS SKID MOUNTED.

2	ABV-1001, -1009, ACV-1007	4/26/93	SCH
1	REVISED ABV-1009	4/5/93	SCH
0	APPROVED FOR CONSTRUCTION	2/26/93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPVD

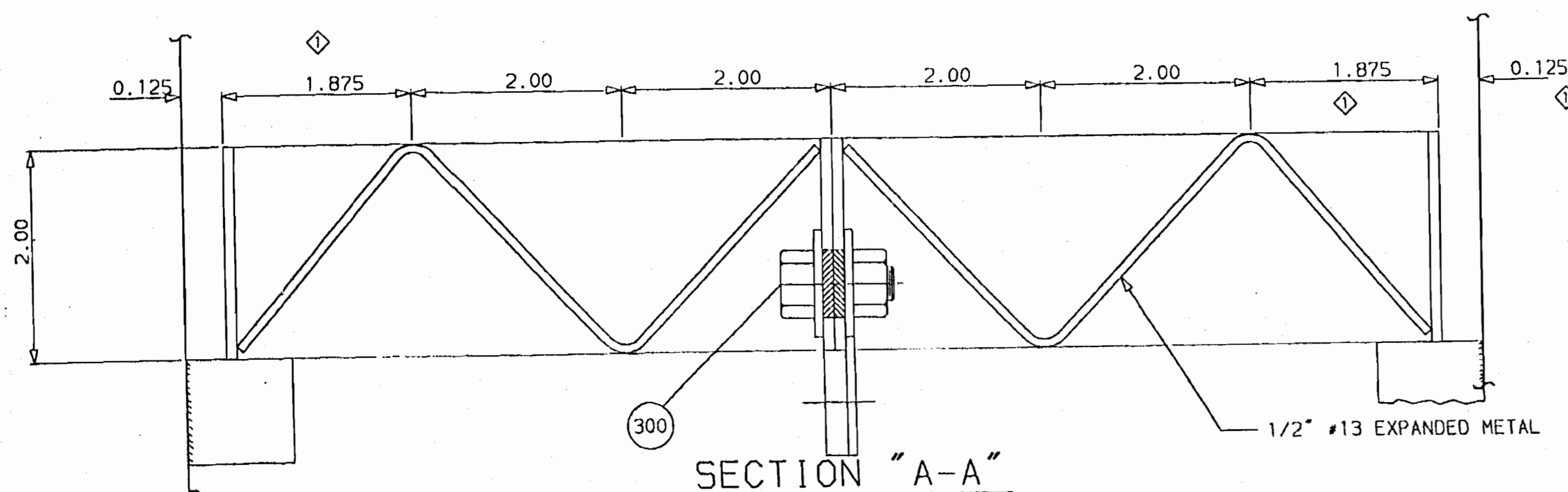
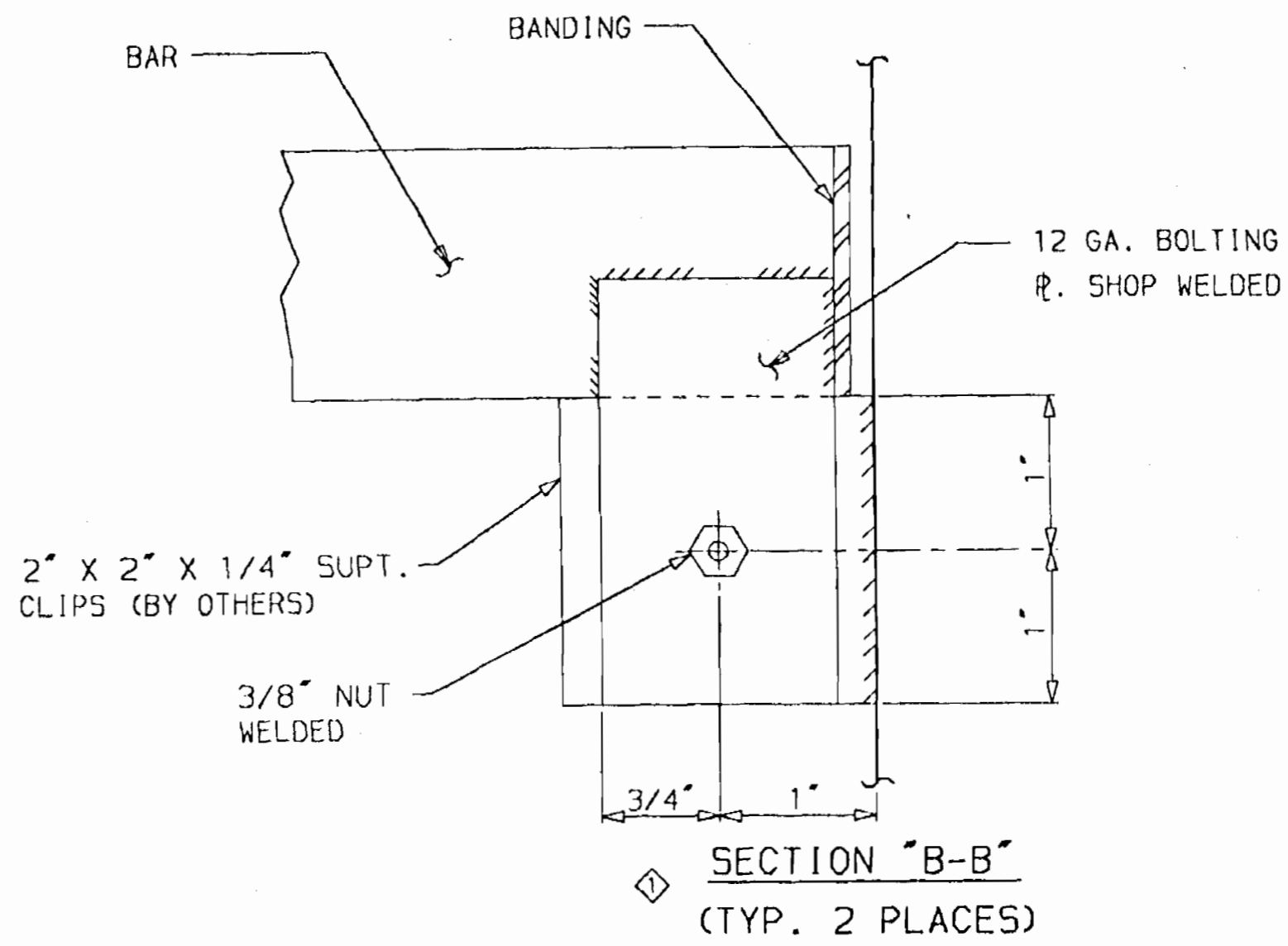
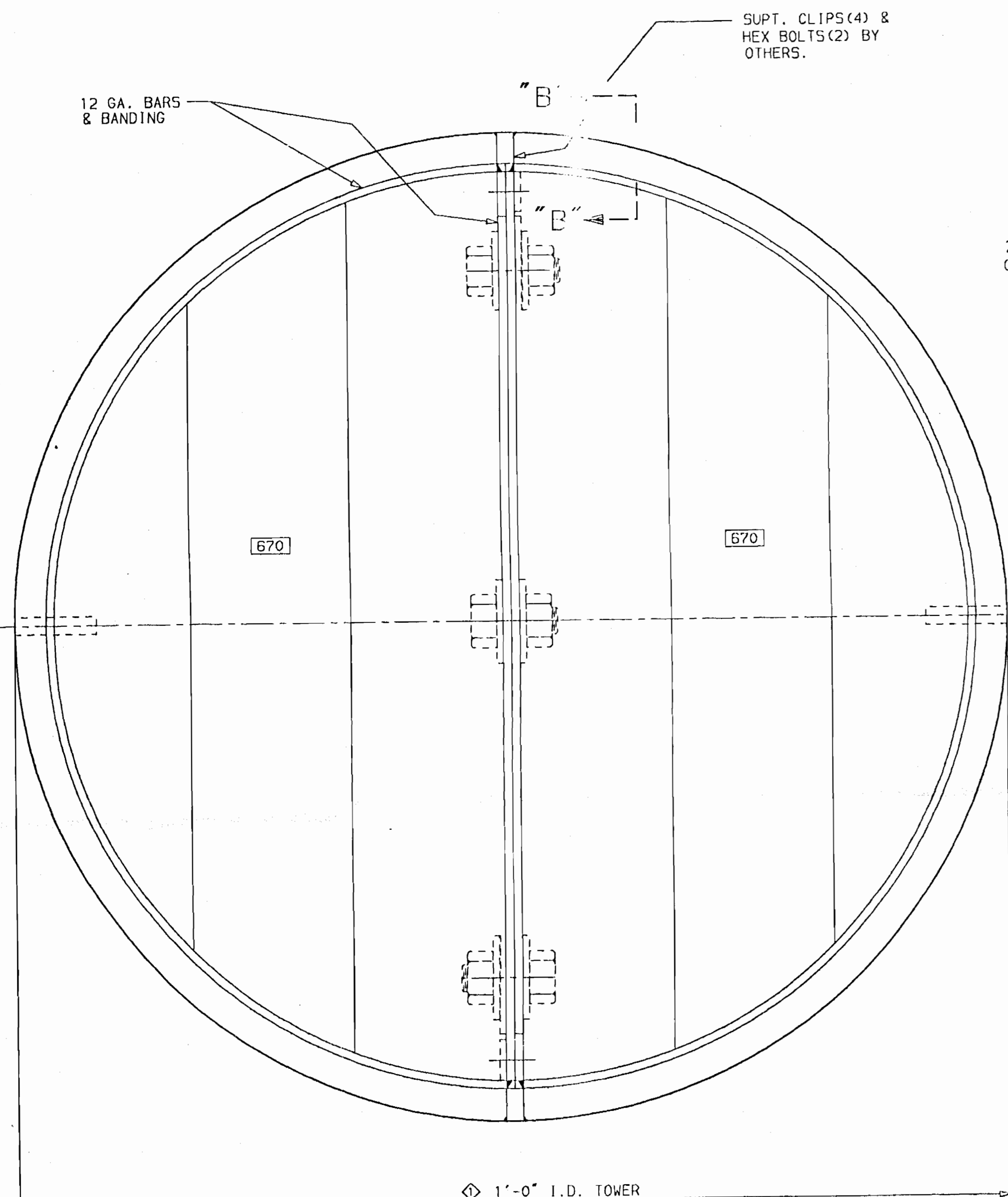
REVISIONS

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**GLITSCH, INC.**  
Package Plants Division

CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA.		P&ID AMMONIA VALVE RACK AND INJECTION MANIFOLD FOR BOILER 1A	
SCALE NONE	DATE 1-25-93	JOB NO. 6J-7877	REV.
DRAWN BENDEROTH	DATE	DRAWING NO. D-7877-01-02	2
CHECK ENGR.	DATE		





QUANTITY SHOWN IS FOR ONE UTS-209. TWO (2) ARE REQUIRED.

TOTAL QUANTITY FOR TOWER →

- GENERAL NOTES**
- 1. ACTUAL TOWER MANHOLE, TOWER I.D.
  - 2. DIMENSIONS ARE IN INCHES
  - 3. TOLERANCES ± 0.125
  - 4. PART NUMBERS ARE ENCLOSED THUS: 670
  - 5. HARDWARE ASSEMBLY NUMBERS ARE INDICATED BY ○
  - 6. SEE VESSEL ARRANGEMENT DWG NO. G.P.P. D-7877-08-01
  - 7. 10% SPARE BOLTING HARDWARE AND GASKETING TO BE FURNISHED.
  - 8. PART NUMBERS ARE PAINT STENCILED ON MAJOR COMPONENTS. SMALL PARTS AND HARDWARE WILL BE BAGGED AND/OR TAGGED FOR SHIPMENT.
  - 9. CORROSION ALLOWANCE NONE
  - 10. ALL MATERIAL THICKNESSES IN ACCORDANCE WITH U.S. STD. REVISED GAUGE.
  - 11. ALL THREADED PARTS ARE AMERICAN STANDARD U.N.C. THREADED SERIES.

**SPECIFIC NOTES**

UNLESS OTHERWISE SPECIFIED:

**PARTS LIST**

QUAN	PART NO.	DESCRIPTION	REMARKS / MATERIAL
2	88308-670	U.T.S. PANEL	12 GA. TY-304
6	810-3041	TRAY WASHER FOR 3/8" BOLT	TY-304
3	890-30411	3/8" X 1" BOLT	TY-304
3	891-30401	3/8" HEX NUT	TY-304
22 CU.FT.	33500-100	#1 CASCADE MINI-RINGS	TY-304

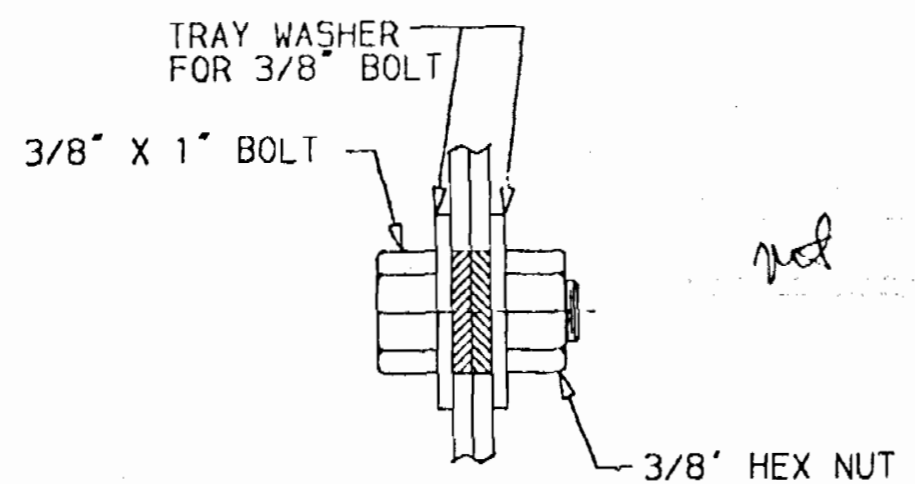
NO.	DESCRIPTION OF REVISION	ENG. BY/DATE
1	RE-DESIGNED HOLDDOWN METHOD, CORR. I.D. TOR. PER MKD. PARTS.	CEL 3-15-93

**CUSTOMER'S IDENTIFICATION**

PURCHASED BY: PYROPOWER CORP.  
 P.O. NUMBER: -  
 ULTIMATE USER: PYROPOWER CORP.  
 REFINERY SITE: JACKSONVILLE, FL  
 UNIT NAME: -  
 VESSEL NAME: AMMONIA STRIPPER VESSEL NUMBER: 1CCF-VSL-  
 REFERENCE: -  
 GLITSCH JOB NO: 6J-7877

**GLITSCH, INC.**  
 P.O. Box 660053, Dallas, Tx. 75266-0053

DRAWN: LED  
 CHECK: CB  
 PROCESS: -  
 TITLE: UTS-209  
 TOWER ID: 1'-0" PRODUCT CODE: 0870806  
 DWG. NO.: 88308  
 SCALE: 1:1 SHT: 1 OF 1



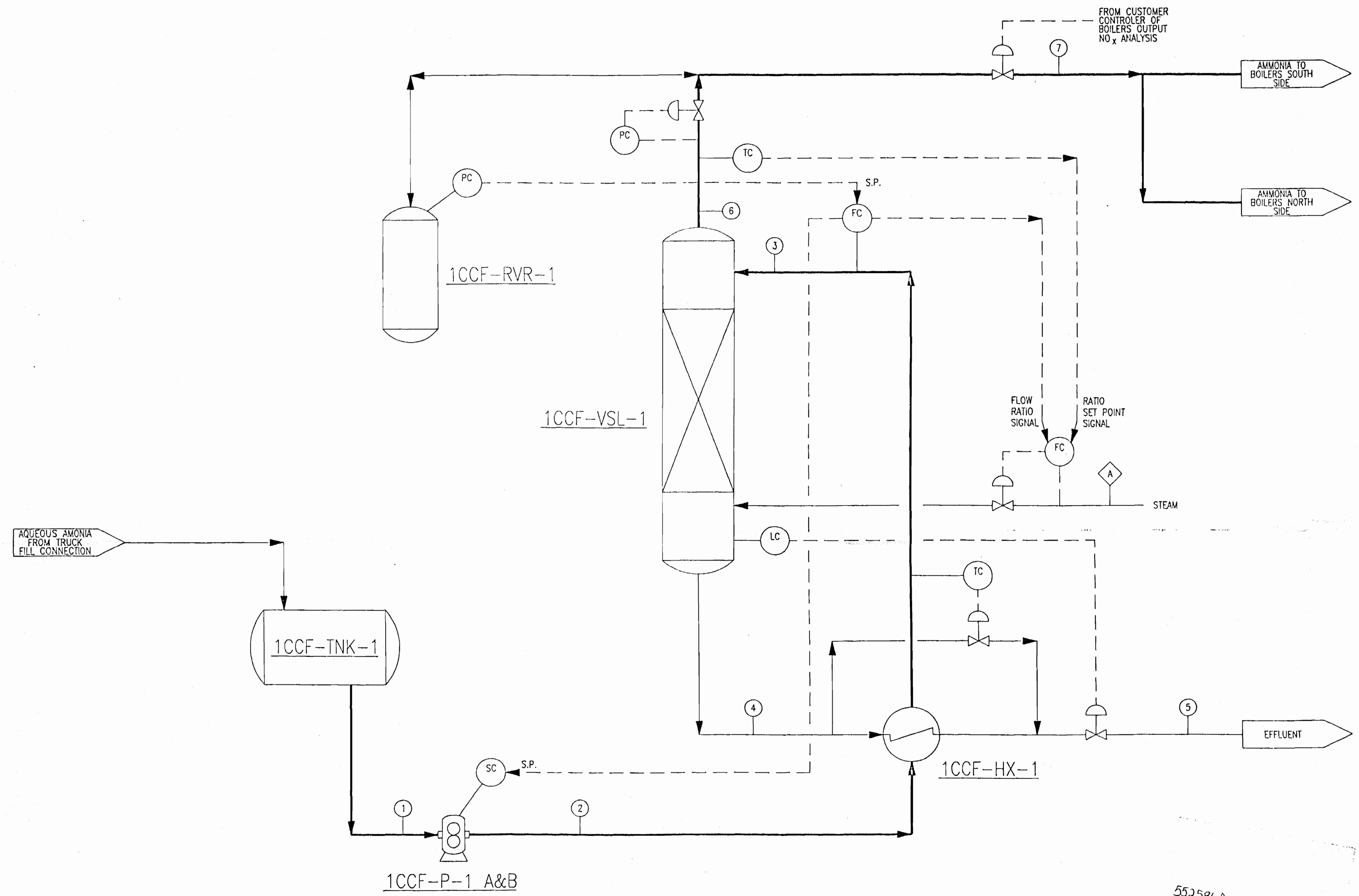
ASSEMBLY 300 (3 PLACES)

**PyroPower**  
 SAN DIEGO, CALIFORNIA  
 DRAWING NO. 552536-88308  
 REV 1

COMPUTER GENERATED, DO NOT MODIFY MANUALLY.

EQUIPMENT LIST (32)		
EQUIP. NO.	DESCRIPTION	MATERIAL
1CCF-TNK-1	AQUEOUS AMONIA STORAGE TANK	CARBON STEEL
1CCF-VSL-1	STRIPPER COLUMN	CARBON STEEL VESSEL 304 SS PACKING
1CCF-HX-1	FEED AND BOTTOMS EXCHANGER	TYPE BEM SHELL: CARBON STEEL TUBES: 304 SS
1CCF-P-A&B	FEED PUMP	316 SS
1CCF-RVR-1	VAPOR RESERVOIR	CARBON STEEL

NOTES:  
1. THE PRESSURE SHOWN IS THE MINIMUM PRESSURE. MAXIMUM PRESSURE CAN BE 33 PSIA.



APPROVED FOR CONSTRUCTION  
BY SGH DATE MAY 1 1993  
GLITSCH PACKAGE PLANTS

(NOTE 1)

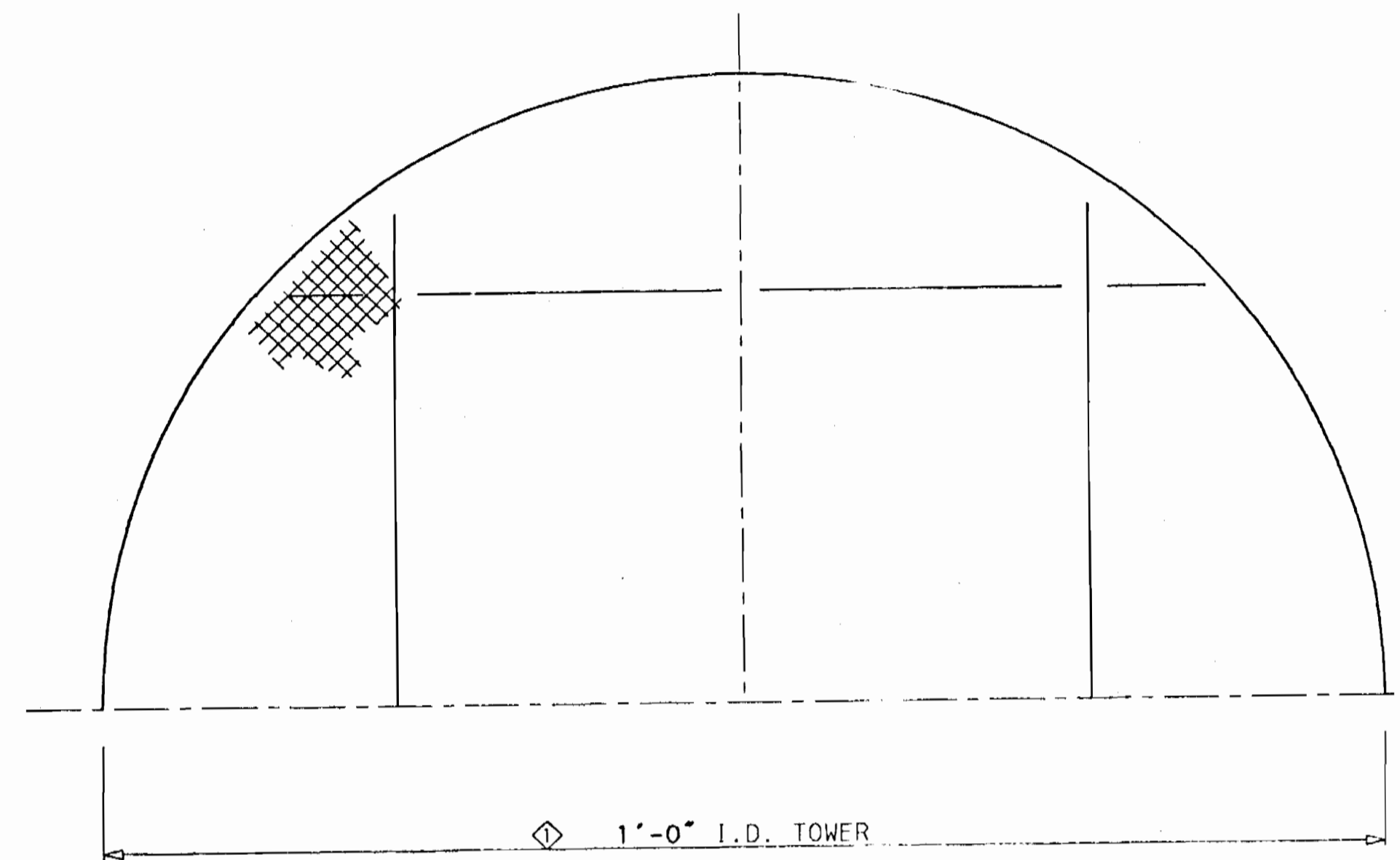
MATERIAL BALANCE STREAM NUMBER & IDENTITY		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		COLD FEED TO PUMP	PREHEATER INLET	PREHEATED FEED TO STRIPPER	STRIPPER BOTTOMS	EFFLUENT	VAPORS FROM STRIPPER	VAPORS TO BOILERS
1	WATER	18.015	2175.000	2175.000	3054.760	3054.760	163.330	163.330
2	AMMONIA	17.031	825.000	825.000	0.030	0.030	824.970	824.970
TOTAL (LBS/H)		3,000.000	3,000.000	3,000.000	3,054.790	3,054.790	988.300	988.300
TEMPERATURE	°F	75.00	75.00	140.00	312.25	247.16	217.07	217.07
PRESSURE	PSIA	15.86	104.70	80.00	80.50	17.00	80.00	49.70
DENSITY	lb/ft <sup>3</sup>	52.84	52.84	50.33	56.96	58.88	0.19	0.19
VISCOSITY	cp	0.594	0.594	0.315	0.174	0.174	0.013	0.013
FLOW	gpm/(ACFM)	7.09	7.09	7.44	6.69	6.47	(87.05)	(87.05)
WT FRACTION VAPOR		0.0	0.0	0.0	0.0	0.0	1.0	1.0

UTILITIES		
STREAM LABEL	HEAT DUTY BTU/HR.	STEAM SUPPLY • 200 PSIG (LBS/HR.)
A	938804.	1043
B	35000.	-

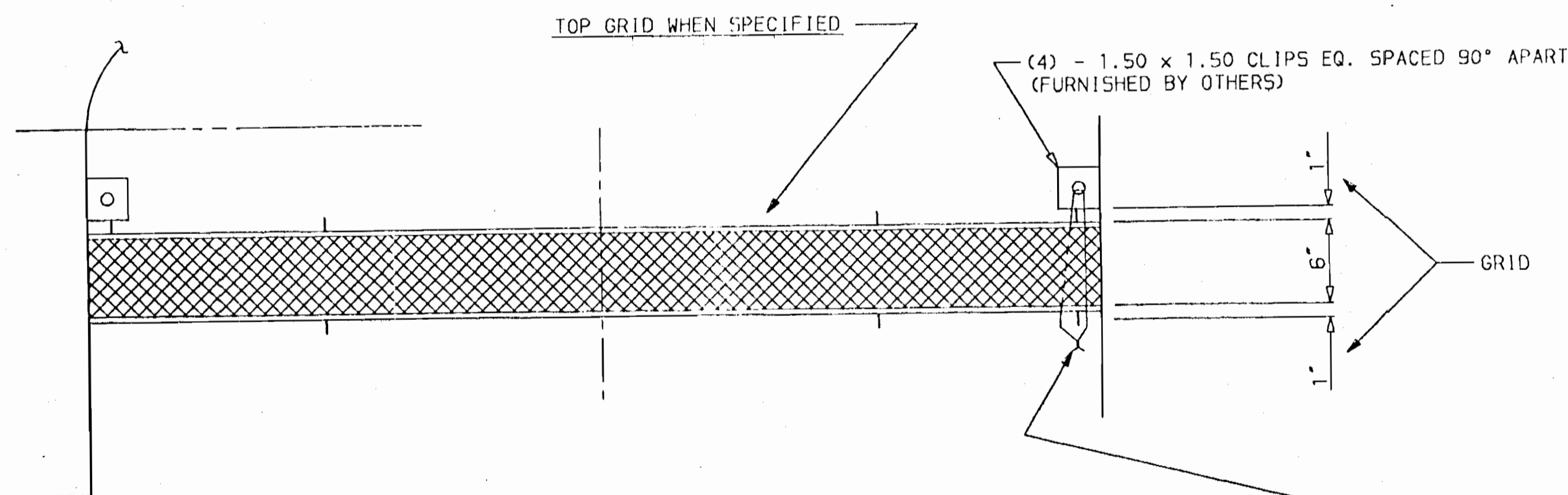
0		APPROVED FOR CONSTRUCTION	4-26-93	SCH
SYMBOL	DESCRIPTIONS	DATE	APPROV	
REVISIONS				
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GLITSCH, INC.				
Package Plants Division		PROCESS FLOW DIAGRAM AMMONIA STRIPPING SYSTEM		
CEDAR BAY GENERATING CO. PYROPOWER SAN DIEGO, CA		SCALE NONE		
SCALE	NONE	DATE 1-25-93	JOB NO. 6J-7877	
DRAWN BENDEROTH	CHECK	DATE	DRAWING NO.	REV.
ENGR.	DATE	D-7877-00-01		0

552586-D-7877-00-01 2  
05 58013





QUANTITY SHOWN IS FOR  
ONE (1) MIST ELIMINATOR  
ONE (1) MIST ELIM. IS REQUIRED



ONE - MIST ELIMINATOR(S) REQ'D

INSTALLATION NOTE

SUPPORT CLIP IS TO HAVE  
Ø0.25" HOLES FOR THE  
TIE WIRE. PANELS ARE TO  
BE TIED SECURELY IN PLACE.

MATERIAL	304	TOP GRID	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
MESH	304	MESH DENSITY	9# PER SQ. FT.
GRID	304	MESH THICKNESS	6"
TIE WIRE	304	WIRE DIAMETER	0.011"

GENERAL NOTES AND INFORMATION

1. ACTUAL TOWER MANHOLE IS 12.00 I.D.
2. MIST ELIMINATOR TO BE ASSEMBLED OR REMOVED FROM BOTTOM SIDE.
3. SUGGESTED SUPPORT CLIP IS 1.50x1.50x0.25
4. SUPPORT CLIP FURNISHED BY OTHERS

SPECIFIC NOTES

UNLESS OTHERWISE SPECIFIED:

PARTS LIST

QUAN	PART NO.	DESCRIPTION	REMARKS / MATERIAL
1	33500-670	MIST PANEL	NTD 304
30 FT.	-	0.051" TIE WIRE	304

NO	DESCRIPTION OF REVISION	CHG. BY/DATE
1	CORR. I.D. THR., CORR. CONFIG. OF M. ELIM.	DL 3-15-93

CUSTOMER'S IDENTIFICATION

PURCHASED BY: PYROPOWER CORP.  
P.O. NUMBER:  
ULTIMATE USER: PYROPOWER CORP.  
REFINERY SITE: JACKSONVILLE, FL  
UNIT NAME:  
VESSEL NAME: AMMONIA STRIPPER VESSEL NUMBER: 1CCF-VSL-1  
REFERENCE: - NONE  
GLITSCH JOB NO. 6J-7877

GLITSCH, INC.  
P.O. Box 660053, Dallas, Tx. 75266-0053

DRAWN LED	TITLE
CHECK CB	MIST ELIMINATOR
PROCESS PK	TOWER ID 1'-0"
ISSUE REV	PRODUCT CODE 08970040
CERT REV 1	DWG. NO. 33500
APVD FOR MFG	SCALE
	SHT 1 OF 1

**PYROPOWER**  
SAN DIEGO, CALIFORNIA  
DRAWING NO. 33500  
REV 1

4-5-93

COMPUTER GENERATED, DO NOT MODIFY MANUALLY.



SYMM

NOTE:  
HATS OMITTED IN PLAN VIEW FOR CLARITY

ALIGNMENT OF FEED HOLES

SYMM

300

FEED PIPE DESIGN  
(FURNISHED BY OTHERS)

1'-0" I.D. TWR.

DETAIL "A"

GENERAL NOTES & INFORMATION

1. ACTUAL TOWER MANHOLE: SHELL FLGS I.D. 34
2. PART NUMBERS WILL BE PAINT STENCILED ON ALL MAJOR TRAY PARTS. SMALL PARTS WILL BE BAGGED OR PACKAGED FOR SHIPMENT AND TAGGED TO INDICATE THE MATERIAL TYPE. OTHER THAN THIS, NO SPECIAL PAINTING, STENCILING, METAL OR PLASTIC TAGS WILL BE USED. PAINT TO BE LEAD FREE.
3. PART NUMBERS ARE ENCLOSED THUS:
4. FOR VESSEL SKETCH, SEE GLITSCH DWG. D-7877-08-01.
5. TOLERANCES: +/- 0.125"
6. ALL DIMENSIONS ARE IN INCHES.

LIST OF MATERIAL

DESCRIPTION	GAUGE	MATERIAL ANALYSIS
HAT	1/2"	304
TRAY FLOORS (ACTIVE)	1/2"	304
TRISERS	NTD	304
EXPANDED METAL	NTD	304
WEIRS (OUTLET)	N/A	-
TRUSSES	N/A	-
SEAL PAN	N/A	-
BEAMS	N/A	-
BAFFLES	N/A	-
INTERNAL PIPING	-	BY OTHERS
STANDARD WASHERS	N/A	-
DOMED WASHERS	N/A	-
FRICTIONAL WASHERS	N/A	-
TRAY CLAMPS	N/A	-
M.W. LOCK CLAMP	N/A	-
M.W. LOCK STUDS	N/A	-
BOLTS	N/A	-
NUTS (REMOVABLE)	N/A	-
NUTS (WELDED)	N/A	-
TRAY SUPT RING (WIDTH: N/A)	N/A	-
D.C. CLAMPING BAR	N/A	-
BOLTING PLATES	N/A	-
FOOTRESTS	N/A	-
WELD ROD (TRAY PARTS)	-	ER-308 OR E-308-16

TRAY DESIGN DATA

ITEM	SIDE DOWNCOMER	TR DOWNCOMER	UNIFORM LOAD	CONC. LOAD
	SQ. FT. X TWR	AR SQ. FT. X TWR	ACTIVE	INLET
D.C. AREA (TOP)	-	-	62	-
D.C. AREA (BIM)	-	-	ALLOW DEF.	DESIGN TEMP.
O.F. WEIR LENGTH	-	-	-	650

EQUIPMENT DESCRIPTION (FURNISHED BY GLITSCH)

QUAN	ITEM	DESCRIPTION	REMARKS
2	RTD-551	DISTRIBUTOR	AS SHOWN

DESCRIPTION OF REVISION

NO.	DESCRIPTION OF REVISION	CHG. BY/DATE
1	CORR. I.D. TWR, ADD. DRAINHOLE, CHG'D. SPC. OF FEED PIPE HOLES, CHG'D. EXP. METAL, OTHER ENG'S. PER CHK.	3-13-93

CUSTOMER'S IDENTIFICATION

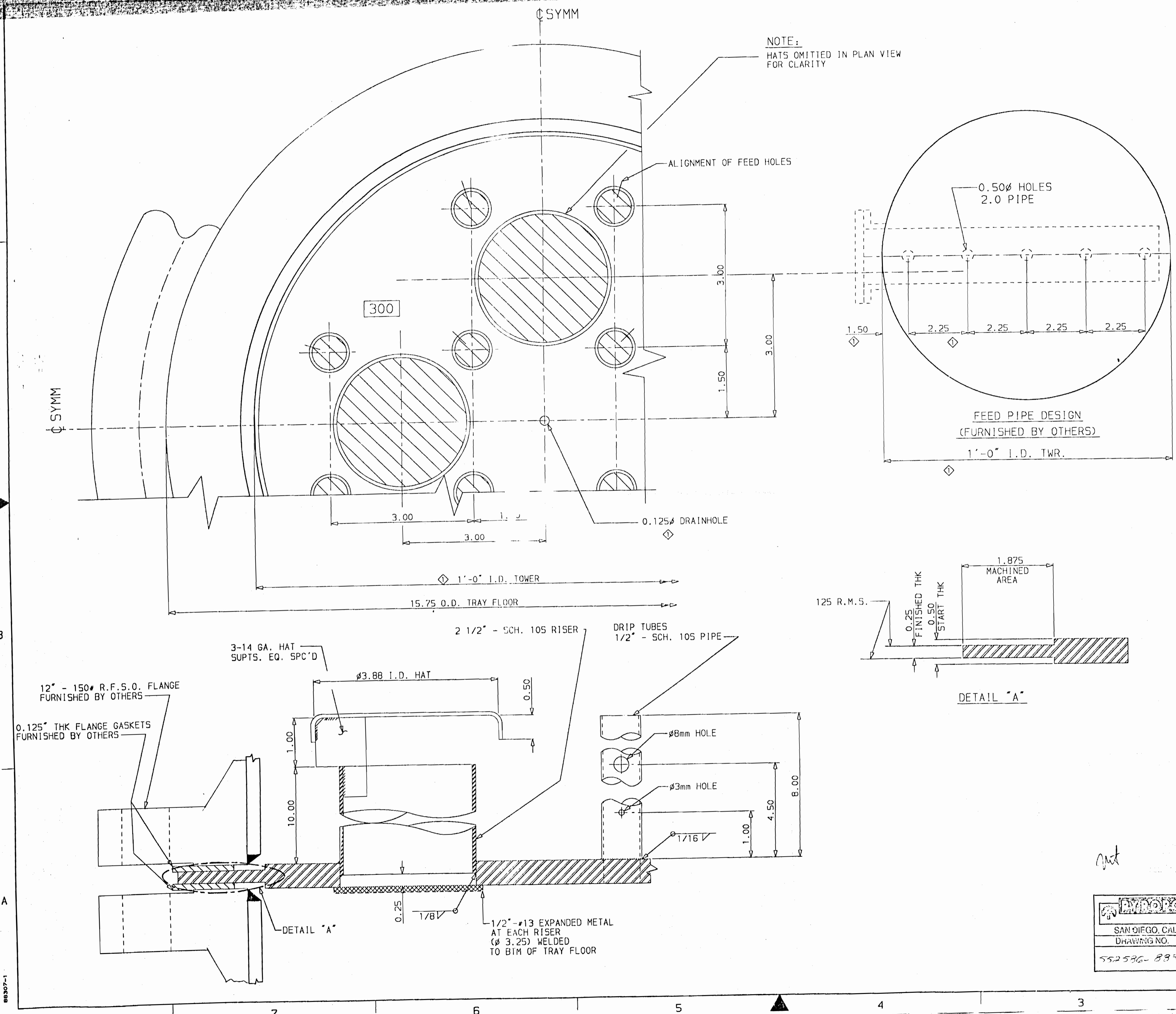
PURCHASED BY: PYROPOWER CORP.  
 SPEC. NUMBER: NONE  
 ULTIMATE USER:  
 REFINERY SITE: JACKSONVILLE, FL  
 UNIT NAME:  
 VESSEL NAME: AMMONIA STRIPPER | VESSEL NUMBER: ICCF-VSL-1  
 REFERENCE: NONE  
 GLITSCH JOB NO: 6J-7877

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**GLITSCH, INC.**  
 P.O. Box 660053, Dallas, Tx. 75266-0053

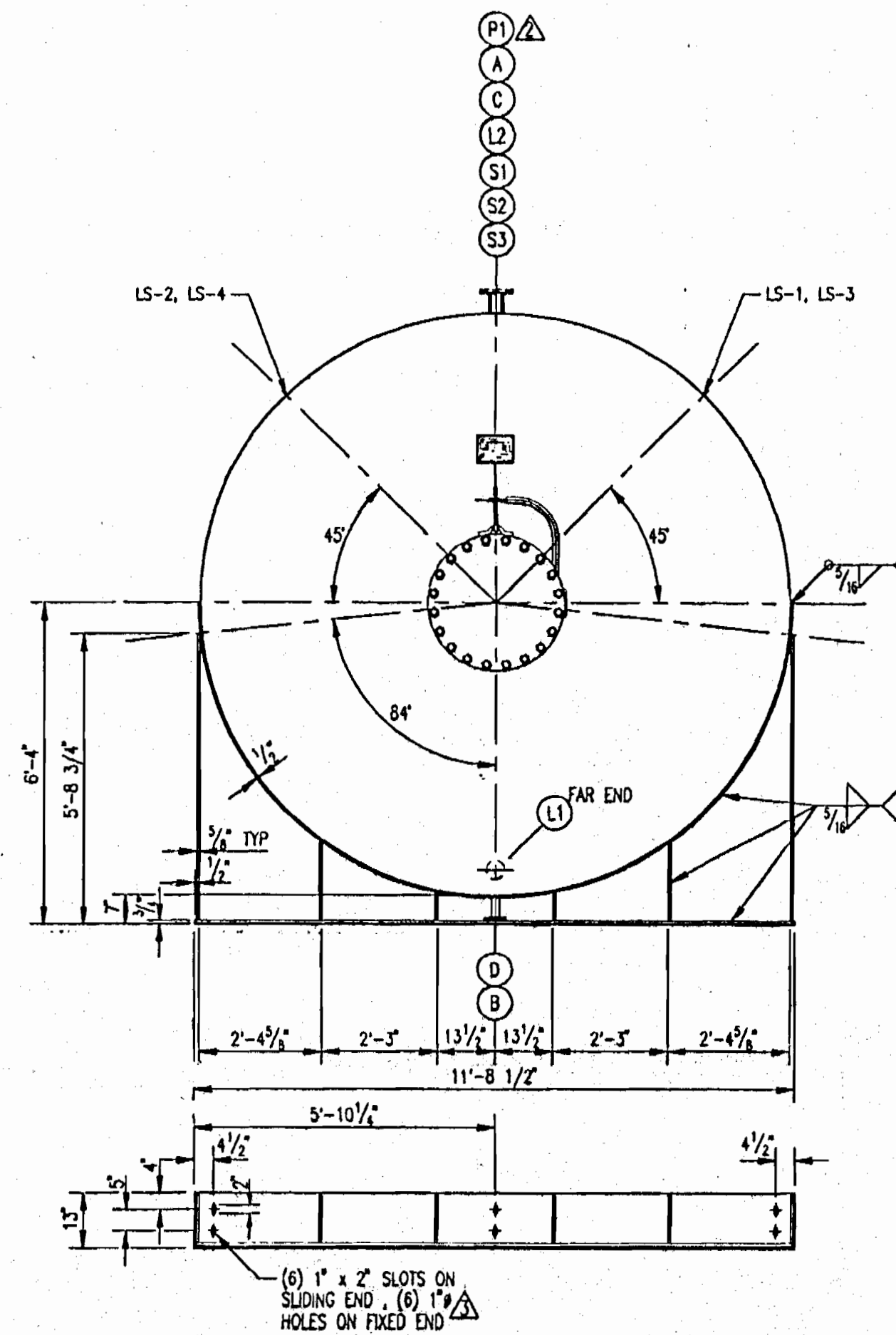
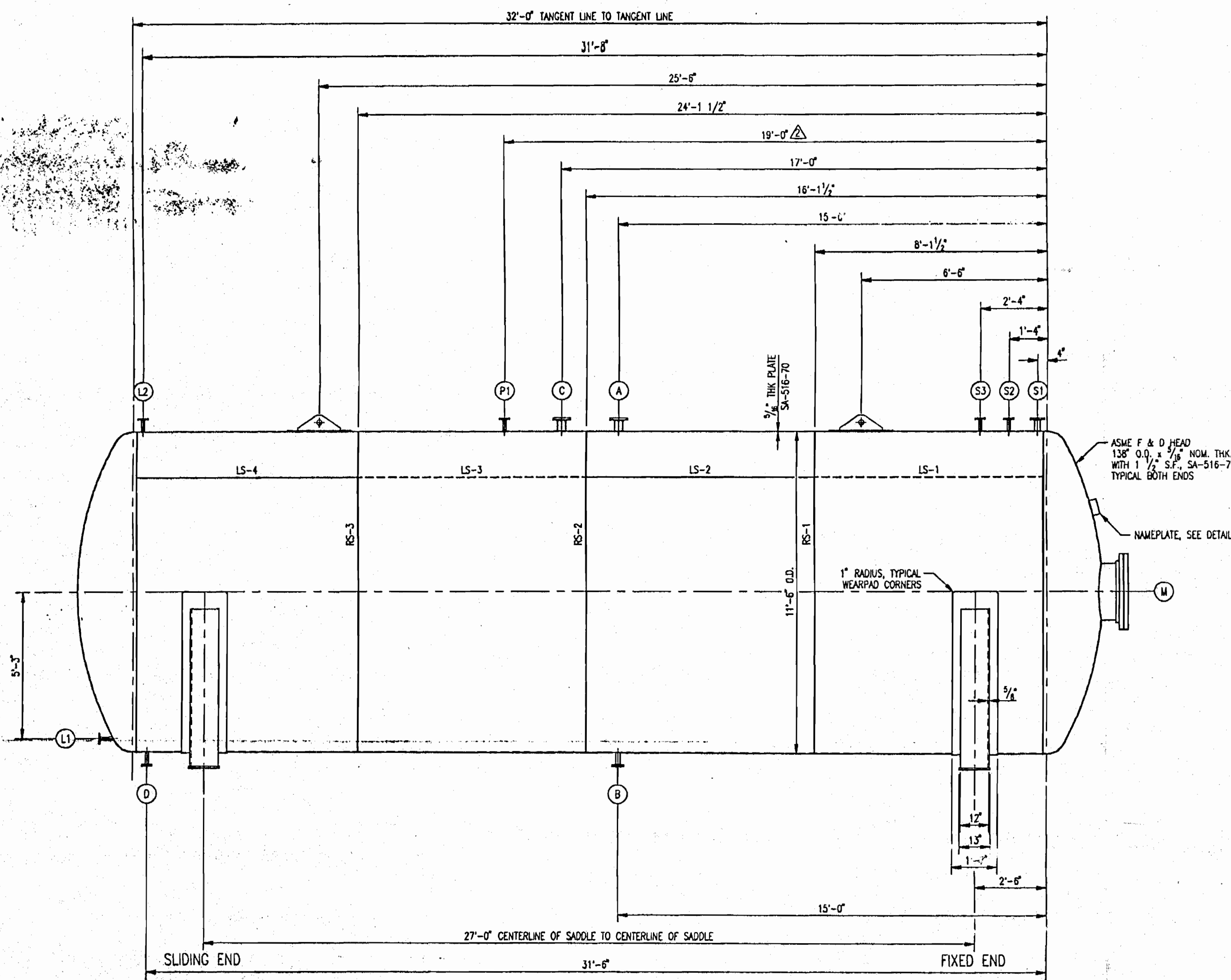
DRAWN LED	TITLE DISTRIBUTOR
CHECK CB	RTD-551
PROCESS PR	TOWER ID 1'-0"   PRODUCT CODE 08723106
ISSUE 3/1/93	DWG. NO. 88307
CERT 3-13-93	SCALE 1:1   SHT 1 OF
APVD FOR MFG	

**PYROPOWER**  
 SAN DIEGO, CALIFORNIA  
 DRAWING NO. 552586-88-77 | REV 1



COMPUTER GENERATED, DO NOT MODIFY MANUALLY.





NOZZLE SCHEDULE						
NO. REQ'D.	LET.	SIZE	RATING	FACING	NOZZLE NECK	SERVICE
1	A	3"	150#	RFSO	SCH 40 PIPE	LIQUID IN
1	B	1 1/2"	150#	RFSO	SCH 40 PIPE	LIQUID OUT
1	C	3"	150#	RFSO	SCH 40 PIPE	EQUAL TO TRUCK
1	D	1"	150#	RFSO	SCH 40 PIPE	DRAIN
1	L1	1"	150#	RFSO	SCH 40 PIPE	LEVEL TRANS
1	L2	1"	150#	RFSO	SCH 40 PIPE	LEVEL TRANS
1	P1	1"	150#	RFSO	SCH 40 PIPE	PRESSURE SWITCH
1	M	24"	150#	RFSO	3/8" PLATE	MANWAY
1	S1	2"	150#	RFSO	SCH 40 PIPE	PRESSURE RELIEF
1	S2	1"	150#	RFSO	SCH 40 PIPE	PRESS REG
1	S3	1"	150#	RFSO	SCH 40 PIPE	SPARE WITH BLIND

- DESIGN NOTES
- VESSEL TO BE FABRICATED IN ACCORDANCE WITH THE 1992 EDITION OF THE ASME CODE, SECTION VIII, DIVISION 1
  - CODE STAMP IS REQUIRED
  - CUSTOMER SPECIFICATION: GLITSCH INC. DWG NO. D-7877-09-02 REV. P2
  - CUSTOMER INSPECTION IS REQUIRED

5. DESIGN DATA:	
DESIGN PRESSURE	25 PSIG
DESIGN TEMPERATURE	300° F
HYDROSTATIC TEST PRESSURE	38 PSIG
RADIOGRAPH	SPOT PER UW-11 (a)5(b)
CORROSION ALLOWANCE	1/16"
CAPACITY	25,000 GAL
HEAT TREATMENT	NONE
IMPACT TESTING	EXEMPT PER UG 20(f)

6. ESTIMATED WEIGHT: 18,900 lbs EMPTY / 242,100 lbs FULL OF WATER	
7. MATERIALS:	VESSEL
SHELL	SA-516-70
HEADS	SA-516-70
FLANGES/COULINGS	SA-105
PIPE	SA-106-B
FITTINGS	SA-234-WPB
SUPPORTS	SA-516-70/A-36
BOLTING (UNLESS NOTED)	SA-194-B7/SA-193-2H (ZINC PLATED)
GASKETS	1/16" THK GARLOCK GRAPH - LOCK STYLE 3125-SS

8. ALL WELDS THAT ARE NEAT AND CLEAN WITHOUT UNDERCUTS OR DEFECTS SHALL BE LEFT AS WELDED UNLESS OTHERWISE NOTED. ACCEPTABLE WELD PROCEDURES ARE FC-11, SM-11, GT-11, GM-11-A, GM-11-C, SA-11-B.

9. ALL FLANGE BOLT HOLES SHALL STRADDLE MAIN VESSEL CENTERLINES UNLESS OTHERWISE NOTED. **CERTIFIED** BY JDE DATE 20 APR 93

10. PAINT:  
 SURFACE PREPARATION: COMMERCIAL BLAST PER SSPC-SP-6-63  
 PRIMER: POLYIMIDE-EPOXY ZINC RICH PRIMER  
 2.5 MILS DFT  
 GLIDDEN NO. 5525/27/28 (OR APPROVED EQUAL)  
 SECOND COAT: POLYIMIDE-EPOXY  
 4.0 MILS DFT  
 GLIDDEN NO. 5430/34 (OR APPROVED EQUAL)  
 COLOR: WHITE  
 THIRD COAT: POLYIMIDE-EPOXY  
 3.0 MILS DFT  
 GLIDDEN 4250/42 (OR APPROVED EQUAL)  
 COLOR: WHITE

FINAL

NO.	BY	DATE	DESCRIPTION
3	JDE	09 MAR 93	CHANGE HOLE AND SLOT SIZE IN BASEPLATE
2	JDE	24 FEB 93	CORRECT NOZZLE DETAILS / DELETE NOZZLE P2
1	JDE	14 FEB 93	APPROVAL CHANGES

REVISIONS			
CUSTOMER: GLITSCH INC.			
CUSTOMER PO No.: 18979			
ITEM: AQUEOUS AMMONIA STORAGE TANK			
ITEM No.: 10CF-TNK-1 PROJECT No.:			
PLANT: JACKSON, FLORIDA			
<b>McABEE CONSTRUCTION, Inc.</b>			
TUSCALOOSA ALABAMA			
DATE: 04 FEB 93	SHOP ORDER No.	DRAWING NUMBER	REV.
SCALE: 3/8" = 1'-0"	217120	217120	3
DRAWN BY: JDE/RC			

NAT'L. BD. NO. \_\_\_\_\_

**CERTIFIED BY**  
**McABEE CONSTRUCTION, INC.**  
 TUSCALOOSA, ALABAMA

**SHELL** 25 PSI AT 300° F  
 MAX ALLOW WORKING PRESS

**COIL** PSI AT ° F  
 MAX ALLOW WORKING PRESS

**JKT/TUBE** PSI AT ° F  
 MAX ALLOW WORKING PRESS  
 MIN DESIGN METAL TEMP ° F AT 25 PSI

SERIAL NO. 217120-1 YEAR BUILT 1993  
 MFG FOR GLITSCH INC.  
 P.O. NO. 18979 ITEM NO. 10CF-TNK-1

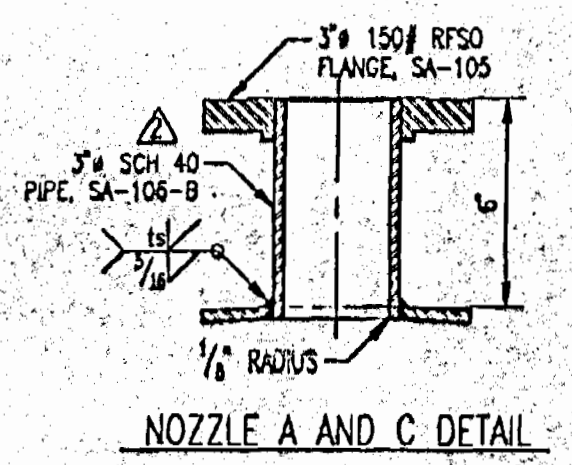
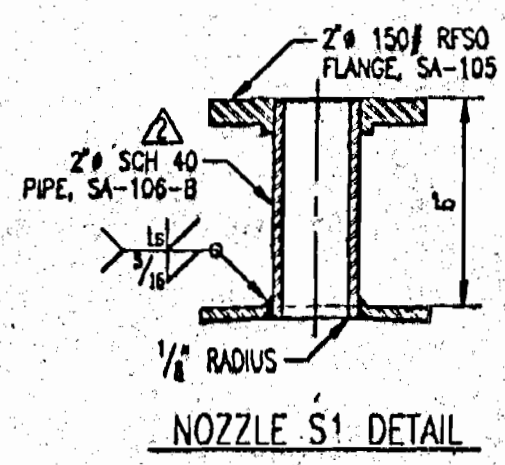
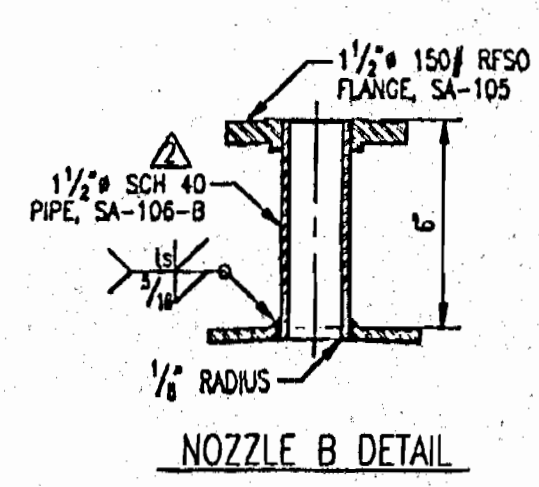
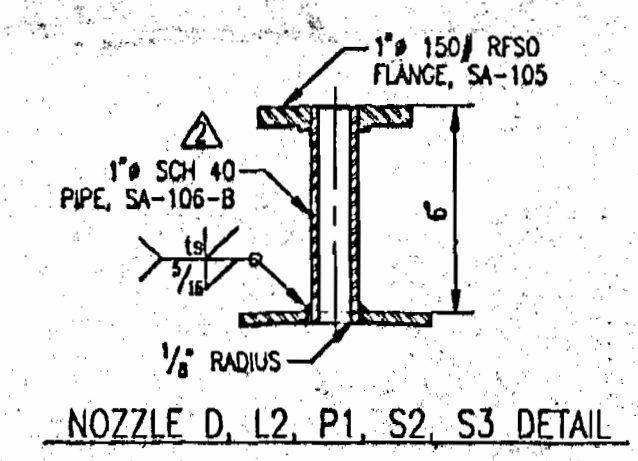
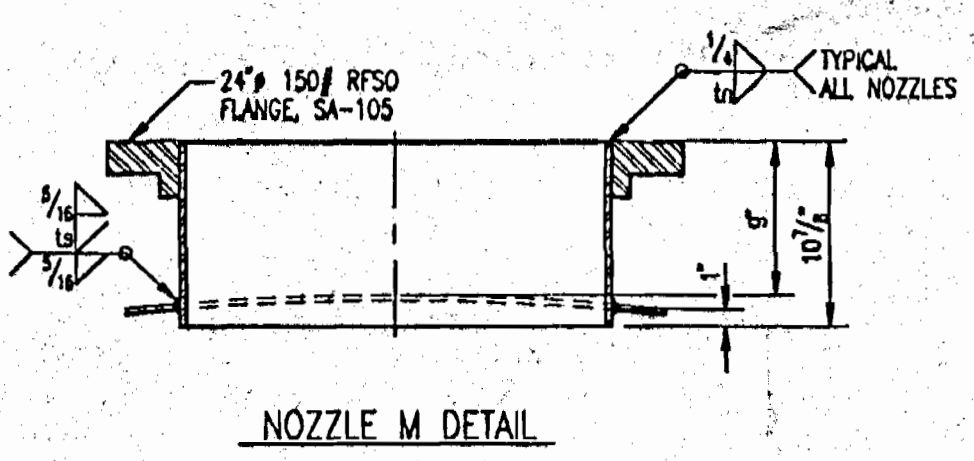
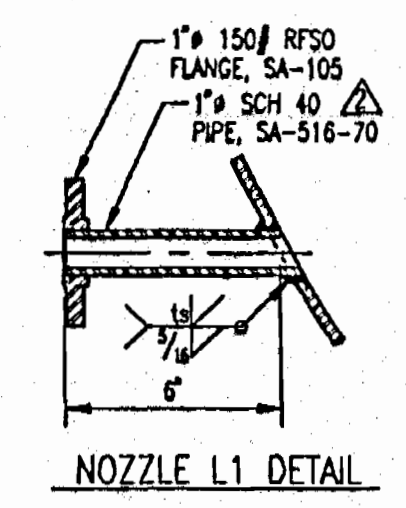
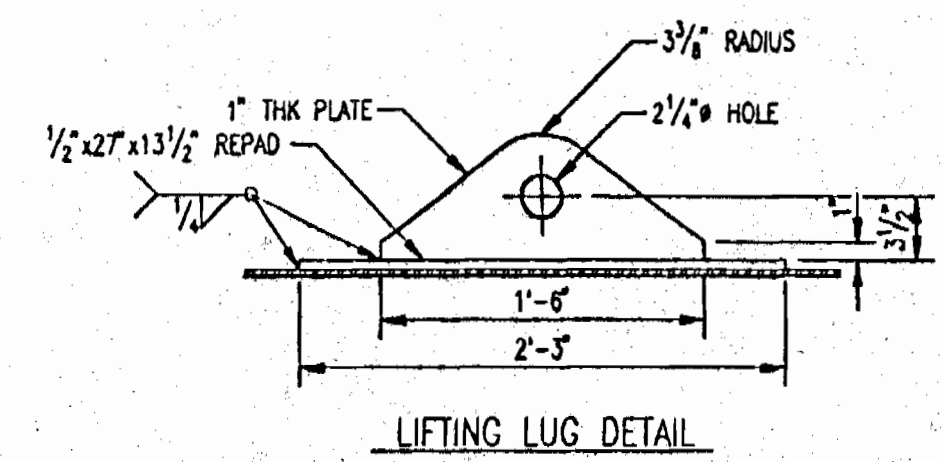
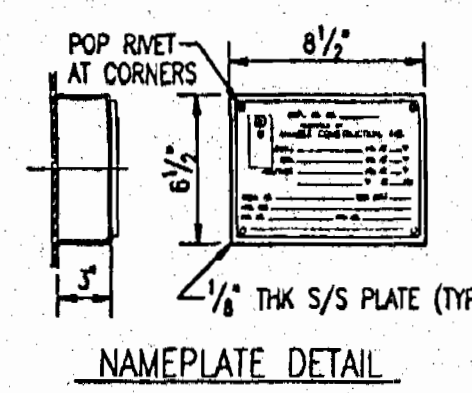
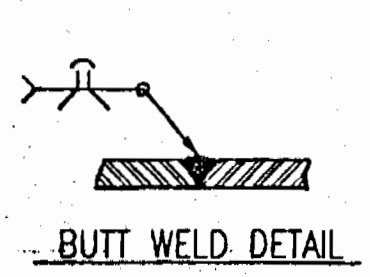
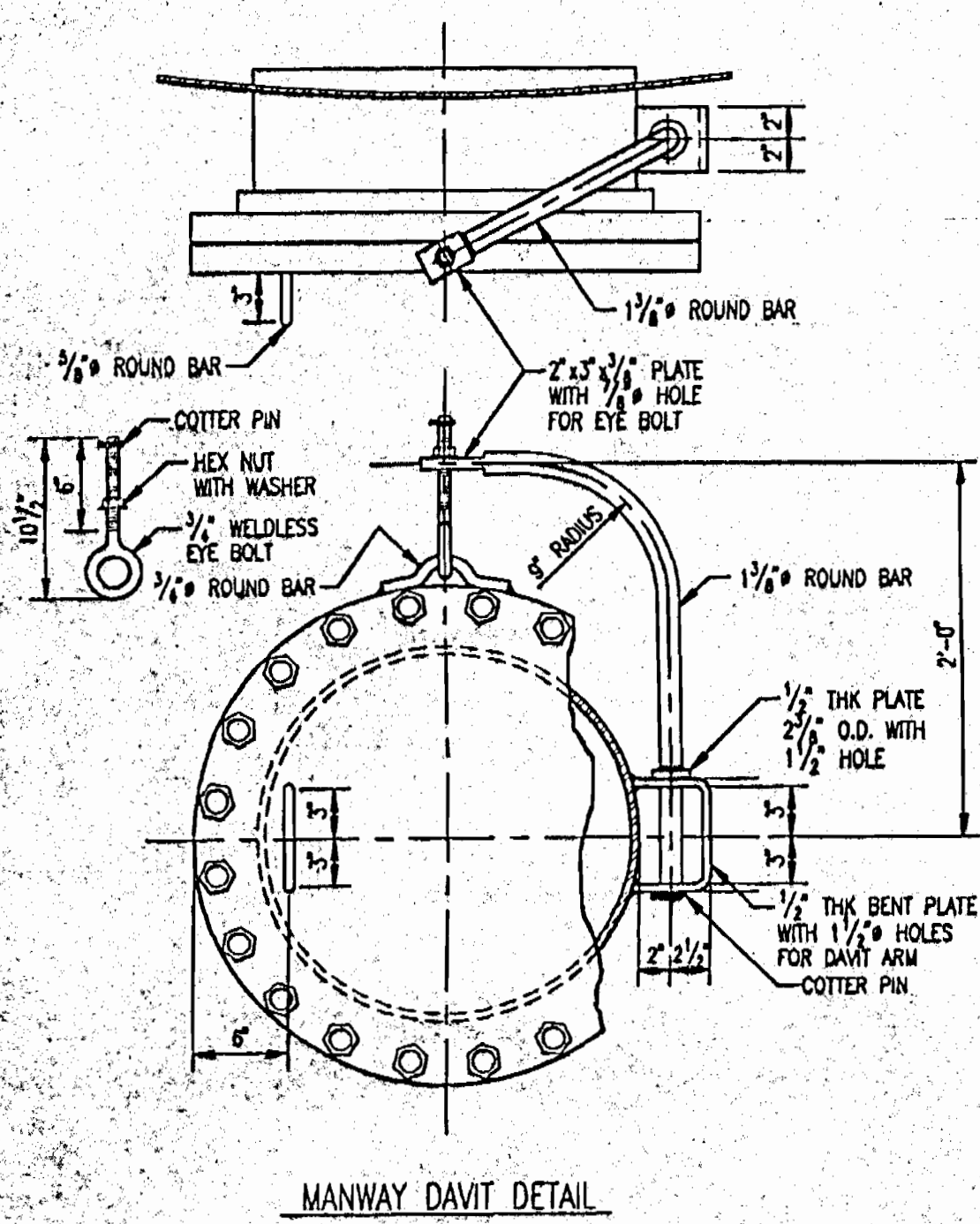


Table 5-1. Part Numbers for Pipes and Flanges - 1337L

	Catalog Number		Part Number	
	1337LZ		Downstream Item 4	Upstream Item 5
1 Inch Pipe	2	1	27S526SG03	27S526SG05
	2	2	27S526SG09	27S526SG11
	2	4	27S527SG03	27S527SG05
	2	5	27S528SG03	27S528SG05
	2	6	27S527SG09	27S527SG11
	2	8	27S528SG09	27S528SG11
1-1/2 Inch Pipe	3	1	27S526SG01	27S526SG06
	3	2	27S526SG07	27S526SG12
	3	4	27S527SG01	27S527SG06
	3	5	27S528SG01	27S528SG06
	3	6	27S527SG07	27S527SG12
	3	8	27S528SG07	27S528SG12

Table 5-2. Part Numbers for WEDGEds and Bodies - 1335L, 1336L, and 1337L

	Catalog Number		Part Number	
	133_LZ		WEDGE Kit 1335L/1336L/1337L	Body Kit 1336L/1337L
1 Inch Pipe	2	2	155S216-001	155S217-001(NPT) 155S217-003(BSPT)
	2	3	155S216-002	
	2	4	155S216-003	
	2	5	155S216-004	
1-1/2 Inch Pipe	3	2	155S216-005	155S217-002(NPT) 155S217-004(BSPT)
	3	3	155S216-006	
	3	4	155S216-007	
	3	5	155S216-008	

**PARTS LIST**

---



ABB Kent-Taylor  
95 Ames Street  
P.O. Box 110  
Rochester, New York 14692

Dimensions & Data certified correct for:

Customer Glitsch Inc Order 19377

Job 6J-7877 Propower

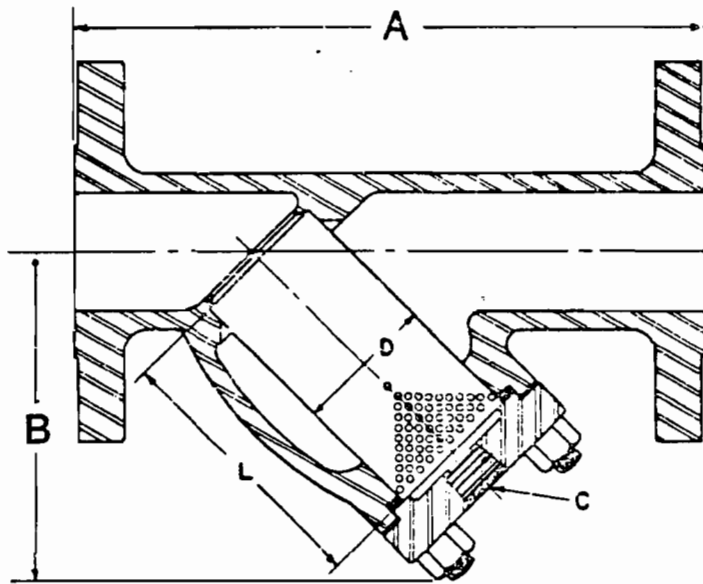
Job Requirements:

- 2- 1 1/2" BXFL-1 1/2-300 Armstrong Y strainer, cast carbon steel, 300 lb RF flanged, 20 mesh 316 stainless steel screen, 3/4" blowdown conn stainless steel tag.

Tag: FX-119, FX-126

ARMSTRONG MACHINE WORKS

By *M. A. B.*



B1FL-(size)-150  
B1FL-(size)-300  
B1FL-(size)-600

DIMENSIONS:

SIZE	"A"	"B"	"C"	"D"	"L"	Weight					
1-1/2" 150# Flg.	9-1/4"	235 mm	4-5/8"	117 mm	1/2" 15 DN	2"	51 mm	3-3/4"	95 mm	18 lbs	8.2 kgs
300# Flg.	9-1/2"	241 mm	4-5/8"	117 mm	1/2" 15 DN	2"	51 mm	3-3/4"	95 mm	18 lbs	8.2 kgs
600# Flg.	10-1/8"	257 mm	4-5/8"	117 mm	1/2" 15 DN	2"	51 mm	3-3/4"	95 mm	18 lbs	8.2 kgs
2" 150# Flg.	10-1/2"	267 mm	5-3/4"	146 mm	1/2" 15 DN	2-3/8"	60 mm	4-5/8"	117 mm	31 lbs	14.1 kgs
300# Flg.	10-3/4"	273 mm	5-3/4"	146 mm	1/2" 15 DN	2-3/8"	60 mm	4-5/8"	117 mm	29 lbs	13.2 kgs
600# Flg.	11-1/2"	292 mm	5-3/4"	146 mm	1/2" 15 DN	2-3/8"	60 mm	4-5/8"	117 mm	33 lbs	15.0 kgs

MATERIALS:

Body & Retainer: ASTM A-216 Gr. WCB  
Gasket: Non-Asbestos  
Screen: Type 304 S.S. w/233 - .045" perf. per sq. in.  
Stud: ASTM A-193, Gr. B-7  
Nut: ASTM A-194, Gr. 2-H

PRESSURE TEMP. RATINGS (Non-shock)

150# Flanges:  
205 psi @ 390°F - 14.1 bar @ 198.8°C  
285 psi @ 100°F - 19.6 bar @ 37.8°C  
300# Flanges:  
605 psi @ 490°F - 41.7 bar @ 254.4°C  
740 psi @ 100°F - 51 bar @ 37.8°C  
600# Flanges:  
1135 psi @ 562°F - 78 bar @ 294°C  
1480 psi @ 100°F - 102 bar @ 37.8°C

A Dimensions ± 1/16" or 1.5 mm  
B Dimensions ± 1/8" or 3 mm

Flanged Conn. to ANSI B16.5

ARMSTRONG MACHINE WORKS	
1-1/2"-2" (WCB) Carbon Steel Str. 150-300-600# Flanges	SM-614-D  10-27-88



Dimensions & Data certified correct for:

Customer Glitsch Inc Order 19377

Job 6J-7877 Pyropower

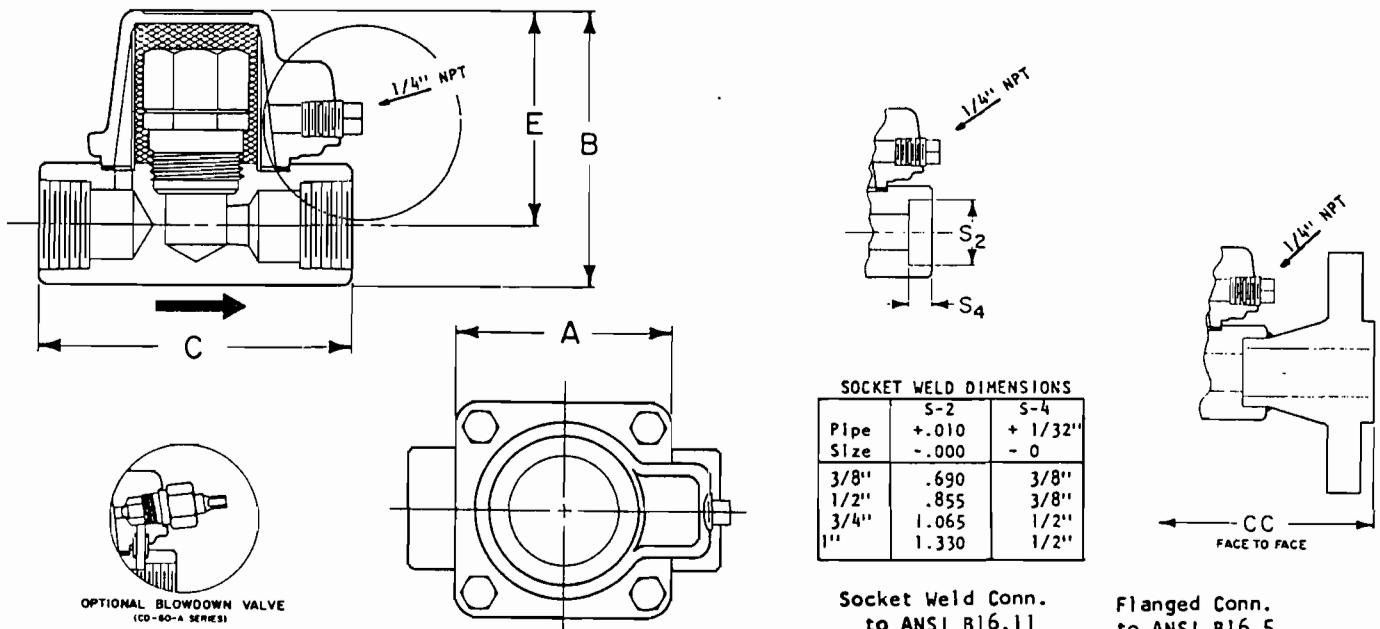
Job Requirements:

- 2- 1/2" CD-61A Armstrong controlled disc steam trap carbon steel body, stainless steel trim, integral strainer, blowdown valve, screwed connections, stainless steel tag.

Tag: LCV-119, LCV-126

ARMSTRONG MACHINE WORKS

By *M. P. [Signature]*



OPTIONAL BLOWDOWN VALVE (CD-60-A SERIES)

Socket Weld Conn. to ANSI B16.11

Flanged Conn. to ANSI B16.5

Trap No., Standard	CD-61		CD-62		CD-63	
Trap No., with Blowdown Valve	CD-61A		CD-62A		CD-63A	
Pipe Connections	3/8"	1/2"	1/2"	3/4"	3/4"	1"
Face-to-face, screw/socket weld C	3-1/2" 89 mm	3-1/2" 89 mm	4-5/8" 117 mm	4-5/8" 117 mm	4-13/16" 122 mm	4-13/16" 122 mm
Face-to-face, 600 lb. Flanges *CC	-- --	7-3/8" 187 mm	8-1/2" 216 mm	8-5/8" 219 mm	8-13/16" 224 mm	9-3/16" 233 mm
Width of Body & Cap A	2-1/2" 64 mm	2-1/2" 64 mm	3-1/8" 79 mm	3-1/8" 79 mm	3-5/16" 84 mm	3-5/16" 84 mm
Overall Height, Body & Cap B	2-5/8" 67 mm	2-5/8" 67 mm	3-7/16" 87 mm	3-7/16" 87 mm	4-1/4" 108 mm	4-1/4" 108 mm
C/L to Top of Cap E	2" 51 mm	2" 51 mm	2-11/16" 68 mm	2-11/16" 68 mm	3-5/16" 84 mm	3-5/16" 84 mm
Weight, Screw/Socket Weld	2-3/4 lbs 1.25 kgs	2-1/2 lbs 1.14 kgs	4-3/4 lbs 2.15 kgs	4-3/4 lbs 2.15 kgs	6-3/4 lbs 3.07 kgs	6-3/4 lbs 3.07 kgs
Weight, 600 lb. Flanges	-- --	8-1/2 lbs. 3.85 kgs	10-3/4 lbs 4.88 kgs	11-3/4 lbs 5.33 kgs	13-3/4 lbs 6.24 kgs	14-3/4 lbs 6.69 kgs

\*Add 1/2" (13 mm) to CC dimension for Series 60A models

Minimum Operating Pressure: 10 psi/.75 bar  
Maximum Operating Pressure: 600 psi/40 bar

For best results, back pressure in trap discharge should not exceed 50% of inlet pressure

<b>ARMSTRONG MACHINE WORKS</b>	
CD-60 Series Controlled Disc Steam Traps	SM-1101-A  <b>3/9/90</b>





# INSTALLATION, OPERATION AND MAINTENANCE OF Y-TYPE STRAINERS

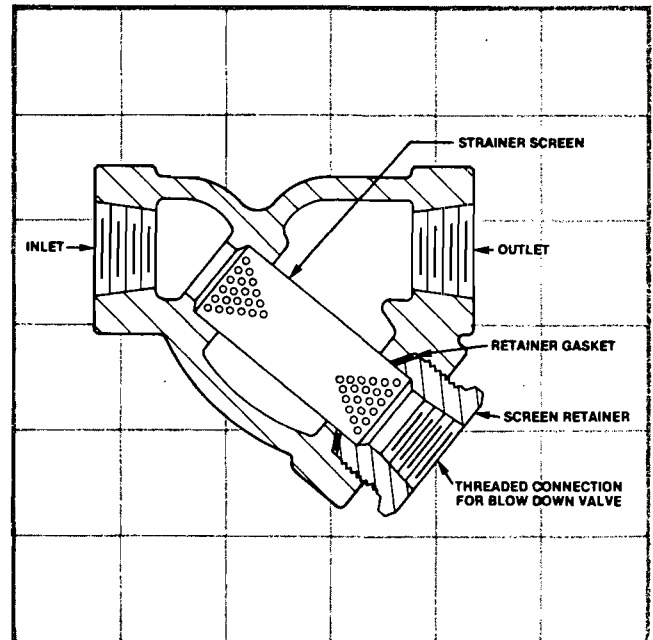
A strainer is a device which provides a means of mechanically removing solids from a flowing fluid or gas in a pipeline by utilizing a perforated or mesh straining element.

For insurance against untimely shutdown of equipment, strainers should be installed ahead of pumps, loading valves, control valves, meters, steam traps, turbines, compressors, solenoid valves, nozzles, pressure regulators, burners, unit heaters and other sensitive equipment.

**INSTALLATION** Clean all threaded areas of pipe thoroughly before installing strainer. Use pipe dope or teflon tape sparingly. Leave the end thread exposed to avoid introducing the sealant into the system. The strainer can be installed in either the horizontal or vertical down position.

## OPERATION AND

**MAINTENANCE** After the initial operation of the system, the strainer should be blown down to remove any debris from installation caught in the screen. Repeat the blow down procedure on a regular schedule thereafter. Frequency of blow down depends on the operating conditions to which the strainer is subjected. If no blow down valve is to be used, the strainer can be cleaned by removing the screen retainer and screen. **CAUTION: ALWAYS ISOLATE STRAINER FROM PRESSURIZED SYSTEM BEFORE OPENING TO CLEAN. USE A NEW GASKET WHEN REASSEMBLING STRAINER.** Strainer screen should be inspected 1 to 2 times per year. Recommended spare parts are 1 screen and 3 gaskets per strainer.



**ORDERING REPLACEMENT PARTS** To order replacement strainer screens, state connection size of strainer, screen material and type of perforation or mesh. See screen specification chart. When ordering replacement screens for flanged strainers, state flange rating.

To order replacement strainer gaskets, state type of connection (screwed, socket weld, butt weld, or flanged), connection size and body material of strainer. Contact your Armstrong Representative if further assistance is required.

# HOW TO ORDER

To order, specify size, material, full details on connections and screen specifications required, or use the ordering code provided.

## Ordering Code for Armstrong Strainers

Strainer Ordering Codes are formed by using a letter code for body, a number code for screen specification followed by the abbreviation for connection required. The code is completed by suffixing the connection size and, for flanged strainers, the flange rating. An A1FL-6-250 is a 6" cast iron strainer with .045" perf. stainless steel screen and 250 lb. flanged connections.

Code	Material
A	Cast Iron 30,000 Min. tensile (ASTM A-278 Cl. 30) or equal
B	Carbon Steel (ASTM A-216 WCB)
C	Chrome Moly Steel (1 1/4% Chrome, 1/2% Moly) ASTM A-217 WC6
D	Forged Steel (2 1/4% Chrome, 1% Moly) ASTM A-182 F22
E	Stainless Steel Type 316 (A-351 Grade CF8M)
F	Bronze (ASTM B-62)

Code	Screen
1	.045" perf. Stainless Steel (Type 304)
2	24 x 110 Mesh T-316 Stainless Steel (.0056" opening)
3	.045" perforated Monel
4	.045" perforated Brass
5	20 x 20 Mesh Monel (.034" opening)
6	40 x 40 Mesh Monel (.015" opening)
7	.045" perforated Type 316 Stainless Steel
8	1/8" perforated Type 304 Stainless Steel
9	100 x 100 Mesh Stainless Steel (.0055" opening)
X	Any screen not number coded — specify screen requirement. See Table A-4.

Code	Connection
SC	Screwed
FL	Flanged
SW	Socket Weld
BW	Butt Weld

## Standard Screens

Assembled strainers in stock have .045" perforated screens, 233 holes per sq. inch. screen material as follows:  
 Cast Iron, 3/8" through 8"..... Type 304 Stainless Screens  
 Cast Iron, 10"..... 1/8" Perf. Type 304 Stainless Screens  
 Cast Steel, 1/2" through 8"..... Type 304 Stainless Screens  
 Forged Steel, all sizes..... Type 304 Stainless Screens  
 Cast Bronze, all sizes..... Brass Screens  
 Stainless Steel, Type 316..... Type 316 Stainless Screens  
 Stainless Steel, Type 304..... Type 304 Stainless Screens

## Other Screens Available

Table A-4 — Armstrong Strainer Screen Materials Available

	Screen Specification	Back-Up Screen Required	Materials			
			Type 304 Stainless	Monel	Brass	Type 316 Stainless
Perforated	1/64" (0.020)	3"-12"	X	X		
	1/32"	None	X	X		X
	.045" (3/64)	None	Code 1	Code 3	Code 4	Code 7
	1/16"	None	X			X
	1/8"	None	Code 8	X	X	X
	3/16"	None	X	X		X
	1/4"	None	X	X		X
Mesh	20 x 20	*6"-12"	X	Code 5		
	24 x 110	5"-12"				Code 2
	40 x 40	†4"-12"	X	Code 6		X
	100 x 100	All Sizes	Code 9	X		
	200 x 200	All Sizes	X			

\*Except 6" - 125 lb. cast iron

†Except 4" - 125 lb. cast iron

**ORDERING CODE** for a strainer with a non-standard screen is made by substituting the Code Number of the screen desired for the standard screen Code Number.

## Steam Specialty Products Armstrong Machine Works

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Europe Parc Industriel Des Hauts-Sarts/4400 Herstal, Liege, Belgium/Phone: (041)640867

Armstrong manufactures Steam Traps, Strainers, Humidifiers, Air Vents, Drainers, Steam Coils and Unit Heaters

Printed in U.S.A.





**INSTALLATION AND MAINTENANCE**

**ARMSTRONG "CD-40" AND "CD-60" SERIES CONTROLLED DISC STEAM TRAPS**

This bulletin should be used by experienced personnel as a guide to the installation and maintenance of "CD-40", and "CD-60" Series Controlled Disc steam traps. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or its local representative if further information is required.

**Table 1. Maximum Operating Pressures.**

Model No.	Connection Size	Minimum Operating Pressure	Maximum Operating Pressure
CD-40 Series	3/8", 1/2", 3/4", 1"	10 psi	600 psi
CD-60 Series	3/8", 1/2", 3/4", 1"	10 psi	600 psi

**INSTALLATION**

*NOTE: Armstrong Series "CD-40" and "CD-60" steam traps may be installed in any position as long as proper flow direction is observed and the trap is not inverted. Since Armstrong Controlled Disc traps do not rely upon radiation losses to operate properly, they can be completely insulated.*

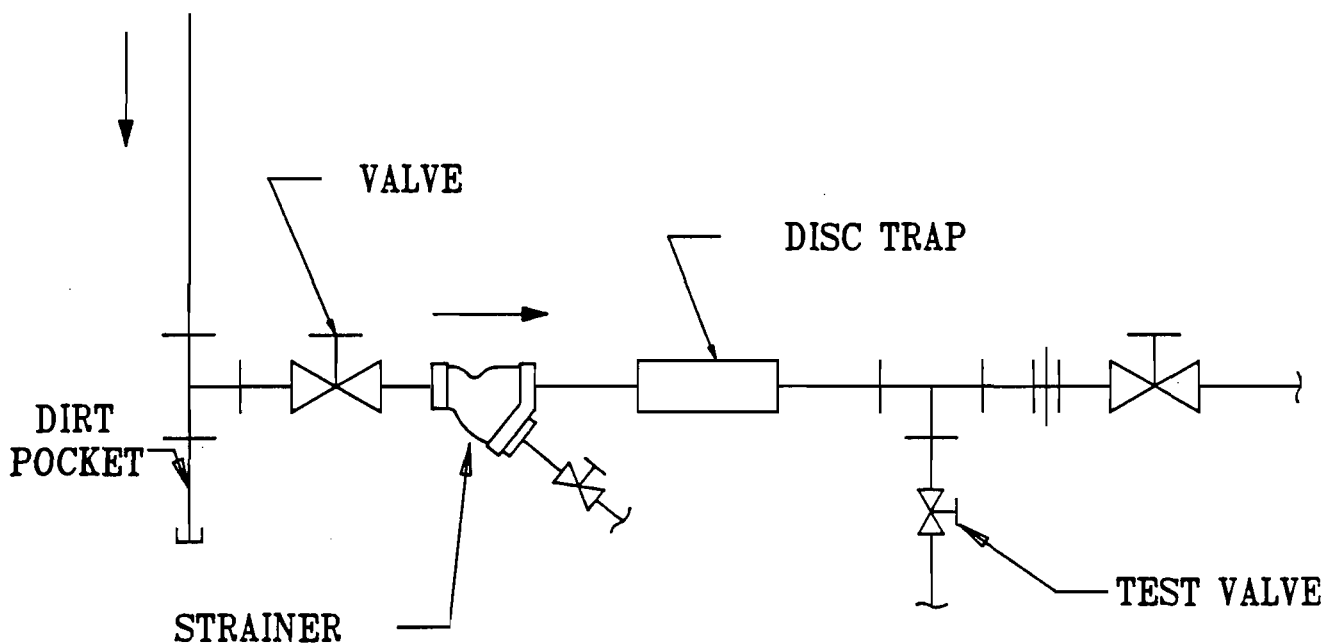
- 1) Before installing any trap, blow down the piping that leads to the unit's inlet. Use full line pressure. Be sure that the maximum operating pressure (MOP) of the trap is adequate for the installation. (The MOP is stamped on the casting or nameplate.)



INSTALLATION AND MAINTENANCE ARMSTRONG  
"CD-40" AND "CD-60" SERIES CONTROLLED DISC STEAM TRAPS

- 2) Install the trap inlet below the liquid level of the equipment to be drained. Figure 1 shows the recommended piping method. **USE GOOD PIPING PRACTICES. MAKE INLET PIPING AS SHORT AS POSSIBLE. USE A MINIMUM NUMBER OF ELBOWS AND OTHER RESTRICTIONS IN INLET AND OUTLET PIPING. INSTALL A DIRT POCKET IN THE LINE AHEAD OF THE TRAP.**

Figure 1.



- 3) To allow maintenance and provide maximum service, install a valve on each side of the trap and a downstream testing tee. All valves should be of the fullported type to avoid restricting flow. Install a strainer ahead of the trap if it does not have an integral strainer.
- 4) Install a union downstream of the trap unless the discharge line is open and short.
- 5) When a disc trap discharges to a return system, extreme caution should be exercised to avoid conditions that create excessive back pressure. **For best results, the back pressure in the return lines should not exceed 50% of the inlet pressure.** If elevating condensate is necessary, remember that every two feet of lift creates about one pound of back pressure.
- 6) Where freezing might be encountered, install a pressure or temperature actuated safety drain device on the inlet piping, directly ahead of the trap. If the trap discharges to a closed return, another safety drain device should be installed in the discharge piping.



### MAINTENANCE

To assist you in the troubleshooting and repair of steam traps, Armstrong makes available the following material:

- Handbook - M-101 "Steam Conservation Guidelines for Condensate Drainage"
- Video tape - "Guidelines for Steam Trap Troubleshooting and Testing"
- Video tape - "Guidelines for Steam Trap Repair"

In order to ensure continuous optimum performance from any steam trap, it should be inspected according to the following schedule:

**Table 2. Suggested Yearly Trap Testing Frequency.**

Operating Pressure (PSIG)	Application			
	Drip	Tracer	Coil	Process
0-100	1	1	2	3
101-250	2	2	2	3
251-450	2	2	3	4
451 and above	3	3	4	12

The renewal of both the "CD-40" and the "CD-60" is accomplished by replacing the capsule. The method of replacement, however, differs between the two series.

#### "CD-40" SERIES

- 1) Close the inlet and outlet valves, make sure the trap is cold.
- 2) Remove the trap from the line. You may replace the trap with a spare to minimize down time, or service it immediately.
- 3) Open the trap and remove the strainer screen, if there is one.
- 4) Remove the old capsule and clean the metal-to-metal seating surfaces.



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INSTALLATION AND MAINTENANCE ARMSTRONG  
"CD-40" AND "CD-60" SERIES CONTROLLED DISC STEAM TRAPS

---

- 5) Clean any dirt or sediment from the trap.
- 6) Check that the body is free from erosion, especially near the inlet and outlet connections.
- 7) Install a new capsule. If a strainer screen is included, clean or replace it, as necessary.
- 8) Reassemble the trap and restore it to service or place it in stock.

**"CD-60" SERIES**

- 1) Close the inlet and outlet valves, make sure the trap is cold.
- 2) Unscrew the four bolts, and remove the cap from the trap.
- 3) Lift out the screen and unscrew the capsule.
- 4) Discard the old gasket and clean both gasket surfaces.
- 5) Clean any dirt or sediment from the trap body and cap.
- 6) Check that the body is free from erosion, especially near the inlet and outlet connections.
- 7) Install a new capsule and a **NEW GASKET**, then secure the cap to the body using a cross-tightening pattern as you would when putting on an automobile wheel.
- 8) Once all the bolts have been securely tightened, open the valves in the supply and discharge lines. Check the equipment for normal operation.

If further information is required, we encourage you to contact Armstrong or its local representative.



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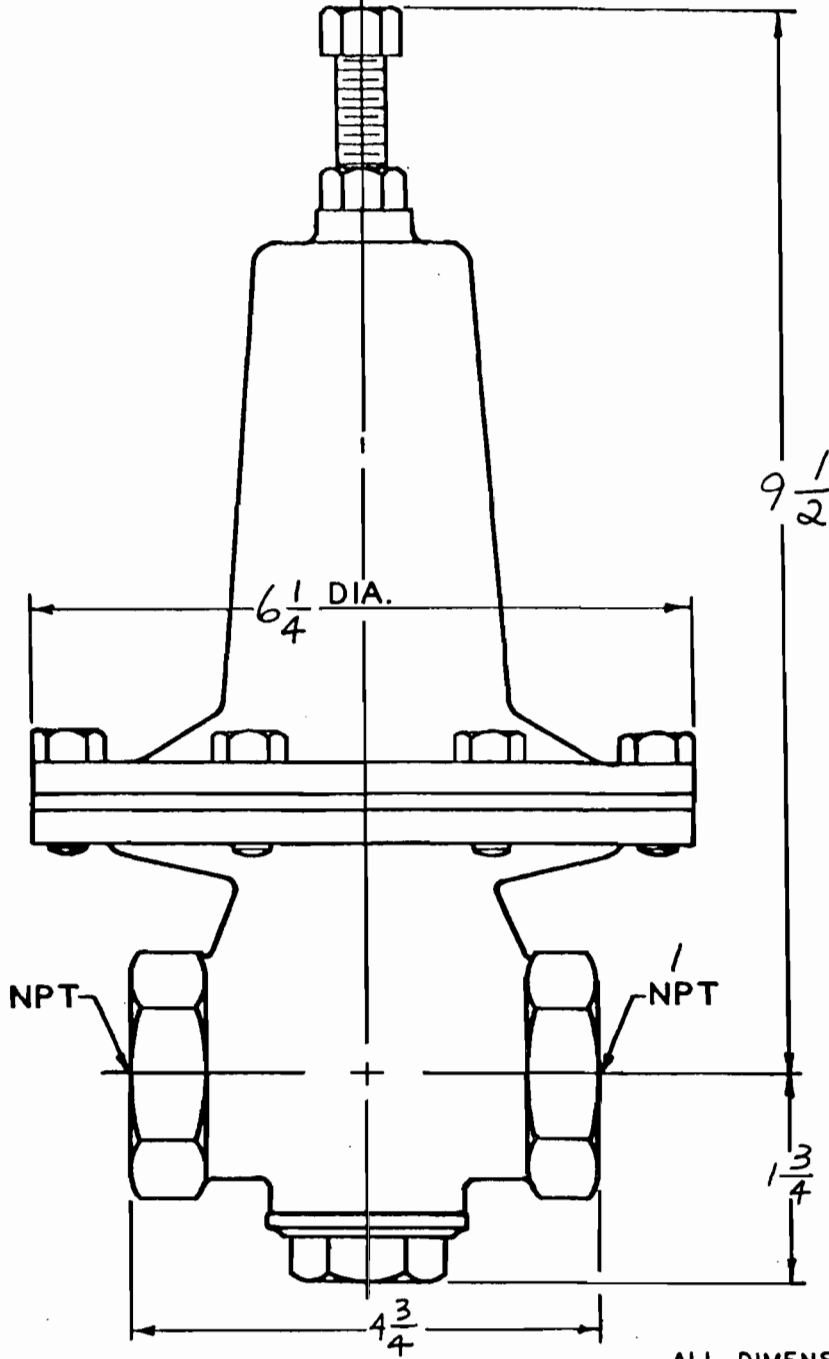
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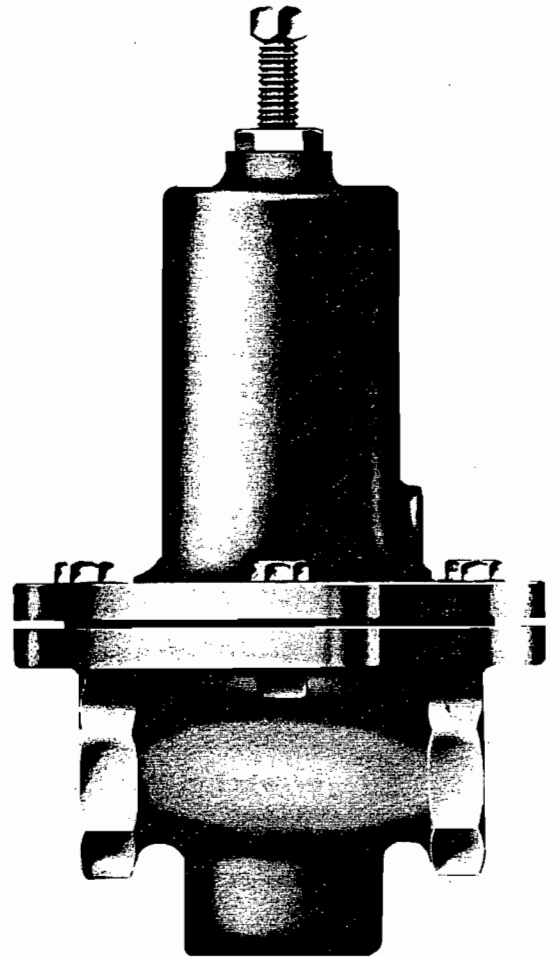
1" 17-17  
MASON NEILAN  
REGULATOR.



ALL DIMENSIONS IN INCHES

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PURCHASE ORDER <u>19754</u>				DATE	REV NO	DRAWN <u>RWM</u>	APP'D CHIEF DR. <u>[Signature]</u>
REQ <u>6J-7877</u> INVOICE						TRACED	SUPERSEDING
ITEM NO.						<b>MASON-NEILAN</b> DIVISION OF WORWINGTON CORPORATION NORWOOD, MASSACHUSETTS, U.S.A.	
FIG. NO. <u>17-17</u> TRIM <u>STAINLESS</u>							
RANGE <u>2-12</u> BY							
SET _____ DATE _____						DATE	DRAWING NO.

# 17 Series Back Pressure Regulator Instructions for Models 17-17 and 17-27



**Masoneilan**

**DRESSER**



**Caution: Temperature and Inlet Pressure Ratings:**

17-17	400°F Max.	250 psi Max.
17-27	150°F Max.	250 psi Max.

## Principle of Operation

The 17 Series back pressure regulators are operated directly by the inlet pressure acting on the underside of the diaphragm through a sense port in the body. A decrease in inlet pressure below the set point allows the range spring to close the valve. An increase in inlet pressure above the set point overcomes the balance force of the range spring and forces the diaphragm up opening the valve.

## Installation

Thoroughly clean and blow out the pipe line before installing the regulator to remove all dirt, chips and other foreign matter. To insure continued protection against foreign matter, install a pipe strainer upstream of the regulator. The regulator may be installed in any position, however, flow must be in the direction indicated by the words **IN** and **OUT** stamped on the regulator ports. Care should be taken to insure that the vent hole in the spring case is unobstructed at all times.

## Adjustment

The 17 Series back pressure regulators are shipped with a pressure setting at the low end of the adjustable range unless otherwise specified by the customer. The pressure setting can be changed to any value within the adjustable range by loosening the adjusting screw locknut (2) and turning the adjusting screw (1) clockwise to increase the pressure setting or counterclockwise to decrease the pressure setting.

## Maintenance

Prior to disassembly remove all system pressure from the regulator. All component parts are accessible from the top of the regulator.

1. Loosen the adjusting screw locknut (2) and turn the adjusting screw (1) counterclockwise to relieve the compression on the range spring. Remove the spring case (4) from the valve body by removing the cap screws (11).
2. Remove the spring button (5) and range spring (6).

To change spring range follow steps 1 and 2 and replace the range spring with one with the desired range. Reassemble and follow the instructions for installation and adjustment.

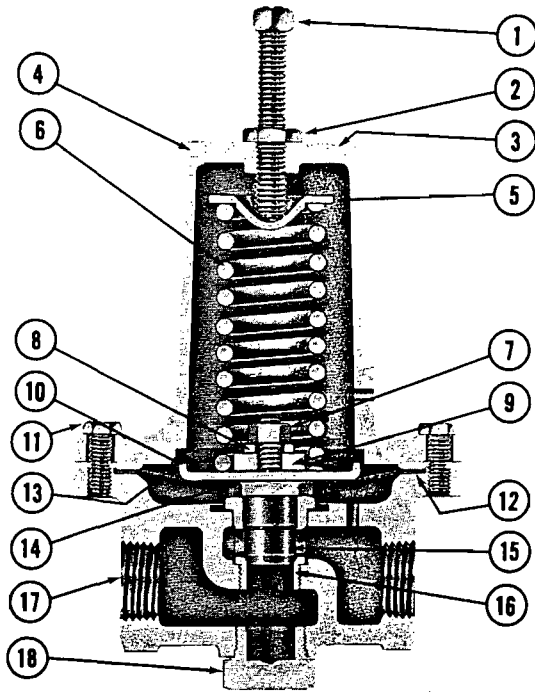
To replace the diaphragm complete steps 1 and 2 and proceed with the following:

3. Lift out the diaphragm-plug assembly.

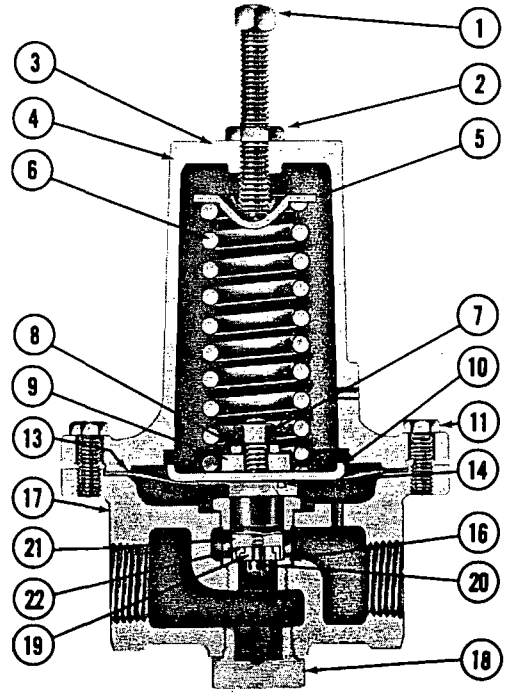
4. Remove the locknut (7), lockwasher (8), spring guide ( $\frac{3}{4}$ " and 1") (9), spring button (10), diaphragm (13), and diaphragm gasket (Model 17-17) (12) from the main valve.

Reassemble with a new diaphragm and gaskets from the **Seals Repair Kit**. Be sure the locknut is tight against the lockwasher. **NOTE: Use care not to damage the plug during diaphragm replacement.** If the regulator is a Model 17-17, replace the diaphragm-plug assembly using the new diaphragm gasket from the repair kit. Replace the range spring, spring button and spring case. Follow instructions for installation and adjustment.

To clean seating surfaces complete steps 1, 2 and 3. The body plug (18) may be removed to gain better access to the seat ring (16). It should be necessary only to keep the seating surfaces free of dirt and accumulated deposits of chemical impurities in order to secure accurate control. Wipe the valve assembly and seat ring with a clean soft cloth. If it is necessary to grind, use a good quality "fine" grinding compound. Clean all parts thoroughly and reassemble. **NOTE: If parts are severely damaged, repair kits are available for parts replacement.**



No. 17-17



No. 17-27

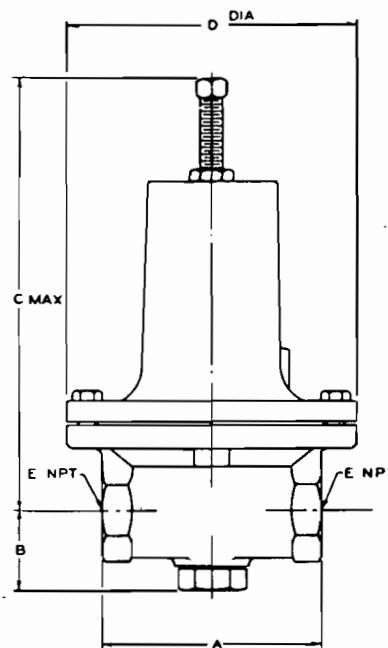
### Parts Reference

Ref. No.	Description	Material		
		Iron Body	Carbon Steel Body	Stainless Steel Body
1	Adjusting Screw	Carbon Steel	Carbon Steel	Carbon Steel
2	Adjusting Screw Locknut			
3	Serial Plate	Aluminum	Aluminum	Aluminum
4	Spring Case	Cast Iron	Carbon Steel	Nickel Plated Cast Iron
5	Spring Button (upper)			
6	Spring			
7	Locknut			
8	Lockwasher			
9*	Spring Guide			
10	Spring Button (lower)			
11	Cap Screws	Steel	Steel	Steel
12†	Diaphragm Gasket	Asbestos	Asbestos	TFE Fluorocarbon
13	Diaphragm	Model 17-17	302 Stainless Steel	302 Stainless Steel
		Model 17-27	Nylon Reinforced Buna-N	Nylon Reinforced Buna-N
14	Plug Gasket	Model 17-17	Asbestos	Asbestos
		Model 17-27	Buna-N Rubber	Buna-N Rubber
15†	Plug	416 Stainless Steel	416 Stainless Steel	Chrome Plated 316 Stainless Steel
16	Seat Ring	Model 17-17	416 Stainless Steel	416 Stainless Steel
		Model 17-27	316 Stainless Steel	316 Stainless Steel
17	Body	Cast Iron	Carbon Steel	316 Stainless Steel
18	Body Plug	Carbon Steel	Carbon Steel	316 Stainless Steel
19‡	Retainer			
20‡	Retainer Screw	316 Stainless Steel	316 Stainless Steel	316 Stainless Steel
21‡	Plug Housing	Chrome Plated 316 Stainless Steel	Chrome Plated 316 Stainless Steel	Chrome Plated 316 Stainless Steel
22‡	Seat Insert	Buna-N Rubber	Buna-N Rubber	Buna-N Rubber

\*Used on ¾" and 1" only.

†Used on Model 17-17 only.

‡Used on Plug S/A Model 17-27 only.



**Dimensions and Weights** (inches & pounds)

Valve Size	A	B	C	D	E	Approx. Shipping Weight
1/2	4	1 3/8	7	4 1/4	1/2	8
3/4	4 1/4	1 5/8	8 1/4	5 1/4	3/4	13
1	4 3/4	1 3/4	9 1/2	6 1/4	1	18

**Replacement part kits** are available as indicated in the following part number chart.

Size (Inches)	Body Material	17-17		17-27	
		Seals Kit	Seals & Valve Kit	Seals Kit	Seals & Valve Kit
1/2	Iron; Carbon Steel	808898-177-040	808898-177-041	808898-178-620	808898-178-621
	Stainless Steel	808898-177-620	808898-177-621		
3/4	Iron; Carbon Steel	808898-177-050	808898-177-051	808898-178-630	808898-178-631
	Stainless Steel	808898-177-630	808898-177-631		
1	Iron; Carbon Steel	808898-177-060	808898-177-061	808898-178-640	808898-178-641
	Stainless Steel	808898-177-640	808898-177-641		
Seals Kit Contents		Diaphragm (13), Diaphragm Gasket (12), Plug Gasket (14)		Diaphragm (13), Plug Gasket (14), Seat Insert (22), Retainer Screw (20)	
Seals & Valve Kit Contents		Diaphragm (13), Diaphragm Gasket (12), Plug Gasket (14), Plug (15), Seat Ring (16)		Diaphragm (13), Plug Gasket (14), Plug S/A (19, 20, 21, 22), Seat Ring (16)	

Facilities: Australia, Brazil, Canada, France, Germany, Italy, Japan, Mexico, Netherlands, Singapore, Spain, United Kingdom, United States



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**PYROPOWER CORPORATION  
OPERATION & MAINTENANCE MANUAL  
FOR PYROFLOW CFB BOILERS  
FOR THE**

**CEDAR BAY, INC.  
COGENERATION PROJECT**

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OPERATING MANUAL FOR  
AMMONIA STRIPPER SYSTEM  
AHLSTROM PYROPOWER  
SAN DIEGO, CALIFORNIA  
GLITSCH JOB NO. 6J-7877

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**SECTION A**  
**PERFORMANCE**

PERFORMANCE

<u>Feed (aqueous ammonia)</u>	<u>Flow Rate (LBS/HR)</u>
Water	2,175.00
Ammonia	825.00
TOTAL	<hr/> 3,000.00

Vapors to Boilers

Water	163.33
Ammonia	824.97
TOTAL	<hr/> 988.30

Effluent

Water	3,054.76
Ammonia	0.03
TOTAL	<hr/> 3,054.79

Utility Requirements

Steam:	1043 LBS/HR @ 200 psig.
Cooling Water:	Nil.
Instrument Air:	Approximately 4 scfm @ 125 psig.
Electrical connected	5 hp 460 Volt/3-phase/60 Hz.



**SECTION B**  
**GENERAL PROCESS DESCRIPTION**

## GENERAL PROCESS DESCRIPTION

Aqueous ammonia solution (approximately 29% ammonia) at ambient temperature is delivered by trucks to Storage Tank 1CCF-TNK-1.

The ammonia solution is pumped via Feed Pump 1CCF-P-1A to the Stripping System. It is then preheated to approximately 140°F in the Feed/Bottoms Exchanger 1CCF-HX-1 against the hot column bottoms and admitted to the top of the stripping column on automatic flow control. As the feed goes through the packing of the column, it is countercurrently contacted with live steam which is admitted to the bottom of the column on flow ratio control with the feed. The flow ratio is set to maintain a constant liquid to vapor ratio inside the tower. As the feed is contacted with steam, ammonia is stripped overhead. The pressure of the Ammonia Stripper is controlled at 65 psig.

The overhead vapor is then stored in the Vapor Reservoir which is set at a pressure of 55 psig. This pressure controls the feedrate of aqueous ammonia to the Ammonia Stripper. When the pressure of the Vapor Reservoir reaches 55 psig ammonia vapor will start flowing through the valve rack, the injection manifolds and the injection nozzles into the boilers. The injection nozzles and the boilers are not in the scope of Glitsch supply.

The stripped ammonia solution now containing only 10 ppm of ammonia flows out the sump of the column on level control, by virtue of its own pressure, through the feed/bottoms interchanger where it is cooled to about 247°F. The differential pressure across the column is measured and indicated at the control panel along with aqueous ammonia feed rate, Stripper and Reservoir pressures, the Stripper overhead, Stripper sump and feed temperatures.

The process is shown schematically on Process Flow Diagram no. D-7877-00-01 and P & I Diagram nos. D-7877-01-01 through D-7877-01-04. These drawings are enclosed in this manual, and should be studied for a thorough understanding of the process.

**SECTION C**

**START-UP**

**SECTION C**

**PART 1**

**PRELIMINARY INSTRUMENT & EQUIPMENT CHECKOUT**

## **PART 1: PRELIMINARY INSTRUMENT & EQUIPMENT CHECKOUT**

### **1.1 Electric and Air Supply**

- (a) The electrical power distribution system should be completed, tested and operational, with seal compound installed in all seal fittings. This includes all motor, lighting and auxiliary circuits.
- (b) Put low condition alarms in bypass mode, where so equipped, or set below prevailing conditions.
- (c) Make sure that the valves are closed at all control valve locations.
- (d) Verify the instrument air supply pressure, and verify that the air is clean and dry. Gradually open the supply valve in the header, and adjust the pressure regulator to about 20-22 psig.
- (e) Energize the control panel (The controllers should have been programmed).
- (f) Observe instruments. Verify that the instruments are on, and check for proper indication where ambient conditions are on-scale.

### **1.2 Alarm Response**

- (a) Check low condition alarms where applicable by adjusting alarm setpoints until alarm response is confirmed.
- (b) Upset the position of field contacts to trigger an alarm and/or interlock condition, and verify the response.

### **1.3 Control Valve Response**

- (a) Switch the controllers to the manual mode.
- (b) Using the manual mode of the controllers, stroke the valves open and close.
- (c) Observe the control valve response. Verify that the direction of the stem travel corresponds with the direction indicated on the controller. For valves with positioners, verify that the percent of stem travel and pneumatic signal at the valve both correspond to the percent controller output.

### **1.4 Instruments**

- (a) Verify the calibration of all field transmitters.

- (b) Set the initial tuning parameters for the indicating controllers as recommended in Section D, Part 1.

#### 1.5 Pump Rotation

- (a) Except for close coupled pumps, all pumps are shipped uncoupled. Hence, install pump couplings.
- (b) Lubricate all pumps in accordance with manufacturers' recommendations.
- (c) Jog all pump motors, and verify proper shaft rotation.

#### 1.6 Piping Integrity

Pressure tests all piping, and inspect all joints, valve packing and connections for leaks before covering with insulation.

SECTION C

PART 2

HYDRAULIC START-UP

## 2.1 Fluid Selection

Hydraulic start-up is recommended to verify equipment operation and perform calibrations, where possible, before the actual process fluids are introduced into the system.

Normally hydraulic start-up is done with water, hence the term "water start-up." However, if the hydraulic start-up is to be done in the winter, special care must be taken to insure that freezing does not occur.

## 2.2 Strategy

The basic strategy of the hydraulic start-up will be to establish liquid flow through piping and equipment, and to operate the system as close as possible to the design conditions with water.

## 2.3 Temporary Piping

Fill Aqueous Ammonia Storage Tank 1CCF-TNK-1 to 50% using a temporary water line. This temporary line can either be connected to the transfer station or to the valve (BV-005) at nozzle D. This tank can remain at atmospheric pressure during the hydraulic startup.

## 2.4 Utilities

- (a) The instrument air supply system should be operational, and all moisture should be drained from air lines. Check instrument air for proper pressure, and verify that it is clean and dry.
- (b) Switch all indicating controllers into manual mode. Close the following control vaves:  
  
ACV-1007 via FIC-1006  
ACV-102 via LIC-102  
ACV-104 via FIC-104.  
ACV-109 via TIC-109
- (c) Drain condensate from steam lines, and verify the proper steam header pressure.
- (d) Set PRV-060 (steam line) to 110 psig and open the manual block valve BV-003 (steam supply) and all other block valves on the condensate and effluent lines (line nos 1"-STM-203-CSL and 1"-P-107-CSL. This allows the steam flow to the Vapor Reservoir jacket.
- (e) Verify the instrument air supply pressure ( >20 psig), and open the supply valve(s).



## 2.5 Ammonia Stripper 1CCF-VSL-1, Operation

- (a) Open all block valves (except valves normally closed and control valve by-passes) on the Ammonia Valve Racks and Injection Manifolds. Put FIC-1006 to manual with an output of approximately 50% to ACV-1006.
- (b) Begin the flow of steam to the stripper column by gradually opening FV-104 (via FIC-104, in manual) until steam flow is observed. Verify the operation of the controller FIC-104 in manual and automatic modes. Leave the controller in manual, and gradually increase the steam flow to 1,043 lbs/hr over a period of 20 minutes. Adjust the preliminary tuning constants for the controller.
- (c) Continue heating the column. Observe the increase in the overhead temperature at TIC-106
- (d) Put PIC-105 to automatic with a set point of 65 psig. Put PIC-107 to automatic with a set point of 55 psig.
- (e) Open all block valves on feed lines 1½"-P-101-SSF through 1½"-P-103-SSF at the Ammonia Stripper.
- (f) Open the level control valve ACV-102 by manually setting the level to 50%.
- (g) Start Feed Pump 1CCF-P-1 and allow water to flow from the Storage Tank to the Ammonia Stripper. Set the flow controller FIC-101 to 6 gpm and verify the operation of FIC-101 in manual and automatic control modes. Leave the controller in manual.
- (h) When a level appears in the sump of the stripper column, verify the operation of the level controller LIC-102 in manual and automatic modes. Put the controller in automatic, and adjust the preliminary set point to about 50%. Adjust the preliminary tuning constants for the controller.
- (i) Put feed temperature controller TIC-109 to automatic with a set point of 140 °F.
- (j) When the Vapor Reservoir reaches a pressure of 55 psig (as shown on PIC-107) switch FIC-101 to automatic. Switch FIC-104 to automatic with flow ratio control from FIC-101. Disable the input from TIC-106. The steam flow will now be a fixed ratio (0.35) of the feed.
- (k) Adjust the opening of ACV-1007 with FIC-1006 in manual to vary the Vapor Reservoir pressure. Verify the control of feed rate and steam rate via PIC-107.

- (l) Observe the temperature of the feed via TIC-106. The temperature of the feed should reach approximately 140 °F. Adjust the preliminary tuning constants of the controller.
- (m) Verify that the vapor flowrate on FIC-1006 is approximately equal to the total of all the values shown on FI-1010 through FI-1017.
- (n) Verify that all the temperature measurement devices on the system are working.
- (o) Verify the operation of the column differential pressure transmitter PDT-103.
- (p) Maintain steady operation for a minimum of 1 hour.
- (q) Shut down the system (see Section E). Remove any temporary lines and temporary strainers on the pump suction, and retighten flanges.

NOTE: TEMPORARY STRAINERS SHOULD ONLY BE UTILIZED DURING HYDRAULIC STARTUP AND REMOVED UPON COMPLETION OF THIS STEP. PIPING SHOULD ALSO BE FLUSHED TO REMOVE ANY IMPURITIES. FAILURE TO DO THESE STEPS MAY RESULT IN POOR PROCESS PERFORMANCE.

SECTION C

PART 3

INITIAL PROCESS START-UP

### 3.1 Initial Process Start-up

After the system has been operated successfully with water, it is ready for the initial product run. During this run, instrument loops that could not be checked when the water run was conducted will now be verified. Fine tuning of the instruments will also be done here.

### 3.2 Temporary Piping

If temporary piping was used in the hydraulic start-up disconnect it and make sure all piping is in its normal configuration.

### 3.3 Utilities

(a) The instrument air supply system should be operational, and all moisture should be drained from air lines. Check instrument air for proper pressure, and verify that it is clean and dry.

(b) Switch all indicating controllers into manual mode. Close the following control valves:

ACV-1007 via FIC-1006  
ACV-102 via LIC-102  
ACV-104 via FIC-104.  
ACV-109 via TIC-109

(c) Drain condensate from steam lines, and verify the proper steam header pressure.

(d) Set PRV-060 (steam line) to 110 psig and open the manual block valve BV-003 (steam supply) and all other block valves on the condensate and effluent lines (line nos 1"-STM-203-CSL and 1"-P-107-CSL. This allows the steam flow to the Vapor Reservoir jacket.

(e) Verify the instrument air supply pressure (>20 psig), and open the supply valve(s).

### 3.4 Storage Tank, 1CCF-TNK-1, Filling

Note that during normal operation this tank is pressurized by air at 20 psig. During filling, vapor will be vented from the tank to the truck.

( IT IS STRONGLY RECOMMENDED TO TURN OFF THE AIR SUPPLY TO 1CCF-TNK-1 BEFORE FILLING THE TANK IN ORDER TO AVOID EXCESSIVE ESCAPE OF VAPOR INTO THE ATMOSPHERE. )

Resume air supply to Storage Tank when filling is completed.

### 3.5 Stripping Column, E-129, Operation

- (a) Open all block valves (except valves normally closed and control valve by-passes) on the Ammonia Valve Racks and Injection Manifolds.
- (b) If the boilers are not in operation put FIC-1006 to manual with an output of approximately 50% to ACV-1006. If the boilers are already in operation, put FIC-1006 to automatic.
- (c) Begin the flow of steam to the stripper column by gradually opening FV-104 (via FIC-104, in manual) until steam flow is observed. Verify the operation of the controller FIC-104 in manual and automatic modes. Leave the controller in manual, and gradually increase the steam flow to 1,043 lbs/hr over a period of 20 minutes. Adjust the preliminary tuning constants for the controller.
- (d) Continue heating the column. Observe the increase in the overhead temperature at TIC-106
- (e) Put PIC-105 to automatic with a point of 65 psig. Put PIC-107 to automatic with a set point of 55 psig.
- (f) Open all block valves on feed lines 1½"-P-101-SSF through 1½"-P-103-SSF at the Ammonia Stripper.
- (g) Open the level control valve ACV-102 by manually setting the level to 50%.
- (h) Start Feed Pump 1CCF-P-1 and allow water to flow from the Storage Tank to the Ammonia Stripper. Set the flow controller FIC-101 to 6 gpm and verify the operation of FIC-101 in manual and automatic control modes. Leave the controller in manual.
- (i) When a level appears in the sump of the stripper column, verify the operation of the level controller LIC-102 in manual and automatic modes. Put the controller in automatic, and adjust the preliminary setpoint to about 50%. Adjust the preliminary tuning constants for the controller.
- (j) Put feed temperature controller TIC-109 to automatic with a set point of 140 °F.
- (k) When the Vapor Reservoir reaches a pressure of 55 psig (as shown on PIC-107) switch FIC-101 to automatic. Switch FIC-104 to automatic with flow ratio control from FIC-101. Enable the input from TIC-106. The steam flow will normally be a fixed ratio (0.35) of the feed but this ratio will automatically be adjusted as the overhead

temperature varies.

- (l) Adjust the opening of ACV-1007 with FIC-1006 in manual to vary the Vapor Reservoir pressure. Verify the control of feed rate and steam rate via PIC-107.
- (m) Observe the temperature of the feed via TIC-106. The temperature of the feed should reach approximately 140 °F. Adjust the preliminary tuning constants of the controller.
- (n) Verify that the vapor flowrate on FIC-1006 is approximately equal to the total of all the values shown on FI-1010 through FI-1017.
- (o) Verify that all the temperature measurement devices on the system are working.
- (p) Verify the operation of the column differential pressure transmitter PDT-103.
- (q) Obtain lab analysis of the bottoms. Adjust the steam to feed ratio constant, if necessary, to maintain the maximum limit of 10 ppm ammonia in the bottoms or the feed temperature to maintain the ammonia concentration in the overhead vapors. See Quality Control (Section D, Part 2) for more details.
- (r) Fine tune all control loops, and record the settings in Section D, Part 1 of this manual and send a copy to Glitsch.

Note that the key to stable operation is a steady pressure in the Ammonia Stripper. The Vapor Reservoir pressure might fluctuate depending on the variation in the demand of ammonia at the boilers.

**SECTION C**

**PART 4**

**NORMAL PROCESS START-UP**

#### 4.1 Normal Process Start-up

It is assumed that all the equipment is filled to near its operating level with process material. For example, if Aqueous Ammonia Storage Tank level is low, then follow the instructions for Initial Process Start-up (Section C, Part 3).

#### 4.2 Utilities

- (a) The instrument air supply system should be operational, and all moisture should be drained from air lines. Check instrument air for proper pressure, and verify that it is clean and dry.
- (b) Switch all indicating controllers into manual mode. Close the following control vaves:
  - ACV-1007 via FIC-1006
  - ACV-102 via LIC-102
  - ACV-104 via FIC-104.
  - ACV-109 via TIC-109
- (c) Drain condensate from steam lines, and verify the proper steam header pressure.
- (d) Set PRV-060 (steam line) to 110 psig and open the manual block valve BV-003 (steam supply) and all other block valves on the condensate and effluent lines (line nos 1"-STM-203-CSL and 1"-P-107-CSL. This allows the steam flow to the Vapor Reservoir jacket.
- (e) Verify the instrument air supply pressure (>20 psig), and open the supply valve(s).

#### 4.3 Stripping Column, E-129, Operation

- (a) Open all block valves (except valves normally closed and control valve by-passes) on the Ammonia Valve Racks and Injection Manifolds.
- (b) If the boilers are in operation, Put FIC-1006 to automatic.
- (c) Begin the flow of steam to the stripper column by gradually opening FV-104 (via FIC-104, in manual) until steam flow is observed. Verify the operation of the controller FIC-104 in manual and automatic modes. Leave the controller in manual, and gradually increase the steam flow to 1,043 lbs/hr over a period of 20 minutes. Adjust the preliminary tuning constants for the controller.



- (d) Continue heating the column. Observe the increase in the overhead temperature at TIC-106
- (e) Put PIC-105 to automatic with a set point of 65 psig. Put PIC-107 to automatic with a set point of 55 psig.
- (f) Open all block valves on feed lines 1½"-P-101-SSF through 1½"-P-103-SSF at the Ammonia Stripper.
- (g) Open the level control valve ACV-102 by manually setting the level to 50%.
- (h) Start Feed Pump 1CCF-P-1 and allow water to flow from the Storage Tank to the Ammonia Stripper. Set the flow controller FIC-101 to 6 gpm and verify the operation of FIC-101 in manual and automatic control modes. Leave the controller in manual.
- (i) When a level appears in the sump of the stripper column, verify the operation of the level controller LIC-102 in manual and automatic modes. Put the controller in automatic, and adjust the preliminary setpoint to about 50%. Adjust the preliminary tuning constants for the controller.
- (j) Put feed temperature controller TIC-109 to automatic with a set point of 140 °F.
- (k) When the Vapor Reservoir reaches a pressure of 55 psig (as shown on PIC-107) switch FIC-101 to automatic. Switch FIC-104 to automatic with flow ratio control from FIC-101. Enable the input from TIC-106. The steam flow will normally be a fixed ratio (0.35) of the feed but this ratio will automatically be adjusted as the overhead temperature varies.
- (l) Adjust the opening of ACV-1007 with FIC-1006 in manual to vary the Vapor Reservoir pressure. Verify the control of feed rate and steam rate via PIC-107.
- (m) Observe the temperature of the feed via TIC-106. The temperature of the feed should reach approximately 140 °F. Adjust the preliminary tuning constants of the controller.
- (n) Verify that the vapor flowrate on FIC-1006 is approximately equal to the total of all the values shown on FI-1010 through FI-1017.
- (o) Verify that all the temperature measurement devices on the system are working.
- (p) Verify the operation of the column differential pressure transmitter PDT-103.

- (q) Obtain lab analysis of the bottoms. Adjust the steam to feed ratio constant, if necessary, to maintain the maximum limit of 10 ppm ammonia in the bottoms or adjust the feed temperature to maintain the ammonia concentration in the overhead vapors. See Quality Control (Section D, Part 2) for more details.

Note that the key to stable operation is a steady pressure in the Ammonia Stripper. The Vapor Reservoir pressure might vary depending on the fluctuation, if any, in the demand of ammonia at the boilers.

**SECTION D**  
**PROCESS OPERATION**

**SECTION D**

**PART 1**

**INSTRUMENTATION**

**PART 1: INSTRUMENTATION**

The product compositions are controlled by a simple control philosophy. The level of ammonia in the bottoms is maintained by controlling the operating line of the stripping column, i.e. the ratio of steam to feed. The concentration of ammonia in the overhead vapors is controlled by both the feed temperature and the steam to feed ratio.

**TABLE OF TUNING PARAMETERS**

The recommended initial constants are listed below. After the controllers have been tuned, enter the actual tuning parameters below for record keeping and send a copy to Glitsch.

<u>CONTROLLER</u> <u>TAG NO.</u>	<u>PROPORTIONAL</u> <u>GAIN</u>		<u>RESET TIME</u> <u>MIN./REPEAT</u>		<u>DERIVATIVE TIME</u> <u>MINUTES</u>	
	<u>Init.</u>	<u>Actual</u>	<u>Init.</u>	<u>Actual</u>	<u>Init.</u>	<u>Actual</u>
FIC-1006	1.0		0.25			
LIC-102	2.0		5.0			
FIC-104.	1.0		0.25			
TIC-109	5.0		2.5			

**SECTION D**

**PART 2**

**QUALITY CONTROL**

## PART 2: QUALITY CONTROL

The system is designed to produce an overhead vapor stream of 80% ammonia and a bottom wastewater stream containing not more than 10 ppm of ammonia. If the product purities are not within the normal design specifications, the following adjustments are recommended:

Overhead vapor ammonia concentration is acceptable, but wastewater contains too much ammonia

- Increase the steam to feed ratio.

Bottoms spec is acceptable, but ammonia concentration too low in the overheads

There can be two possible causes:

1) Too much stripping steam.

If too much stripping steam has been used the ammonia content in the wastewater will be much lower than 10 ppm. Analyze the wastewater and if the ammonia content is lower than necessary, reduce the steam to feed ratio.

2) Feed temperature too high causing feed flashing.

If the ammonia content in the wastewater is higher than acceptable and the ammonia content in the overhead vapors is still too lower, then reduce the aqueous ammonia feed temperature.

Note that by running the system at the highest allowable ammonia content in the wastewater, it will result in the highest possible ammonia concentration in the overhead vapors and the lowest consumption of stripping steam.

It might appear that by operating the column at a high steam to feed ratio, the ammonia contents in the wastewater will be minimized (hence maximizing the stripping of ammonia). This is true to a degree; however, there are two big drawbacks to this concept. Firstly, increasing steam rate increases the operating cost due to the elevated steam consumption. Secondly, increasing the liquid and vapor traffic in the tower beyond a threshold value, known as the "load point", causes the efficiency of the packing to decrease. This counters the positive effect on the separation due to increased flow rates. Further increases in flows through the column will cause the column to "flood". At flooding, the packing efficiency falls off dramatically, the flow of vapor is erratic, and liquid may be forced out of the overhead vapor line. In order to prevent operation near the flood point, do not operate the tower at a pressure drop higher than 2.0" H<sub>2</sub>O per ft of packing (total 56 inches) with the preferred operating limit being less than 1.0" H<sub>2</sub>O per ft of packing (total 28 inches).

**SECTION E**

**SHUTDOWN**



## SHUTDOWN

### 1.0 Normal Shutdown

- (a) Put the steam flow controller FIC-104 in local automatic mode with the prevailing setpoint.
- (b) Stop the feed pump or, if applicable, by-pass the Ammonia Stripping System.
- (c) Continue to run in this mode for about 30 minutes to remove any remaining Ammonia in the Stripper. Put the steam flow controller FIC-104 in manual with zero output to the control valve and stop the steam flow.
- (d) Put the sump level controller LIC-102 in manual with zero output to the valve.

#### NOTE:

If the system will not be operated for an extended period of time, and the ambient temperature is below freezing, drain all equipment and piping that may contain water.

### 2.0 Emergency Shutdown

- (a) Stop the feed pump.
- (b) Put the steam flow controller FIC-104 in manual with zero output to the valve.
- (c) Put the sump level controller LIC-102 in manual with zero output to the valve.
- (d) Close the shutoff valve BV-030 in the steam supply line.

**SECTION F**  
**SPECIFICATIONS**

**SECTION F**

**PART 1**

**HEAT EXCHANGERS**

HEAT EXCHANGER SPECIFICATION SHEET

1 GLITSCH JOB NO. 6J-7877  
 2 AQUEOS AMMONIA DENOX SYSTEM  
 3 1CCF-HX-1 FEED AND BOTTOMS EXCHANGER

4  
 5  
 6 Size 4-72 Type BEU Hor Connected in 1 Parallel 1 Series  
 7 Surf/Unit(Eff) 9 ft2; Shells/Unit 1 Surf/Shell(Eff) 9 ft2

PERFORMANCE OF ONE UNIT

Fluid Allocation		Shell Side		Tube Side	
Fluid Name		BOTTOMS WATER		AQUEOUS NH3	
11	Fluid Quantity, Total	lb/h	3522		3390
12	Vapor (In/Out)	lb/h			
13	Liquid	lb/h	3522	3522	3390 3390
14	Noncondensable	lb/h			
15	Temperature (In/Out)	F	312.3	247.2	75 140
16	Dew Point/Bubble Point	F			
17	Density	lb/ft3	56.888	58.871	52.802 51.053
18	Viscosity	cp	0.189	0.243	0.495 0.274
19	Molecular Weight, Vapor				
20	Molecular Weight, Noncondensable				
21	Specific Heat	BTU/(lb*F)	1.01		1.051
22	Thermal Conductivity	BTU/(ft*h*F)	0.399		0.331
23	Latent Heat	BTU/lb			
24	Inlet Pressure	psia	80.5		104.7
25	Velocity	ft/s	0.6		3.9
26	Pressure Drop, Allow./Calc.	psi	10 / 0.382		2 / 1.169
27	Fouling Resist. (Min.)	ft2*h*F/BTU	0.001		0.001
	Heat Exchanged	BTU/h; MTD (Corrected)		168.0	F
	Transfer Rate, Service	148 Dirty 202 Clean		356	BTU/(ft2*h*F)

CONSTRUCTION OF ONE SHELL

		Shell Side	Tube Side	Sketch	
32	Design/Test Pressure	psig 150/Code	150/Code		
33	Design Temperature	F 400	400		
34	No. Passes per Shell	1	4		
35	Corrosion Allowance	in 0.0625	0.0		
36	Connections	In in 1 / 150	1 / 150		
37	Size /	Out in 1 / 150	1 / 150		
38	Rating	/	/		
39	Tube No. 4Us	OD 0.75 ;Thk-Avg 0.049 in;	Length 6 ft;	Pitch 0.9375 in	
40	Tube Type Plain		Material SS304	Pattern 30	
41	Shell CS	ID 4.026 OD 4.5 in	Shell Cover		
42	Channel or Bonnet	SS304	Channel Cover		
43	Tubesheet-Stationary	SS304	Tubesheet-Floating		
44	Floating Head Cover		Impingement Protection	None	
45	Baffles-Cross CS	Type SSEG	Cut (%d) 33 H;	Spacing: c/c 2.25 in	
46	Baffles-Long	Seal Type		Inlet 6.25 in	
47	Supports-Tube	U-Bend	Type		
48	Bypass Seal Arrangement		Tube-Tubesheet Joint	EXPANDED	
49	Expansion Joint		Type		
50	Rho*V2-Inlet Nozzle	566 Bundle Entrance 2		Bundle Exit 2	
51	Gaskets-Shell Side		Tube Side		
52	-Floating Head				

Code Requirements ASME Code Sec VIII Div 1 TEMA Class B  
 Weight/Shell 250 Filled with Water 282 Bundle 28 lb

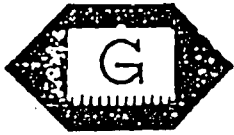
Remarks.

55  
56  
57  
58

SECTION F

PART 2

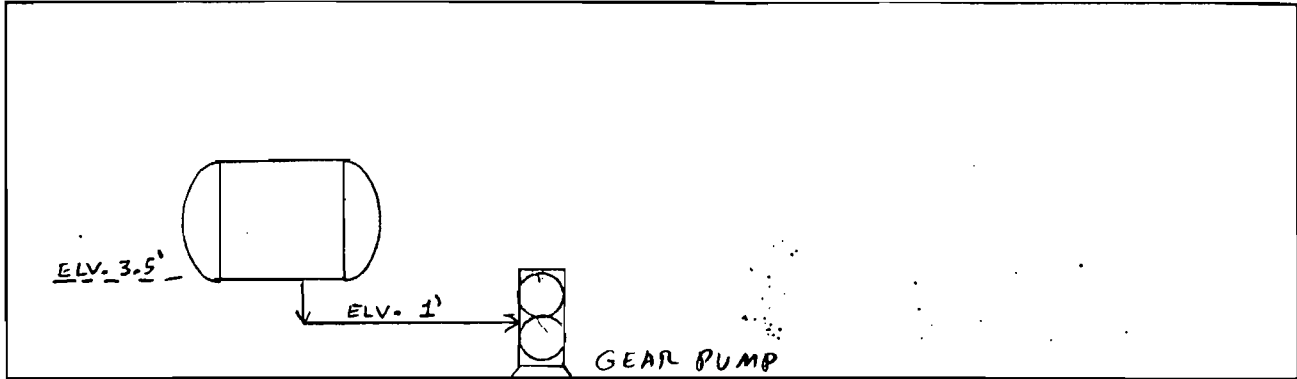
PUMPS



# GLITSCH, INC.

## PUMP CALCULATION SHEET

PUMP No.: 1CCF-P-1 A&B CUSTOMER: \_\_\_\_\_ CONTRACT No.: 65-7877  
 SERVICE: FEED PUMP LOCATION: AMMONIA STRIPPING SYSTEM DATE: 1-20-93 REV: \_\_\_\_\_



LIQUID PUMPED: \_\_\_\_\_ PUMPING TEMPERATURE: 75 °F  
 \_\_\_\_\_ 0.847 SpGr  
 \_\_\_\_\_ 0.594 CPS

### CAPACITY

NORMAL: \_\_\_\_\_ Lb/Hr → \_\_\_\_\_ Lb/Hr • 7.09 GPM  
 Sp Gr x 500

DESIGN: SAFETY FACTOR • 1.2

DESIGN CAPACITY: 8.51 GPM

### SUCTION PRESSURE

VESSEL PRESSURE, PSIG (NORMAL/PSV SET) \_\_\_\_\_

STATIC HEAD (LLL/HLL): 0.4335 x 2.5 FT x 0.85 Sp Gr + \_\_\_\_\_

LINE LOSSES @ 0.241 PSI/100 FT. SAY \_\_\_\_\_ EQ FT - \_\_\_\_\_

OTHER LOSSES, PSI 1 1/2" φ, 100 - \_\_\_\_\_

NET SUCTION PRESSURE \_\_\_\_\_

	PROCESS DESIGN	MECH. DESIGN
VESSEL PRESSURE, PSIG (NORMAL/PSV SET)	0	_____
STATIC HEAD (LLL/HLL): 0.4335 x 2.5 FT x 0.85 Sp Gr	+ 0.92	_____
LINE LOSSES @ 0.241 PSI/100 FT. SAY _____ EQ FT	- 0.24	0
OTHER LOSSES, PSI <u>1 1/2" φ, 100</u>	- _____	0
NET SUCTION PRESSURE	1.16	_____

### NPSH

SUCTION PRESSURE, PSIG \_\_\_\_\_

VAP. PRESS @ 75 °F, PSIG 13.31 PSIA FROM SIMSCI - ( -1.39 )

NET PSI \_\_\_\_\_

NPSH CALC. • 2.55 PSI x 2.31 / Sp Gr \_\_\_\_\_

NPSH AVAILABLE • 6.25

90%

NPSH AV. • 6.25 FT





# GLITSCH, INC.

## PUMP CALCULATION SHEET

PUMP No.: 1CCF-P-1A&B CUSTOMER: \_\_\_\_\_ CONTRACT No.: 6J-7877

### DISCHARGE PRESSURE

*Normal Operation to  
Stripper ✓*

### PROCESS DESIGN

NORMAL      DESIGN

VESSEL PRESSURE, PSIG

\_\_\_\_\_

STATIC HEAD TO HLL: \_\_\_\_\_ FT x \_\_\_\_\_ SpGr / 2.31

\_\_\_\_\_

FRICTION DROP E- \_\_\_\_\_

\_\_\_\_\_

HEATER DP, PSI

\_\_\_\_\_

OTHER DP, PSI

\_\_\_\_\_

CONTROL VALVE DP, PSI

\_\_\_\_\_

LINE LOSS @ \_\_\_\_\_ PSI/100'. SAY \_\_\_\_\_ EQ. FT

\_\_\_\_\_

NET DESIGN DISCHARGE, PSIG

SET TO      90.

### DIFFERENTIAL PRESSURE

DESIGN DISCHARGE PRESSURE, PSIG

\_\_\_\_\_

90

MINUS DESIGN (PROCESS) SUCTION, PSIG

\_\_\_\_\_

1.16

NET DIFFERENTIAL, DP (PSI)

\_\_\_\_\_

88.84

HEAD 88.84 (DP, PSI) x 2.31 / 0.85 (HOT SpGr) = 241.4 FI. SAY: 241.4

### SHUTOFF PRESSURE

NORMAL

MECH DES

SUCTION PRESSURE, PSIG (NET)

\_\_\_\_\_

PLUS 120% \_\_\_\_\_ DP (PSI) DIFFERENTIAL

\_\_\_\_\_

NET PSIG

\_\_\_\_\_

SAY DESIGN (MECHANICAL), PSIG

\_\_\_\_\_

BHP \_\_\_\_\_ GPM x \_\_\_\_\_ PSI / 1715 x 0. \_\_\_\_\_ (PUMP EFF.) = \_\_\_\_\_ HP

POWER \_\_\_\_\_ 0.746 x \_\_\_\_\_ BHP / 0. \_\_\_\_\_ (MOTOR EFF.) = \_\_\_\_\_ KW



**SECTION F**

**PART 3**

**INSTRUMENTS, CONTROL VALVES AND SAFETY DEVICES**

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054	TABLE OF CONTENTS				SHEET 1 OF 1	
	NO.	BY	DATE	REVISION	SPEC. NO. 7877-100	REV. 0
					CONTRACT 6J-7877	DATE 2-12-93
					REQ. P.O.	
					BY	CHK'D
						APPR.
I N S T R U M E N T   S P E C I F I C A T I O N S						
TABLE OF CONTENTS						
DESCRIPTION			SPECIFICATION NUMBER			
CONTROL VALVES			102			
PRESSURE REGULATORS			103			
DIFFERENTIAL PRESSURE TRANSMITTERS			104			
MAGNETIC FLOW METERS			105			
WEDGE FLOW ELEMENTS			106			
RESTRICTION ORIFICES			107			
MAGNETIC FLOAT LEVEL TRANSMITTER			108			
(NOT USED)			109			
PRESSURE GAUGES			110			
PRESSURE TRANSMITTERS			111			
(NOT USED)			112			
(NOT USED)			113			
TEMPERATURE ELEMENTS & WELLS			114			
RELIEF VALVES			115			
VACUUM BREAKER			116			
ROTAMETERS			117			
(NOT USED)			118			
VALVE MANIFOLDS			119			
TRAPS & STRAINERS			120			
QUARTER TURN VALVES			121			
(NOT USED)			122			
PRESSURE SWITCHES			123			
ISA FORM S20.3b						

Specification Forms for Process Measurement & Control Instruments, Primary Elements and Control Valves

ISA S20		CONTROL VALVES						SHEET 1 OF 2			
GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		NO.	BY	DATE	REVISION		SPEC. NO.		REV.		
		1	SCH	6/09/93	POSITIONER		7877-102		1		
							CONTRACT		DATE		
							6J-7877		3-03-93		
							REQ. P.O.				
						BY SH	CHK'D	APPR.			
GENERAL	1. Tag No.			1CCF-ACV-104		1CCF-ACV-1007		1CCF-ACV-2007		1CCF-ACV-3007	
	2. Service			STEAM TO AMMONIA STRIP.		AMMONIA TO BOILER 1A		AMMONIA TO BOILER 1B		AMMONIA TO BOILER 1C	
	3. Line No.\Vessel No.			1.5"-STM201CSL		2"-P-1001-CSP		2"-P-2001-CSP		2"-P-3001-CSP	
	4. Line Size\Sched. No.			1-1/2"/SCH 80		2"/SCH 10S		2"/SCH 10S		2"/SCH 10S	
BODY	5. Type of Body			GLOBE		GLOBE		GLOBE		GLOBE	
	6. Body Size	Port Size		1.5"		1-1/8"		1.5"		1-1/8"	
	7. Guiding	No. of Ports		STEM		1		STEM		1	
	8. End Conn. & Rating			300 LB RF		150 LB RF		150 LB RF		150 LB RF	
	9. Body Material			316 SST		316 SST		316 SST		316 SST	
	10. Packing Material			GRAPHITE		PTFE V-RING		PTFE V-RING		PTFE V-RING	
	11. Lubricator	Isolating Valve		NONE		NONE		NONE		NONE	
	12. Bonnet Type			CAST EXTENSION		PLAIN		PLAIN		PLAIN	
	13. Trim Form			EQUAL PERCENT		EQUAL PERCENT		EQUAL PERCENT		EQUAL PERCENT	
	14. Trim Material	Seat\Plug		316 SST		316 SST		316 SST		316 SST	
		Shaft Mtl.		316 SST		316 SST		316 SST		316 SST	
	15. Required Seat Tightness			IV		IV		IV		IV	
16. Max. Allow. Sound Level dBA			85		85		85		85		
ACTUATOR	17. Model No. & Size			667-40		667-30		667-30		667-30	
	18. Type of Actuator			DIAPHRAGM		DIAPHRAGM		DIAPHRAGM		DIAPHRAGM	
	19. Close at	Open at		3 PSI		15 PSI		3 PSI		15 PSI	
	20. Flow Action to			OPEN		OPEN		OPEN		OPEN	
	21. Fail Position			CLOSE		CLOSE		CLOSE		CLOSE	
	22. Handwheel & Location			NONE		NONE		NONE		NONE	
POSITIONER	23. MFR. & Model No.			FISHER 35821		FISHER 35821		FISHER 35821		FISHER 35821	
	24. Filt. Reg	Gages		Bypass		YES		YES		YES	
	25. Input Signal			4-20 mADC		4-20 mADC		4-20 mADC		4-20 mADC	
	26. Air Supply Pressure			20 PSIG		20 PSIG		20 PSIG		20 PSIG	
TRANSDUCER	27. Make & Model No.										
	28. Input Signal										
	29. Output Signal										
SERVICE	30. Flow Units			LB\HR		LB\HR		LB\HR		LB\HR	
	31. Fluid			SUPERHEAT STM		H2O & AMMONIA		H2O & AMMONIA		H2O & AMMONIA	
	32. Quant. Max.	Cg (Cs)		1500		(24.1)		513		173.24	
	33. Quant. Oper.	Cg (Cs)		1043		(16.8)		330		111.65	
	34. Valve Cg(Cs)	Valve C1		(42.1)		33.4		842		33.4	
	35. Norm. Inlet Press.	Delta P		92 PSIG		15		52 PSIG		17	
	36. Max. Inlet Press.			200 PSIG		52 PSIG		52 PSIG		52 PSIG	
	37. Max. Shut Off Delta P			92 PSID		52 PSID		52 PSIG		52 PSIG	
	38. Temp. Max.	Operating		490 F		434 F		300 F		217 F	
	39. Density lb/cf	Mol. Wt.		-----		--		0.19		--	
	40. Oper. Visc.	% Flash		.017 CP		--		.013 CP		--	
	41. % Superheat	% Solids		--		--		--		--	
	42. Vapor Press.	Crit. Press		-----		-----		-----		-----	
	43. Predicted Sound Level dBA			<64 dBA		<61 dBA		<61 dBA		<61 dBA	
44. Manufacturer			FISHER CTRLS		FISHER CTRLS		FISHER CTRLS		FISHER CTRLS		
45. Model No.			1.5"-667-CE		1.5"-667-CE		1.5"-667-CE		1.5"-667-CE		

NOTES: 1. Vendor to supply valve calculations & stainless steel instrument tags.  
 2. All tubing and fittings shall be 316 stainless steel.  
 3. Vendor shall mount and tube 546 I/P transducer.  
 4. Vendor shall supply 67 AFR mounted and tubed.  
 5. Separable flange-type valve. Flanges to be carbon steel. 6. (\*) Actuator size by Vendor.

ISA S20 GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		CONTROL VALVES						SHEET 2 OF 2		
		NO.	BY	DATE	REVISION			SPEC. NO.		REV.
		1	SCH	6/09/93	POSITIONER			7877-102		2
		2	SCH	7/23/93	TEMP ACV-109			6J-7877		DATE 3-03-93
								REQ. P.O.		
								BY SH	CHK'D	APPR.
GENERAL	1. Tag No.			1CCF-ACV-102		1CCF-ACV-105		1CCF-ACV-109		
	2. Service			STRIPPER EFFLUENT		STRIPPER OVERHEAD		STRIPPER BOTTOMS		
	3. Line No. \ Vessel No.			1"-P-107-CSP		3"-P-104-CSP		1"-P-109-CSP		
	4. Line Size \ Sched. No.			1"/SCH 10S		3"/SCH 10S		1"/SCH 10S		
BODY	5. Type of Body			GLOBE		GLOBE		GLOBE		
	6. Body Size \ Port Size			1"	3/4"	2"	1-1/2"	1"	3/4"	
	7. Guiding \ No. of Ports			STEM	1	STEM	1	STEM	1	
	8. End Conn. & Rating			150 LB RF		150 LB RF		150 LB RF		
	9. Body Material			316 SST		316 SST		316 SST		
	10. Packing Material			PTFE V-RING		PTFE V-RING		PTFE V-RING		
	11. Lubricator \ Isolating Valve			NONE	NONE	NONE	NONE	NONE	NONE	
	12. Bonnet Type			PLAIN		PLAIN		PLAIN		
	13. Trim Form			EQUAL PERCENT		EQUAL PERCENT		EQUAL PERCENT		
	14. Trim Material \ Seat \ Plug			316 SST		316 SST		316 SST		
				Shaft Mtl.		316 SST		316 SST		
	15. Required Seat Tightness			IV		IV		IV		
	16. Max. Allow. Sound Level dBA			85		85		85		
ACTUATOR	17. Model No. & Size			667-30		657-30		667-30		
	18. Type of Actuator			DIAPHRAGM		DIAPHRAGM		DIAPHRAGM		
	19. Close at \ Open at			3 PSI	15 PSI	15 PSI	3 PSI	3 PSI	15 PSI	
	20. Flow Action to			OPEN		OPEN		OPEN		
	21. Fail Position			CLOSE		OPEN		CLOSE		
	22. Handwheel & Location			NONE		NONE		NONE		
POSITIONER	23. MFR. & Model No.			FISHER 3582I		FISHER 3582I		FISHER 3582I		
	24. Filt. Req \ Gages \ Bypass			YES	YES	YES	YES	YES	YES	
	25. Input Signal			4-20 mADC		4-20 mADC		4-20 mADC		
	26. Air Supply Pressure			20 PSIG		20 PSIG		20 PSIG		
TRANSDUCER	27. Make & Model No.									
	28. Input Signal									
	29. Output Signal									
SERVICE	30. Flow Units			GPM		LB\HR		GPM		
	31. Fluid			H2O/TRACE NH3		16%H2O 84%NH3		H2O/TRACE NH3		
	32. Quant. Max. \ Cv (Cg)			9.5	4.119	1500	(602)	9.5	4.053	
	33. Quant. Oper. \ Cv (Cg)			6.47	2.371	992.3	(398)	6.7	2.854	
	34. Valve Cv(Cg) \ Valve C1			10.9	0.95	(1490)	32.6	10.9	0.95	
	35. Norm. Inlet Press. \ Delta P			61 PSIG	5	65 PSIG	10	66 PSIG	5	
	36. Max. Inlet Press.			61 PSIG		65 PSIG		66 PSIG		
	37. Max. Shut Off Delta P			61 PSID		65 PSID		66 PSIG		
	38. Temp. Max. \ Operating			300 F	247 F	300 F	217 F	312 F	280 F	
	39. Density lb/cf \ Mol. Wt.			58.88	--	0.19	--	56.96	--	
	40. Oper. Visc. \ % Flash			.174 CP	--	.013 CP	--	.174 CP	--	
	41. % Superheat \ % Solids			--	--	--	--	--	--	
	42. Vapor Press. \ Crit. Press			-----	-----	-----	-----	-----	-----	
	43. Predicted Sound Level dBA			<70 dBA		<70 dBA		<70 dBA		
44. Manufacturer			FISHER CTRLS		FISHER CTRLS		FISHER CTRLS			
45. Model No.			1"-667-CE		2"-657-CE		1"-667-CE			

NOTES: 1. Vendor to supply valve calculations & stainless steel instrument tags.  
 2. All tubing and fittings shall be 316 stainless steel.  
 3. Vendor shall mount and tube 546 I/P transducer.  
 4. Vendor shall supply 67 Ark mounted and tubed.  
 5. Separable flange-type valve. Flanges to be carbon steel.      6. (\*) Actuator size by vendor.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESS. CONTROL VALVES PILOTS & REGS.				SHEET 1 OF 4				
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-103		REV. 0		
						CONTRACT 6J-7877		DATE 3-03-92		
						REQ. P.O.				
						BY	CHK'D	APPR.		
GENERAL	1.	Tag No.	1CCF-PRV-1019		1CCF-PRV-2019		1CCF-PRV-3019		1CCF-PRV-127	
	2.	Service	Instr Air		Instr Air		Instr Air		Instr Air	
	3.	Line No.\Vessel No.	IA-1200-CSA		IA-2200-CSA		IA-3200-CSA		IA-500-CSA	
	4.	Line Size\Sched. No.	1/2" Sch 40		1/2" Sch 40		1/2" Sch 40		1/2" Sch 40	
	5.	Function	Press Reducing		Press Reducing		Press Reducing		Press Reducing	
BODY	6.	Type of Body	Regulator		Regulator		Regulator		Regulator	
	7.	Body Size   Port Size	1/2"   1/2"	1/2"   1/2"	1/2"   1/2"	1/2"   1/2"	1/2"   1/2"	1/2"   1/2"	1/2"   1/2"	
	8.	Guiding   No. of Ports	Post   1	Post   1	Post   1	Post   1	Post   1	Post   1	Post   1	
	9.	End Conn. & Rating	1/2" NPTF		1/2" NPTF		1/2" NPTF		1/2" NPTF	
	10.	Body Material	ZINC BOWL		ZINC BOWL		ZINC BOWL		ZINC BOWL	
	11.	Packing Material	None		None		None		None	
	12.	Lubricator   Isolating Valve								
	13.	Seal Type								
	14.	Trim Form								
	15.	Trim Material								
	16.	Seat/Plug Material								
	17.	Required Seat Tightness								
	18.	Max. Allow. Sound Level dBA								
ACTUATOR \ PILOT	19.	Type of Actuator								
	20.	Spring Part Number								
	21.	Spring Color								
	22.	Self Cont.   Ext. Conn.								
	23.	Diaphragm Material								
	24.	Diaphragm Rating								
	25.	Spring Range	0 To 30 psig		0 To 30 psig		0 To 30 psig		0 To 30 psig	
	26.	Set Point	20 psig		20 psig		20 psig		20 psig	
ACCESSORIES	27.	Filt. Reg.   Output Gage	---	---	---	---	---	---	---	
	28.	Line Strainer	----	----	----	----	----	----	----	
	29.	Housing Vent								
	30.	Internal Relief								
SERVICE	31.	Flow Units	SCFM		SCFM		SCFM		SCFM	
	32.	Fluid	AIR		AIR		AIR		AIR	
	33.	Quant. Max.   Cv	10 SCFM		10 SCFM		10 SCFM		10 SCFM	
	34.	Quant. Oper.   Cv	0.5SCFM		0.5SCFM		0.5SCFM		0.5SCFM	
	35.	Valve Cv   Valve FL								
	36.	Norm. Inlet Press.   Delta P	110psig	90 psi	110psig	90 psi	110psig	90 psi	110psig	90 psi
	37.	Max. Inlet Press.	125 psig		125 psig		125 psig		125 psig	
	38.	Max. Shut Off Delta P	125 psig		125 psig		125 psig		125 psig	
	39.	Temp. Max.   Operating	110 F	68 F	110 F	68 F	110 F	68 F	110 F	68 F
	40.	Oper. Sp. Gr.   Mol. Wt.		29		29		29		29
	41.	Oper. Visc.   % Flash	0.18 CP		0.18 CP		0.18 CP		0.18 CP	
	42.	% Superheat   % Solids								
	43.	Vapor Press.   Crit. Press								
	44.	Predicted Sound Level dBA								
45.	Manufacturer	WATTS		WATTS		WATTS		WATTS		
46.	Model No.	B11-04		B11-04		B11-04		B11-04		

NOTES: 1. Vendor to supply stainless steel instruments tags.  
2. Vendor to verify spring ranges and part nos.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESS. CONTROL VALVES PILOTS & REGS.				SHEET 2 OF 4			
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-103		REV. 0	
						CONTRACT 6J-7877		DATE 3-03-92	
						REQ. P.O.			
						BY	CHK'D	APPR.	
GENERAL	1.	Tag No.	1CCF-PRV-058						
	2.	Service	Instr Air						
	3.	Line No.\Vessel No.	1CCF-TNK-1						
	4.	Line Size\Sched. No.	1/2" Sch 40						
	5.	Function	Press Reducing						
BODY	6.	Type of Body	Regulator						
	7.	Body Size	Port Size	1/2"	1/2"				
	8.	Guiding	No. of Ports	Post	1				
	9.	End Conn. & Rating	1/2" NPTF						
	10.	Body Material	ZINC BOWL						
	11.	Packing Material	None						
	12.	Lubricator	Isolating Valve						
	13.	Seal Type							
	14.	Trim Form							
	15.	Trim Material							
	16.	Seat/Plug Material							
	17.	Required Seat Tightness							
	18.	Max. Allow.Sound Level dBA							
ACTUATOR\ PILOT	19.	Type of Actuator							
	20.	Spring Part Number							
	21.	Spring Color							
	22.	Self Cont.	Ext. Conn.						
	23.	Diaphragm Material							
	24.	Diaphragm Rating							
	25.	Spring Range	0 To 30 psig						
	26.	Set Point	20 psig						
ACCESSORIES	27.	Filt. Reg.	Output Gage	---	---	---	---	---	
	28.	Line Strainer	----		----	----	----	----	
	29.	Housing Vent							
	30.	Internal Relief							
SERVICE	31.	Flow Units	SCFM						
	32.	Fluid	AIR						
	33.	Quant. Max.	Cv	10 SCFM					
	34.	Quant. Oper.	Cv	0.5SCFM					
	35.	Valve Cv	Valve FL						
	36.	Norm. Inlet Press.	Delta P	110psig	90 psi				
	37.	Max. Inlet Press.	125 psig						
	38.	Max. Shut Off	Delta P	125 psig					
	39.	Temp. Max.	Operating	110 F	68 F				
	40.	Oper. Sp. Gr.	Mol. Wt.	29					
	41.	Oper. Visc.	% Flash	0.18 CP					
	42.	% Superheat	% Solids						
	43.	Vapor Press.	Crit. Press						
	44.	Predicted Sound Level dBA							
45.	Manufacturer	WATTS							
46.	Model No.	B11-04							

NOTES:1. Vendor to supply stainless steel instruments tags.  
2. Vendor to verify spring ranges and part nos.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESS. CONTROL VALVES PILOTS & REGS.				SHEET 3 OF 4		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	
						7877-103	0	
						CONTRACT	DATE	
						6J-7877	3-03-93	
		REQ. P.O.						
		BY		CHK'D		APPR.		
GENERAL	1.	Tag No.	1CCF-PRV-060					
	2.	Service	Steam					
	3.	Line No.\Vessel No.	STM-201-CSL					
	4.	Line Size\Sched. No.	1-1/2" SCH 80					
	5.	Function	Press Reducing					
BODY	6.	Type of Body	Regulator					
	7.	Body Size	Port Size	1"	9/16"			
	8.	Guiding	No. of Ports	Post	1			
	9.	End Conn. & Rating	300 lb RF					
	10.	Body Material	Carbon Steel					
	11.	Packing Material	None					
	12.	Lubricator	Isolating Valve					
	13.	Seal Type	Diaphragm					
	14.	Trim Form	Std					
	15.	Trim Material	416 St Stl					
	16.	Seat/Plug Material	416 St Stl					
	17.	Required Seat Tightness						
	18.	Max. Allow.Sound Level dBA						
ACTUATOR\PILOT	19.	Type of Actuator	Pilot/Spring					
	20.	Spring Part Number	1E3927 27142					
	21.	Spring Color	Red					
	22.	Self Cont.	Ext. Conn.		Yes			
	23.	Diaphragm Material	St Stl					
	24.	Diaphragm Rating						
	25.	Spring Range	20-150 psig					
	26.	Set Point	110 psig					
ACCESSORIES	27.	Filt. Reg.	Output Gage	---	---			
	28.	Line Strainer	By Others					
	29.	Housing Vent						
	30.	Internal Relief	No					
SERVICE	31.	Flow Units	lb/Hr					
	32.	Fluid	Steam					
	33.	Quant. Max.	Cv	1400				
	34.	Quant. Oper.	Cv	1050	5.71			
	35.	Valve Cs	Valve C1	8.5	34			
	36.	Norm. Inlet Press.	Delta P	200psig	90 psi			
	37.	Max. Inlet Press.	300 psig					
	38.	Max. Shut Off	Delta P	300 psig				
	39.	Temp. Max.	Operating	550 F	490 F			
	40.	Oper. Sp. Gr.	Mol. Wt.	18				
	41.	Oper. Visc.	% Flash					
	42.	% Superheat	% Solids					
	43.	Vapor Press.	Crit. Press					
	44.	Predicted Sound Level dBA						
45.	Manufacturer	FISHER CTRLS.						
46.	Model No.	92C						

NOTES:1. Vendor to supply stainless steel instruments tags.  
2. Vendor to verify spring ranges and part nos. 3. Loading Pressure Tubing to be 316 St Stl  
4. Down stream control line connection is 1/4" NPT

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESS. CONTROL VALVES PILOTS & REGS.				SHEET 4 OF 4		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	
		1	SCH	6/09/93	ADDED TAG NO.	7877-103	1	
						CONTRACT	DATE	
					6J-7877	3-25-93		
					REQ. P.O.			
					BY	CHK'D	APPR.	
GENERAL	1.	Tag No.	1CCF-PRV-089					
	2.	Service	Effluent					
	3.	Line No.\Vessel No.	1"-P-107-CSP					
	4.	Line Size\Sched. No.	1" SCH 40					
	5.	Function	Back Pressure					
BODY	6.	Type of Body	Regulator					
	7.	Body Size	Port Size	1"	1"			
	8.	Guiding	No. of Ports					
	9.	End Conn. & Rating	Screwed NPT					
	10.	Body Material	St. Stl.					
	11.	Packing Material	None					
	12.	Lubricator	Isolating Valve					
	13.	Seal Type	Diaphragm					
	14.	Trim Form	Std					
	15.	Trim Material	316 St Stl					
	16.	Seat/Plug Material	316 St Stl					
	17.	Required Seat Tightness						
	18.	Max. Allow. Sound Level dBA						
ACTUATOR\PILOT	19.	Type of Actuator						
	20.	Spring Part Number						
	21.	Spring Color						
	22.	Self Cont.	Ext. Conn.					
	23.	Diaphragm Material	316 St Stl					
	24.	Diaphragm Rating						
	25.	Spring Range	2-12 psig					
	26.	Set Point	2 psig					
ACCESSORIES	27.	Filt. Reg.	Output Gage	---	---			
	28.	Line Strainer						
	29.	Housing Vent						
	30.	Internal Relief	No					
SERVICE	31.	Flow Units	gpm					
	32.	Fluid	Water					
	33.	Quant. Max.	Cv	8	1.32			
	34.	Quant. Oper.	Cv	5	0.83			
	35.	Valve Cs	Valve C1					
	36.	Norm. Inlet Press.	Delta P	50psig	48 psi			
	37.	Max. Inlet Press.	50 psig					
	38.	Max. Shut Off	Delta P	50 psig				
	39.	Temp. Max.	Operating		247 F			
	40.	Oper. Sp. Gr.	Mol. Wt.		18			
	41.	Oper. Visc.	% Flash					
	42.	% Superheat	% Solids					
	43.	Vapor Press.	Crit. Press					
	44.	Predicted Sound Level dBA						
45.	Manufacturer	MASONEILAN						
46.	Model No.	17-17						

NOTES:1. Vendor to supply stainless steel instruments tags.



Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		DIFFERENTIAL PRESSURE INSTRUMENTS			SHEET 1 OF 5			
		NO.	BY	DATE	REVISION	SPEC NO.	REV.	
		1	SCH	06/09/93	MODEL NO.	7877-104	1	
						CONTRACT 6J-7877	DATE 2-12-93	
		REQ. P.O.						
		BY	SH	CHK'D	APPR.			
1. Tag:SEE SHEET 2		Service: SEE SHEET 2						
GENERAL	2. Function	Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input checked="" type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____						
	3. Case	MFR STD <input checked="" type="checkbox"/> Nom Size _____ Color: MFR STD <input checked="" type="checkbox"/> Other _____						
	4. Mounting	Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input type="checkbox"/> Other <input type="checkbox"/>						
	5. Enclosure Class	General Purpose <input type="checkbox"/> Weather Proof <input type="checkbox"/> Explosion Proof <input checked="" type="checkbox"/> Class 1, Group D, Division 2 _____ For Use in Intrinsically Safe System <input type="checkbox"/> Other _____						
	6. Power Supply	117 V 60Hz <input type="checkbox"/> Other ac _____ dc <input checked="" type="checkbox"/> 24 Volts, 2 Wire						
	7. Chart	12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____						
	8. Chart Drive	24 Hr Other _____ Elect. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____						
	9. Scales	Type _____ Range 1 _____ 2 _____ 3 _____						
	XMTR	10. Transmitter Output	4-20mA <input checked="" type="checkbox"/> 10-50mA <input type="checkbox"/> 21-103kPa(3-15psig) <input type="checkbox"/> Other _____ For Receiver See Spec. Sheet _____					
CONTROLLER	11. Control Modes	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast I <input type="checkbox"/> f <input type="checkbox"/> D <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> Is <input type="checkbox"/> Ds <input type="checkbox"/> Other _____						
	12. Action	On Meas. Increase Output: Increases <input type="checkbox"/> Decreases <input type="checkbox"/>						
	13. Auto-Man Switch	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____						
	14. Set Point Adj.	Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____						
	15. Manual Reg	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____						
	16. Output	4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa(3-15 psig) <input type="checkbox"/> Other _____						
UNIT	17. Service	Flow <input checked="" type="checkbox"/> Level <input type="checkbox"/> Diff. Pressure <input type="checkbox"/> Other _____						
	18. Element Type	Diaphragm <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Mercury <input type="checkbox"/> Other _____						
	19. Material	Body: 316SS Element: 316SS						
	20. Rating	Ovrrange: 3000 psig Body Range: 3000 psig						
	21. Range	Fixed <input type="checkbox"/> Adj. Range: 25 & 150 in H2O Set at: SEE SHEET 2						
	22.	Elevation: _____ Suppression: _____						
	23. Process Data	Fluid: NH3/H2O VAPOR Max Temp: 217 F Max Press: 69 PSIA						
	24. Process Conn.	1 1/2 in. NPT <input type="checkbox"/> Other <input checked="" type="checkbox"/> Mount directly to Wedge Element-NOTE 2						
	25. Alarm Switches	Quantity _____ Form _____ Rating _____						
	26. Function	Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas						
	27. Options	Pressure Element <input type="checkbox"/> Range _____ Material: _____ Temp. Element <input type="checkbox"/> Range _____ Type _____  Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/> Valve Manifold: Supplied by Glitsch, ref spec 7877-119 Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> Integrator _____ Other _____						
	22. MFR & Model No.	FOXBORO 823DP-13S1SM2						

Notes: 1. Vendor to supply Calibration Data Sheet and SS tags for instruments.  
2. Refer to spec no.7877-106 for Wedge flow element details.



GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054	DIFFERENTIAL PRESSURE INSTRUMENTS				SHEET 3 OF 5	
	NO.	BY	DATE	REVISION	SPEC NO. 7877-I04	REV. 2
	1	SCH	06/09/93	PROCESS CONN., MODEL #	CONTRACT 6J-7877	DATE 2-12-93
	2	SCH	07/23/93	ADDED EQUIV. FLOW		
						REQ. P.O.
			BY SH	CHK'D	APPR.	

	1. Tag: LCCF-FT-104	Service: STEAM TO AMMONIA STRIPPER
GENERAL	2. Function	Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input checked="" type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____
	3. Case	MFR STD <input checked="" type="checkbox"/> Nom Size _____ Color: MFR STD <input checked="" type="checkbox"/> Other _____
	4. Mounting	Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input type="checkbox"/> Other <input type="checkbox"/>
	5. Enclosure Class	General Purpose <input type="checkbox"/> Weather Proof <input type="checkbox"/> Explosion Proof <input checked="" type="checkbox"/> Class I, Group D, Division 2 _____ For Use in Intrinsically Safe System <input type="checkbox"/> Other _____
	6. Power Supply	117 V 60Hz <input type="checkbox"/> Other ac _____ dc <input checked="" type="checkbox"/> 24 Volts, 2 Wire
	7. Chart	12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____
	8. Chart Drive	24 Hr Other _____ Elect. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____
	9. Scales	Type _____ Range 1 _____ 2 _____ 3 _____
	XMTR	10. Transmitter Output
CONTROLLER	11. Control Modes	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast If <input type="checkbox"/> Df <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> Is <input type="checkbox"/> Ds <input type="checkbox"/> Other _____
	12. Action	On Meas. Increase Output: Increases <input type="checkbox"/> Decreases <input type="checkbox"/>
	13. Auto-Man Switch	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____
	14. Set Point Adj.	Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____
	15. Manual Req	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____
	16. Output	4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa(3-15 psig) <input type="checkbox"/> Other _____
UNIT	17. Service	Flow <input checked="" type="checkbox"/> Level <input type="checkbox"/> Diff. Pressure <input type="checkbox"/> Other _____
	18. Element Type	Diaphragm <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Mercury <input type="checkbox"/> Other _____
	19. Material	Body: C.S. Element: 316SS
	20. Rating	Overrange: 3000 psig Body Range: 3000 psig
	21. Range	Fixed <input type="checkbox"/> Adj. Range: 25 & 150 in H2O Set at: 80.32 in H2O (3)
	22.	Elevation: _____ Suppression: _____
	23. Process Data	Fluid: STEAM Max Temp: 434 F Max Press: 110 psia
	24. Process Conn.	1/2 in. NPT <input checked="" type="checkbox"/> Other <input type="checkbox"/>
	25. Alarm Switches	Quantity _____ Form _____ Rating _____
	26. Function	Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas
	27. Options	Pressure Element <input type="checkbox"/> Range _____ Material: _____ Temp. Element <input type="checkbox"/> Range _____ Type _____  Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/> Valve Manifold: Supplied by Glitsch, ref spec 7877-I19 Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> Integrator _____ Other _____
	22. MFR & Model No.	FOXBORO 823DP-I3K1SH2-B

Notes: 1. Vendor to supply Calibration Data Sheet and SS tags for instruments.  
 2. Refer to spec no. 7877-I06 for Wedge Flow Element Details.  
 3. Equivalent flow rate: 1500 lbs/hr.

ISA FORM S20.20a

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		DIFFERENTIAL PRESSURE INSTRUMENTS				SHEET 4 OF 5		
		NO.	BY	DATE	REVISION	SPEC NO.	REV.	
		1	SCH	06/09/93	MODEL NO.	7877-104	1	
						CONTRACT 6J-7877	DATE 2-12-93	
						REQ. P.O.		
						BY SH	CHK'D	
							APPR.	
	1. Tag:	1CCF-LT-102						
	2. Function	Service: AMMONIA STRIPPER 1CCF-VSL-1 LEVEL						
GENERAL	3. Case	Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input checked="" type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____						
	4. Mounting	MFR STD <input checked="" type="checkbox"/> Nom Size _____ Color: MFR STD <input checked="" type="checkbox"/> Other _____						
	5. Enclosure Class	Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input checked="" type="checkbox"/> Other <input type="checkbox"/> 2" PIPE General Purpose <input type="checkbox"/> Weather Proof <input type="checkbox"/> Explosion Proof <input checked="" type="checkbox"/> Class I, Group D, Division 2 _____ For Use in Intrinsically Safe System <input type="checkbox"/> Other _____						
	6. Power Supply	117 V 60Hz <input type="checkbox"/> Other ac _____ dc <input checked="" type="checkbox"/> 24 Volts, 2 Wire						
	7. Chart	12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____						
	8. Chart Drive	24 Hr Other _____ Elect. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____						
	9. Scales	Type _____ Range 1 _____ 2 _____ 3 _____						
	XMTR	10. Transmitter Output	4-20mA <input checked="" type="checkbox"/> 10-50mA <input type="checkbox"/> 21-103kPa(3-15psig) <input type="checkbox"/> Other _____ For Receiver See Spec. Sheet _____					
		11. Control Modes	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast I <input type="checkbox"/> D <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> Is <input type="checkbox"/> Ds <input type="checkbox"/> Other _____					
CONTROLLER	12. Action	On Meas. Increase Output: Increases <input type="checkbox"/> Decreases <input type="checkbox"/>						
	13. Auto-Man Switch	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____						
	14. Set Point Adj.	Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____						
	15. Manual Reg	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____						
	16. Output	4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa(3-15 psig) <input type="checkbox"/> Other _____						
UNIT	17. Service	Flow <input type="checkbox"/> Level <input checked="" type="checkbox"/> Diff. Pressure <input type="checkbox"/> Other _____						
	18. Element Type	Diaphragm <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Mercury <input type="checkbox"/> Other _____						
	19. Material	Body: 316SS Element: 316SS						
	20. Rating	Overrange: _____ Body Range: 2000 psig						
	21. Range	Fixed <input type="checkbox"/> Adj. Range: 25 & 150 in H2O Set at: -43.68 TO 0 in H2O NOTE 1						
	22.	Elevation: _____ Suppression: _____						
	23. Process Data	Fluid: NH3/H2O Max Temp: 312 F Max Press: 80 PSIA S.G.=0.91						
	24. Process Conn.	1 1/2 in. NPT <input checked="" type="checkbox"/> Other <input type="checkbox"/>						
25. Alarm Switches	Quantity _____ Form _____ Rating _____							
26. Function	Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas							
27. Options	Pressure Element <input type="checkbox"/> Range _____ Material: _____ Temp. Element <input type="checkbox"/> Range _____ Type _____  Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/> Valve Manifold: By Glitsch - ref spec 7877-119 Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> Integrator _____ Other _____							
22.	MFR & Model No.	FOXBORO 823DP-13S1SM2-M						

Notes: 1. Equivalent to 48 inches of liquid, SG=0.91

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
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GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		DIFFERENTIAL PRESSURE INSTRUMENTS			SHEET 5 OF 5		
		NO.	BY	DATE	REVISION	SPEC NO.	REV.
		1	SCH	04/07/93	SET RANGE	7877-104	2
2	SCH	06/09/93	MODEL NO.	CONTRACT 6J-7877	DATE 2-12-93		
				REQ. P.O.			
				BY SH	CHK'D	APPR.	
1. Tag: ICCF-PDT-103		Service: AMMONIA STRIPPER ICCF-VSL-1 DIFFERENTIAL PRESSURE					
GENERAL	2. Function	Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input checked="" type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____					
	3. Case	MFR STD <input checked="" type="checkbox"/> Nom Size _____ Color: MFR STD <input checked="" type="checkbox"/> Other _____					
	4. Mounting	Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input type="checkbox"/> Other <input checked="" type="checkbox"/> 2" PIPE					
	5. Enclosure Class	General Purpose <input type="checkbox"/> Weather Proof <input type="checkbox"/> Explosion Proof <input checked="" type="checkbox"/> Class I, Group D, Division 2 _____ For Use in Intrinsically Safe System <input type="checkbox"/> Other _____					
	6. Power Supply	117 V 60Hz <input type="checkbox"/> Other ac _____ dc <input checked="" type="checkbox"/> 24 Volts, 2 Wire					
	7. Chart	12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____					
	8. Chart Drive	24 Hr Other _____ Elect. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____					
	9. Scales	Type _____ Range 1 _____ 2 _____ 3 _____					
	XMTR	10. Transmitter Output	4-20mA <input checked="" type="checkbox"/> 10-50mA <input type="checkbox"/> 21-103kPa(3-15psig) <input type="checkbox"/> Other _____ For Receiver See Spec. Sheet _____				
CONTROLLER	11. Control Modes	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast I <input type="checkbox"/> D <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> Is <input type="checkbox"/> Ds <input type="checkbox"/> Other _____					
	12. Action	On Meas. Increase Output: Increases <input type="checkbox"/> Decreases <input type="checkbox"/>					
	13. Auto-Man Switch	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	14. Set Point Adj.	Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____					
	15. Manual Reg	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	16. Output	4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa(3-15 psig) <input type="checkbox"/> Other _____					
UNIT	17. Service	Flow <input type="checkbox"/> Level <input type="checkbox"/> Diff. Pressure <input checked="" type="checkbox"/> Other _____					
	18. Element Type	Diaphragm <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Mercury <input type="checkbox"/> Other _____					
	19. Material	Body: 316SS Element: 316SS					
	20. Rating	Overrange: 3000 psig Body Range: 3000 psig					
	21. Range	Fixed <input type="checkbox"/> Adj. Range: 25 & 150 in H2O Set at: 0-60" in H2O					
	22.	Elevation: _____ Suppression: _____					
	23. Process Data	Fluid: NH3/H2O VAPOR Max Temp: 400 F Max Press: 150 psig					
	24. Process Conn.	1/2 in. NPT <input checked="" type="checkbox"/> Other <input type="checkbox"/>					
25. Alarm Switches	Quantity _____ Form _____ Rating _____						
26. Function	Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas						
	27. Options	Pressure Element <input type="checkbox"/> Range _____ Material: _____ Temp. Element <input type="checkbox"/> Range _____ Type _____					
	Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/>						
	Valve Manifold: Supplied by Glitsch, ref spec 7877-119						
	Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> Integrator _____ Other _____						
22.	MFR & Model No.	FOXBORO 823DP-13S1SM2-M					
Notes: 1. Vendor to supply Calibration Data Sheet and SS tags for instruments.							

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		MAGNETIC FLOWMETERS				SHEET 1 OF 1	
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.
		1	SCH	6/09/93	CONN.TYPE	7877-105	1
						CONTRACT 6J-7877	DATE 2-12-93
						REQ. P.O.	
		BY		CHK'D	APPR.		
GENERAL	1.	Meter Tag No.	1CCF FE-101				
	2.	Service	Column Feed				
	3.	Location	P-111-SSC				
METERING ELEMENT	4.	CONN'S.	Line Size,Sched.	1-1/2" Sch 10			
	5.		Line Material	316SS			
	6.		Connection Type	1"150# RF FLG.			
	7.		Connection Mat'ls	316SS			
	8.	METER	Tube Material	304 SS			
	9.		Liner Material	PTFE			
	10.		Electrode Type	Standard			
	11.		Electrode Mat'l	316LSS			
	12.		Meter Casing	X-Proof			
	13.		Power Sup Elect Code	120VAC	I,D.2		
	14.		Grounding Type & Mtl	Through Bolts			
	15.	Enclosure Class	NEMA 4-7				
	16.	Nominal Diameter	1"				
	17.	FLUID	Fluid	Water & NH3			
	18.		Max. Flow,Units	14 GPM			
	19.		Max. Velocity, Units	5.72 FT/S			
	20.		Norm Flow Min Flow	7 GPM	2.3 GPM		
21.	Max. Temp Min. Temp		110 F	75 F			
22.	Max Press Min. Press		150psi	0 psig			
23.	Min Fluid Conduct.		2mS/cm				
24.	Vacuum Possibility		NONE				
25.							
ASSOCIATED INSTRUMENT	26.	Instrument Tag Number	1CCF-FT-101				
	27.	Function	Transmitter				
	28.	Mounting	Integral				
	29.	Enclosure	NEMA 4/7				
	30.	Length Signal Cable	None				
	31.	Type Span Adjustment					
	32.	Power Supply	120 VAC				
	33.	TRANS.	Transmitter Output	4 to 20 mA			
	34.						
	35.	DISPLAY	Scale Size	Range	--	---	
	36.		Chart Drive	Speed	--	---	
	37.		Chart Range	Chart#	--	---	
	38.		Integrator	-----			
	39.	CONTR.	Modes	Output	--	---	
	40.		Action	Auto-Man.	--	---	
41.		-----					
42.	ALARM	Contact No	Form	--	---		
43.		Rating Elec. Code	--	---			
44.		Action	-----				
45.	Manufacturer	Foxboro					
46.	Meter Model Number	2801-SABB-TSF-L					
47.	Transmitter Model Number	896-TA-A					

Notes: 1. Vendor to supply stainless steel instrument tag, FM label for Cl1- Grp C/D Div. 2 Area and Certified System Calibration with flow tube and transmitter calibrated together.  
2. Zinc, copper or copper bearing alloys are not permitted in contact with the process fluid.



Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
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GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054	ORIFICE PLATES and FLANGES			SHEET 1 OF 1		
	NO.	BY	DATE	REVISION	SPEC. NO.	REV.
	1	SCH	3/23/93	FLG.MAT.,PRESS.	7877-107	2
	2	SCH	3/25/93	PIPE SIZE	CONTRACT 6J-7877	DATE 3-23-93
					REQ. P.O.	
				BY SH	CHK'D	APPR.

<b>ORIFICE PLATES</b> 1. Concentric <input checked="" type="checkbox"/> Other _____ 2. ISA Standard <input checked="" type="checkbox"/> Other: _____ 3. Bore: Maximum Rate <input type="checkbox"/> Nearest 1/8 in. 4. Material: 304SS <input type="checkbox"/> 316SS <input checked="" type="checkbox"/> Other: _____ 5. Ring Material & Type: _____ 6. MFR. & Model No.: PEK-PADDLE TYPE	<b>ORIFICE FLANGES</b> 7. Taps: Flange <input type="checkbox"/> Vena Contracta <input type="checkbox"/> Pipe <input type="checkbox"/> Other: <input checked="" type="checkbox"/> NONE 8. Tap Size: 1/2 in. <input checked="" type="checkbox"/> Other: NONE _____ 9. Type: Weld Neck <input type="checkbox"/> Slip On <input checked="" type="checkbox"/> Socket Weld <input checked="" type="checkbox"/> 10. Material: Steel <input checked="" type="checkbox"/> Other: _____ 11. Flanges included <input type="checkbox"/> By others <input checked="" type="checkbox"/> 12. Flange Rating : 1 1/2" 150# ANSI RF
--	--

FLUID DATA	13. Tag Number	1CCF-RO-114				
	14. Service	EFFLUENT				
	15. Line Number	1"-P-107-CSP				
	16. Fluid	WATER				
	17. Fluid State	LIQUID				
	18. Maximum Flow	GPM				
	19. Normal Flow	GPM	6.5			
	20. Pressure		80.0 PSIA			
	21. Temperature		247 F			
	22. Specific Gravity At Base					
	23. Operating Specific Gravity		0.944			
	24. Supercomp. Factor		---			
	25. Mol. Weight	Cp\Cv	18.0	--		
	26. Operating Viscosity		0.174 Cp			
	27. Quality % or oSuperheat		---			
28. Base Press.	Base Temp.	14.7PSIG	80 F			
30. Differential Press.(Oper)		10.0 PSI				

METER	29. Type of Meter				
	30. Diff. Range-Dry				
	31. Seal sp. gr. at 60oF				
	32. Static Press. Range				
	33. Chart or Scale Range				
34. Chart Multiplier					

PLATE & FLANGE	Type	NOTE 1			
	35. Beta=d\D	NOTE 2			
	36. Orifice Bore Diameter	NOTE 2			
	37. Line I.D.	1.049"(NOTE 3)			
	38. Flange Rating	1" 150# RF			
	39. Vent or Drain Hole	NOT REQUIRED			
40. Plate Thickness	1/8"				

NOTES: 1.) Paddle type plate with handle to project 1-1/2" minimum beyond flange O.D., with tag no. stamped in visible portion of handle.  
 2.) Vendor to calculate orifice bore diameter.  
 3.) 1" Sch. 40 pipe.



Specification Forms for Process Measurement & Control Instruments, Primary Elements and Control Valves

ISA S20 GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		LEVEL INSTR. (MAGNETIC)				SHEET 1 OF 1		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	DATE
		1	SCH	7/23/93	ADDED CALIBRTD. RANGE	3942-108	1	2-22-93
						CONTRACT 6J-7877		
						REQ. P.O.		
						BY SH	CHK'D	APPR.
BODY	1. Tag No.			1CCF-LI/LT-110				
	2. Service			AQ.NH3 STOR TK				
	3. Line No. \ Vessel No.			1CCF-TNK-1				
	4. Body Mtl			316 SS				
	Rating			600 PSIG@500 F				
	5. Conn Size & Location Upper			1"-TOP				
	Type			150# RF ANSI				
	6. Conn Size & Location Lower			1"-SIDE				
	Type			150# RF ANSI				
	7. Indicator Mounting			TOP/SIDE				
Type			MAGNETIC FLAG					
8. Hermetically Sealed			YES					
9. Orientation			RIGHT					
10. Measuring Scale			NO					
FLOAT	11. Tank Conns. CL to CL (in)			NOTES 2&4				
	12. Length of Indication			132"				
	13. Overall Length			BY MFR.				
	14. Float Material			316 SS				
	15. Level or Interface			LEVEL				
XMTR \ CONT.	16. Function			TRANSMIT				
	17. Output (5)			4-20 mADC				
	18. Control Modes			-----				
	19. Output Action: Level Rise			OUTPUT INCR.				
	20. Mounting			NOTE 3				
	21. Enclosure Class			1,D,2				
	22. Elec. Power or Air Supply			24 VDC, 2-WIRE				
	23. Model No.			NOTE 4				
SERVICE	24. Upper Liquid			H2O + AMMONIA				
	25. Lower Liquid			NONE				
	26. sp. gr.: Upper	Lower	0.920	-----				
	27. Press. (psia) Max.	Normal	40	15.86				
	28. Temp. (F) Max.	Normal	300	75				
OPTIONS	29. Switches:			NOT REQ'D				
	30. Type: Magnetic			-----				
	31. Contact Rating			-----				
	32. Latching/Non-Latching			-----				
	33. Vent Conn. Type & Rating			NONE				
	34. Drain Conn. Type & Rating			NONE				
	35.							
36. Manufacturer			GEMS (IMO)					
37. Model Number			NOTE 4					

NOTES: 1. Vendor to supply stainless steel instrument tags.  
 2. Vendor to submit dimensional data and completed data sheet with proposal.  
 3. Transmitter to be mounted 90 deg. to flag assembly.  
 4. Provide top /side version of type "B" Sure Site Transmitter to be Model No. H (Module NO. 86158) with J-Box.  
 5. Calibrated range: 4 mADC = 6"  
 20 mADC = 132"

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054	PRESSURE GAGES				SHEET 1 OF 2	
	NO.	BY	DATE	REVISION	SPEC. NO.	REV.
	1	SCH	6/09/93	ADDED PI-112	7877-110	1
					CONTRACT	DATE
					6J-7877	3-03-93
				REQ. P.O.		
				BY	CHK'D	APPR.

1. Type: Direct Rdg <input checked="" type="checkbox"/> 3-15 lb Receiver <input type="checkbox"/> Other _____ 2. Mounting: Surface <input type="checkbox"/> Local <input checked="" type="checkbox"/> Flush <input type="checkbox"/> 3. Dial: Diameter 4 1/2" Color: White 4. Case: Cast Iron <input type="checkbox"/> Aluminum <input type="checkbox"/> Phenol <input checked="" type="checkbox"/> Other _____ 5. Ring: Screwed <input checked="" type="checkbox"/> Hinged <input type="checkbox"/> Slip <input type="checkbox"/> Std <input type="checkbox"/> Other _____ 6. Blow-out Protection None <input type="checkbox"/> Back <input checked="" type="checkbox"/> Disc <input type="checkbox"/> Solid Front <input checked="" type="checkbox"/> Other _____ 7. Lens: Glass <input type="checkbox"/> Plastic <input type="checkbox"/> Laminated <input checked="" type="checkbox"/> 8. Options: Syphon <input type="checkbox"/> See Table and Notes Snubber <input type="checkbox"/> Pressure Limit Valve <input type="checkbox"/> Movement Damping _____ 9. Nominal Accuracy Required: +/- 0.5% _	10. MFR. & Model No. Ashcroft 45 1279SS04L XSG XNH 11. Press. Element: Bourdon <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Other _____ 12. Element Mtl: Bronze <input type="checkbox"/> Steel <input checked="" type="checkbox"/> 316SS <input checked="" type="checkbox"/> Other _____ 13. Socket Mtl: Bronze <input type="checkbox"/> Steel <input checked="" type="checkbox"/> 316SS <input checked="" type="checkbox"/> Other _____ 14. Connection-NPT: 1/4 in. <input type="checkbox"/> 1/2 in <input checked="" type="checkbox"/> Other _____ Bottom <input checked="" type="checkbox"/> Back <input type="checkbox"/> 15. Movement: Bronze <input type="checkbox"/> SS <input checked="" type="checkbox"/> Nylon <input type="checkbox"/> Other _____ 16. Diaphragm Seal: <input type="checkbox"/> (None Required)
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REV.	QUAN.	TAG NO.	RANGE	OPERATING PRES.	SERVICE	NOTES
0	1	1CCF-PI-110	0-30 psig	3.0 psig	1CCF-TK-1, Aqueous Ammonia Storage	1
0	1	1CCF-PI-104	0-300 psig	110 psig	1CCF-RVR-1, Vapor Reservoir Stream Jacket	1,2
0	1	1CCF-PI-115	0-300 psig	200 psig	Steam to Regulator PRV-060	1,2
0	1	1CCF-PI-116	0-300 psig	110 psig	Steam to 1CCF-VSL-1, Stripper Column	1,2
0	1	1CCF-PI-125	0-160 psig	65 psig	1CCF-RVR-1, Vapor Reservoir	1
1	1	1CCF-PI-112	0-160 psig	65 psig	Aqueous Ammonia Pump Discharge	1
0	1	1CCF-PI-1004	0-160 psig	65 psig	Ammonia Vapor to Injection Rack 1A	1
0	1	1CCF-PI-1008	0-160 psig	60 psig	Ammonia Vapor to Injection Rack 1A	1
0	1	1CCF-PI-2004	0-160 psig	65 psig	Ammonia Vapor to Injection Rack 1B	1
0	1	1CCF-PI-2008	0-160 psig	60 psig	Ammonia Vapor to Injection Rack 1B	1
0	1	1CCF-PI-3004	0-160 psig	65 psig	Ammonia Vapor to Injection Rack 1C	1
0	1	1CCF-PI-3008	0-160 psig	60 psig	Ammonia Vapor to Injection Rack 1C	1

NOTE : 1. Vendor to supply stainless steel instrument tags.  
 2. Provide with syphon, Ashcroft Type #1/4-1100A, 1/2" NPT  
 3. Zinc, copper or copper bearing alloys are not permitted in contact with the process fluid.



Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESSURE TRANSMITTERS				SHEET 1 OF 2	
		NO.	BY	DATE	REVISION	SPEC NO. 7877-111	REV. 0
						CONTRACT 6J-7877	DATE 2-22-93
						REQ. P.O.	
						BY SH	CHK'D
						APPR.	
1. Tag #:SEE SHEET 2		Service: SEE SHEET 2					
GENERAL	2. Function	Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input checked="" type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____					
	3. Case	MFR STD <input checked="" type="checkbox"/> Nom Size _____ Color: MFR STD <input checked="" type="checkbox"/> Other _____					
	4. Mounting	Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input type="checkbox"/> Other <input checked="" type="checkbox"/> Pipe Bracket					
	5. Enclosure Class	General Purpose <input type="checkbox"/> Weather Proof <input type="checkbox"/> Explosion Proof <input checked="" type="checkbox"/> Class 1, Group D, Division 2 _____					
	6. Power Supply	For Use in Intrinsically Safe System <input type="checkbox"/> Other _____ 117 V 60Hz <input type="checkbox"/> Other ac _____ dc <input checked="" type="checkbox"/> 24 Volts, 2 Wire					
	7. Chart	12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____					
	8. Chart Drive	24 Hr Other _____ Elect. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____					
	9. Scales	Type _____ Range 1 _____ 2 _____ 3 _____					
	XMTR	10. Transmitter Output	4-20mA <input checked="" type="checkbox"/> 10-50mA <input type="checkbox"/> 21-103kPa(3-15psig) <input type="checkbox"/> Other _____ For Receiver See Spec. Sheet _____				
CONTROLLER	11. Control Modes	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast If <input type="checkbox"/> Df <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> Is <input type="checkbox"/> Ds <input type="checkbox"/> Other _____					
	12. Action	On Meas. Increase Output: Increases <input type="checkbox"/> Decreases <input type="checkbox"/>					
	13. Auto-Man Switch	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	14. Set Point Adj.	Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____					
	15. Manual Reg	None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	16. Output	4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa(3-15 psig) <input type="checkbox"/> Other _____					
UNIT	17. Service	Gage Press. <input checked="" type="checkbox"/> Vacuum <input type="checkbox"/> Absolute <input type="checkbox"/> Compound <input type="checkbox"/>					
	18. Element Type	Diaphragm <input checked="" type="checkbox"/> Helix <input type="checkbox"/> Bourdon <input type="checkbox"/> Bellows <input type="checkbox"/> Other _____					
	19. Material	Body: 316 SS Element: 316 SS					
	20. Rating	Overrange: 0 to 2000 psig Body Range: 0 to 2000 psig					
	21. Range	Fixed <input type="checkbox"/> Adj. Range: 0-30 to 0-150 psig Set At: 0-150 PSIG					
	22.	Elevation: N/A Suppression: N/A					
	23. Process Data	Fluid: NH3/H2O Press: Normal-65 psig MAX-150 psig					
	24. Process Conn.	1/2 in. NPT <input checked="" type="checkbox"/> Other _____					
	25. Alarm Switches	Quantity _____ Form _____ Rating _____					
	26. Function	Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas					
	27. Options	Pressure Element <input type="checkbox"/> Range _____ Material _____ Temp. Element <input type="checkbox"/> Range _____ Type _____  Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/> _____ Charts Valve Manifold (NONE) _____ Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> Integrator _____ Other: _____					
	22. MFR & Model No.	Foxboro 821GM-1S1SM2-M					
Notes: SEE SHEET 2 OF 2 (7877-111)							





Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESSURE RELIEF VALVES				SHEET 1 OF 3			
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-115		REV. 1	
		1	SCH	6/09/93	MODEL NO.	CONTRACT 6J-7877		DATE 03-03-93	
						REQ. P.O.			
						BY	CHK'D	APPR.	
GENERAL	1.	Tag No.		1CCF-RV-006	1CCF-RV-039	1CCF-RV-059	1CCF-RV-052		
	2.	Service		Press Relief	Press Relief	Col 1CCF-VSL-1	RVR-1 Jacket		
	3.	Line No.\Vessel No.		1CCF-TNK-1	1CCF-RVR-1	STM-201-CSL	STM-202-CSL		
	4.	Full Nozzle\Semi Nozzle		Full Nozzle	Full Nozzle	Full Nozzle	Full Nozzle		
	5.	Safety or Relief		Safety	Safety	Safety	Safety		
	6.	Conv., Bellows,Pilot Op.		Conventional	Conventional	Conventional	Conventional		
	7.	Bonnet Type		Bolted	Bolted	Bolted	Bolted		
CONN.	8.	Size Inlet	Outlet	2"   3"	1"   2"	1"   2"	1"   2"		
	9.	Flange Rating or Screwed		150x150 ANSI	150x150 ANSI	300x150 ANSI	300x150 ANSI		
	10.	Type of Facing		R.F.	R.F.	R.F.	R.F.		
MATERIALS	11.	Body and Bonnet		C.S.- SA216	C.S.- SA216	C.S.- SA216	C.S.- SA216		
	12.	Seat and Disc		316SS	316SS	316SS	316SS		
	13.	Resilient Seat Seal		Note 2	Note 2	None	None		
	14.	Guide and Rings		316SS	316SS	316SS	316SS		
	15.	Spring		Std CS	Std CS	High Temp Aly.	High Temp Aly.		
	16.	Bellows		-----	-----	-----	-----		
	17.								
OPTIONS	18.	Cap: Screwed or Bolted		Screwed	Screwed	Screwed	Screwed		
	19.	Lever: Plain or Packed		-----	-----	PACKED	PACKED		
	20.	Test Gag		-----	-----	-----	-----		
BASIS	21.	Code		ASME SECT VIII	ASME SECT VIII	ASME SECT VIII	ASME SECT VIII		
	22.	Fire		-----	YES	YES	YES		
	23.	Liquid Expansion		-----	-----				
	24.	Other		Pump In Rate	-----	Vlv Fail Open	Vlv Fail Open		
FLUID DATA	25.	Fluid and State		NH3/H2O Vapor	NH3 Vapor	Steam	Steam		
	26.	Required Capacity		1500 Lb/Hr	510 Lb/Hr	1300 Lb/Hr	1300 Lb/Hr		
	27.	Mol. Wt.	Oper. Sp. Gr.	18	17	18	18		
	28.	Oper. Press.	Set Press.	3 psig   25 psi	65 psig   150psi	110 psi   150 psi	110 psi   150 psi		
	29.	Oper. Temp.	Rel. Temp.	70 F   300 F	217 F   300 F	450 F   500 F	450 F   500 F		
	30.	Constant		ATM	ATM	ATM	ATM		
	31.	Back Pressure Variable							
	32.	Total		ATM	ATM	ATM	ATM		
	33.	% Allowable Overpressure		10%	10%	10%	10%		
	34.	Overpressure Factor		-----	-----	-----	-----		
	35.	Compressibility Factor		-----	-----	-----	-----		
	36.	Latent Heat of Vapor.		-----	587 BTU/lb	-----	-----		
	37.	Ratio of Specific Heats		-----	-----	-----	-----		
	38.	Operating Viscosity		-----	0.572 cp	-----	-----		
	39.	Barometric Pressure		-----	-----	-----	-----		
40.	Spring Range		-----	-----	-----	-----			
41.									
42.	Calc. Area (sq. in.)			0.0572	0.1759	0.1759			
43.	Selected Area (sq. in.)		1.287	0.110	0.1960	0.1960			
44.	Orifice Designation		J	D	E	E			
45.	Manufacturer		FARRIS	FARRIS	FARRIS	FARRIS			
46.	Model No.		26JC10-120/S1	26DC10-120/S1	26EA21-140/S2	26EA21-140/S2			

NOTES: 1. Vendor to supply stainless steel instrument tags. 2. Provide with resilient seat of Kalrez.  
3. Zinc, Copper or copper bearing alloys shall not be used for parts which come in contact with the process fluid.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESSURE RELIEF VALVES				SHEET <u>2</u> OF <u>3</u>	
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.
		1	SCH	6/09/93	MODEL NO.	7877-115	1
						CONTRACT	DATE
						6J-7877	3-03-93
					REQ. P.O.		
					BY SH	CHK'D APPR.	
GENERAL	1. Tag No.	1CCF-RV-075		1CCF-RV-076		1CCF-RV-088	
	2. Service	P-1A RELIEF		P-1B RELIEF		1CCF-HX-1	
	3. Line No.\Vessel No.	1.5"-P-102-SSC		1.5"-P-111-SSC		1"-P-103-SSC	
	4. Full Nozzle\Semi Nozzle	FULL NOZZLE		FULL NOZZLE		FULL NOZZLE	
	5. Safety or Relief	Relief		Relief		Relief	
	6. Conv., Bellows,Pilot Op.	Conventional		Conventional		Conventional	
	7. Bonnet Type	SCREWED		SCREWED		SCREWED	
CONN.	8. Size Inlet\Outlet	3/4"	1"	3/4"	1"	3/4" M	1" F
	9. Flange Rating or Screwed	150# RF		150# RF		SCREWED	
	10. Type of Facing	RF		RF		-----	
MATERIALS	11. Body and Bonnet	316SS		316SS		316SS	
	12. Seat and Disc	316SS		316SS		316SS	
	13. Upper "O" Ring Seal						
	14. Guide and Rings	316SS		316SS		316SS	
	15. Spring	316SS		316SS		316SS	
	16. Bellows						
	17. Lower "O" Ring Seal						
OPTIONS	18. Cap: Screwed or Bolted	N.A.		N.A.		N.A.	
	19. Lever: Plain or Packed	NONE		NONE		NONE	
	20. Test Gag						
BASIS	21. Code	NON CODE		NON CODE		NON CODE	
	22. Fire						
	23. Liquid Expansion						
	24. Pump Discharge Blocked	Yes		Yes		THERMAL	
FLUID DATA	25. Fluid and State	See Note 2/Liq		See Note 2/Liq		H2O & NH3	
	26. Required Capacity (GPM)	10 gpm		10 gpm		-----	
	27. Mol. Wt. Oper. Sp. Gr.	17.72	0.92	17.72	0.92	----	----
	28. Oper.Press. Set Press.PSIG	90	125	90	125	----	150
	29. Oper. Temp. Rel.Temp.	75 F	75 F	75 F	75 F	----	----
	30. Constant	1.16 psig		1.16 psig		ATM	
	31. Back Pressure Variable	Neg.		Neg.		---	
	32. Total	1.16 psig		1.16 psig		ATM	
	33. % Allowable Overpressure	10 %		10 %		10%	
	34. Overpressure Factor						
	35. Compressibility Factor						
	36. Latent Heat of Vapor.						
	37. Ratio of Specific Heats						
	38. Operating Viscosity	0.594 cps		0.594 cps		-----	
	39. Barometric Pressure	-----		-----		-----	
	40. Spring Range						
	41.						
42. Calc. Area (sq. in.)	0.0298		0.0298		-----		
43. Orifice Size (sq. in.)	0.060		0.060		-----		
44. Orifice Designation					-----		
45. Manufacturer	FARRIS		FARRIS		FARRIS		
46. Model No.	F2740UL/S4		F2740UL/S4		2740UL/S4		

NOTES: 1) Vendor shall provide stainless steel instrument tags.  
2) Fluid composition: 72.5 % ammonia and 27.5 % water.



Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		PRESSURE RELIEF VALVES				SHEET <u>3</u> OF <u>3</u>			
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-115		REV. 2	
		1	SCH	4/07/93	OPER./SET PRES.	CONTRACT 6J-7877		DATE 3-03-93	
		2	SCH	6/09/93	SERVICE FOR RV-2020,3020	REQ. P.O.			
						BY SH	CHK'D	APPR.	
GENERAL	1. Tag No.	1CCF-RV-128		1CCF-RV-1020		1CCF-RV-2020		1CCF-RV-3020	
	2. Service	STRIPPER HDR.		BOILER 1A HDR.		BOILER 1B HDR.		BOILER 1C HDR.	
	3. Line No.\Vessel No.	0.5"-IA-500CSA		0.5"-IA1200CSA		0.5"-IA2200CSA		0.5"-IA3200CSA	
	4. Full Nozzle\Semi Nozzle	FULL NOZZLE		FULL NOZZLE		FULL NOZZLE		FULL NOZZLE	
	5. Safety or Relief	Relief		Relief		Relief		Relief	
	6. Conv., Bellows,Pilot Op.	Conventional		Conventional		Conventional		Conventional	
	7. Bonnet Type	SCREWED		SCREWED		SCREWED		SCREWED	
CONN.	8. Size Inlet   Outlet	1/4" M   1/4" F		1/4" M   1/4" F		1/4" M   1/4" F		1/4" M   1/4" F	
	9. Flange Rating or Screwed	NPT		NPT		NPT		NPT	
	10. Type of Facing	N.A.		N.A.		N.A.		N.A.	
MATERIALS	11. Body and Bonnet	316SS/304SS		316SS/304SS		316SS/304SS		316SS/304SS	
	12. Seat and Disc	316SST		316SST		316SST		316SST	
	13. Upper "O" Ring Seal	VITON B		VITON B		VITON B		VITON B	
	14. Guide and Rings	316SST		316SST		316SST		316SST	
	15. Spring	17 PH SS		17 PH SS		17 PH SS		17 PH SS	
	16. Bellows								
	17. Lower "O" Ring Seal	VITON B		VITON B		VITON B		VITON B	
OPTIONS	18. Cap: Screwed or Bolted	N.A.		N.A.		N.A.		N.A.	
	19. Lever: Plain or Packed	NONE		NONE		NONE		NONE	
	20. Test Gag								
BASIS	21. Code	NON CODE		NON CODE		NON CODE		NON CODE	
	22. Fire								
	23. Liquid Expansion								
	24. Regulator Failure	Yes		Yes		Yes		Yes	
FLUID DATA	25. Fluid and State	AIR/GAS		AIR/GAS		AIR/GAS		AIR/GAS	
	26. Required Capacity (SCFM)	65.1915		65.1915		65.1915		65.1915	
	27. Mol. Wt.   Oper. Sp. Gr.	29	1.00	29	1.00	29	1.00	29	1.00
	28. Oper.Press.   Set Press.PSIG	22	25	22	25	22	25	22	25
	29. Oper. Temp.   Rel.Temp.	75 F	75 F	75 F	75 F	75 F	75 F	75 F	75 F
	30. Constant	ATMOS		ATMOS.		ATMOS.		ATMOS.	
	31. Back Pressure Variable	-----		-----		-----		-----	
	32. Total	ATMOS		ATMOS.		ATMOS.		ATMOS.	
	33. % Allowable Overpressure	25 %		25 %		25 %		25 %	
	34. Overpressure Factor								
	35. Compressibility Factor								
	36. Latent Heat of Vapor.								
	37. Ratio of Specific Heats								
	38. Operating Viscosity	-----		-----		-----		-----	
	39. Barometric Pressure	-----		-----		-----		-----	
40. Spring Range	20 - 75 PSIG		20 - 75 PSIG		20 - 75 PSIG		20 - 75 PSIG		
41.									
42. Calc. Area (sq. in.)									
43. Orifice Size (in.)	0.25		0.25		0.25		0.25		
44. Orifice Designation									
45. Manufacturer	HOKE		HOKE		HOKE		HOKE		
46. Model No.	6532L4Y		6532L4Y		6532L4Y		6532L4Y		

NOTES: 1) Vendor shall provide stainless steel instrument tags.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>1</u> OF <u>6</u>				
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-117		REV. 0		
						CONTRACT 6J-7877		DATE 3-03-93		
						REQ. P.O.				
						BY SH	CHK'D	APPR.		
GENERAL	1. Tag No.	1CCF-FI-1010		1CCF-FI-1011		1CCF-FI-1012		1CCF-FI-1013		
	2. Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3. Line No. \ Vessel No.	1CCF-MXX-3A1		1CCF-MXX-3A1		1CCF-MXX-3A1		1CCF-MXX-3A1		
	4. Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5. Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6. Power Supply	----		----		----		----		
	7. Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8. Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.
	9. Fitting Material	316SS		316SS		316SS		316SS		
	10. Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11. Enclosure Type	-----		-----		-----		-----		
METER	12. Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13. Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14. Meter Scale: Length & Type									
	15. Meter Scale Range	0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		
	16. Meter Factor	BY MFR.		BY MFR.		BY MFR.		BY MFR.		
	17. Rated Accuracy	+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		
	18. Calibration Req'd (NOTE 2)	YES		YES		YES		YES		
	19. Fluid	NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		
FLUID DATA	20. Color or Transparency	CLEAR		CLEAR		CLEAR		CLEAR		
	21. Maximum Flow Rate (NOTE 2)	7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM		
	22. Norm Flow	Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
	23. Oper Specific Gravity(Liq)	-----		-----		-----		-----		
	24. Max. Oper. Viscosity	0.013 cp		0.013 cp		0.013 cp		0.013 cp		
	25. Oper. Press.	Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
	26. Oper. Density (Gases)	0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		
	27. Std. Density	Mol. Wt.	--	--	--	--	--	--	--	--
	28. Max. Allowable Press. Drop									
	29.									
EXT	30. Extension Well Mtl.	-----		-----		-----		-----		
	31. Gasket Mtl.	-----		-----		-----		-----		
XMTR	32. Transmitter Output	NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D		
	33. Trans. Enclosure Class	-----		-----		-----		-----		
	34. Scale Range	-----		-----		-----		-----		
ALARM	35. No. of Contacts	Form	--	--	--	--	--	--	--	
	36. Rating	Housing	--	--	--	--	--	--	--	
	37. Action	-----		-----		-----		-----		
	38.									
OPTIONS	39. Valve Size & Material	-----		-----		-----		-----		
	40. Valve Location	-----		-----		-----		-----		
	41. Const. Diff. Relay Mtl.	-----		-----		-----		-----		
	42. Purge Meter Tubing	-----		-----		-----		-----		
	43. Airset	-----		-----		-----		-----		
	43a.									
	44. Manufacturer	ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		
	45. Model Number	3263-04T0		3263-04T0		3263-04T0		3263-04T0		
	46. Tube Number	BY MFR.		BY MFR.		BY MFR.		BY MFR.		
	47. Float Number	BY MFR.		BY MFR.		BY MFR.		BY MFR.		

NOTES: 1.) Vendor to provide SS Tags.  
2.) Maximum flow equivalent to 19.47 SCFM. Provide direct reading scales calibrated in ACFM.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>2</u> OF <u>6</u>				
		NO.	BY	DATE	REVISION	SPEC. NO. <u>7877-117</u>		REV. <u>0</u>		
						CONTRACT <u>6J-7877</u>		DATE <u>3-03-93</u>		
						REQ. P.O.				
						BY SH	CHK'D	APPR.		
GENERAL	1. Tag No.	1CCF-FI-1014		1CCF-FI-1015		1CCF-FI-1016		1CCF-FI-1017		
	2. Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3. Line No. \ Vessel No.	1CCF-MXX-3A2		1CCF-MXX-3A2		1CCF-MXX-3A2		1CCF-MXX-3A2		
	4. Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5. Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6. Power Supply	----		----		----		----		
	7. Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8. Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.
	9. Fitting Material	316SS		316SS		316SS		316SS		
	10. Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11. Enclosure Type	-----		-----		-----		-----		
METER	12. Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13. Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14. Meter Scale: Length & Type									
	15. Meter Scale Range		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM	
	16. Meter Factor		BY MFR.		BY MFR.		BY MFR.		BY MFR.	
	17. Rated Accuracy		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.	
	18. Calibration Req'd (NOTE 2)		YES		YES		YES		YES	
	FLUID DATA	19. Fluid		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR
20. Color or Transparency		CLEAR		CLEAR		CLEAR		CLEAR		
21. Maximum Flow Rate (NOTE 2)		7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM		
22. Norm Flow		Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
23. Oper Specific Gravity(Liq)		-----		-----		-----		-----		
24. Max. Oper. Viscosity		0.013 cp		0.013 cp		0.013 cp		0.013 cp		
25. Oper. Press.		Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
26. Oper. Density (Gases)		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		
27. Std. Density		Mol. Wt.	--	--	--	--	--	--	--	--
28. Max. Allowable Press. Drop										
29.										
EXT	30. Extension Well Mtl.		-----		-----		-----		-----	
	31. Gasket Mtl.		-----		-----		-----		-----	
XMTR	32. Transmitter Output		NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D	
	33. Trans. Enclosure Class		-----		-----		-----		-----	
	34. Scale Range		-----		-----		-----		-----	
ALARM	35. No. of Contacts	Form	--	--	--	--	--	--	--	
	36. Rating	Housing	--	--	--	--	--	--	--	
	37. Action		-----		-----		-----		-----	
	38.									
OPTIONS	39. Valve Size & Material		-----		-----		-----		-----	
	40. Valve Location		-----		-----		-----		-----	
	41. Const. Diff. Relay Mtl.		-----		-----		-----		-----	
	42. Purge Meter Tubing		-----		-----		-----		-----	
	43. Airset		-----		-----		-----		-----	
43a										
44. Manufacturer		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		
45. Model Number		3263-04T0		3263-04T0		3263-04T0		3263-04T0		
46. Tube Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.		
47. Float Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.		

NOTES: 1.) Vendor to provide SS Tags.

2.) Maximum flow equivalent to 19.47 SCFM. Provide direct reading scales calibrated in ACFM.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>3</u> OF <u>6</u>					
		NO.	BY	DATE	REVISION	SPEC. NO. <u>7877-117</u>		REV. <u>0</u>			
						CONTRACT <u>6J-7877</u>		DATE <u>3-03-93</u>			
						REQ. P.O.					
						BY	SH	CHK'D	APPR.		
GENERAL	1.	Tag No.	1CCF-FI-2010		1CCF-FI-2011		1CCF-FI-2012		1CCF-FI-2013		
	2.	Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3.	Line No.\Vessel No.	1CCF-MXX-3B1		1CCF-MXX-3B1		1CCF-MXX-3B1		1CCF-MXX-3B1		
	4.	Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5.	Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6.	Power Supply	----		----		----		----		
	7.	Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8.	Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	
	9.	Fitting Material	316SS		316SS		316SS		316SS		
	10.	Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11.	Enclosure Type	-----		-----		-----		-----		
METER	12.	Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13.	Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14.	Meter Scale: Length & Type									
	15.	Meter Scale Range		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM	
	16.	Meter Factor		BY MFGR.		BY MFGR.		BY MFGR.		BY MFGR.	
	17.	Rated Accuracy		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.	
	18.	Calibration Req'd (NOTE 2)		YES		YES		YES		YES	
	FLUID DATA	19.	Fluid		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR
20.		Color or Transparency		CLEAR		CLEAR		CLEAR		CLEAR	
21.		Maximum Flow Rate (NOTE 2)		7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM	
22.		Norm Flow	Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
23.		Oper Specific Gravity(Liq)		-----		-----		-----		-----	
24.		Max. Oper. Viscosity		0.013 cp		0.013 cp		0.013 cp		0.013 cp	
25.		Oper. Press.	Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
26.		Oper. Density (Gases)		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.	
27.		Std. Density	Mol. Wt.	--	--	--	--	--	--	--	--
28.		Max. Allowable Press. Drop									
EXT	30.	Extension Well Mtl.		-----		-----		-----		-----	
	31.	Gasket Mtl.		-----		-----		-----		-----	
XMTR	32.	Transmitter Output		NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D	
	33.	Trans. Enclosure Class		-----		-----		-----		-----	
	34.	Scale Range		-----		-----		-----		-----	
ALARM	35.	No. of Contacts	Form	--	--	--	--	--	--	--	--
	36.	Rating	Housing	--	--	--	--	--	--	--	--
	37.	Action		-----		-----		-----		-----	
	38.										
OPTIONS	39.	Valve Size & Material		-----		-----		-----		-----	
	40.	Valve Location		-----		-----		-----		-----	
	41.	Const. Diff. Relay Mtl.		-----		-----		-----		-----	
	42.	Purge Meter Tubing		-----		-----		-----		-----	
	43.	Airset		-----		-----		-----		-----	
43a											
	44.	Manufacturer		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP	
	45.	Model Number		3263-04T0		3263-04T0		3263-04T0		3263-04T0	
	46.	Tube Number		BY MFGR.		BY MFGR.		BY MFGR.		BY MFGR.	
	47.	Float Number		BY MFGR.		BY MFGR.		BY MFGR.		BY MFGR.	

NOTES: 1.) Vendor to provide SS Tags.  
2.) Maximum flow equivalent to 19.47 SCFM. Provide direct reading scales calibrated in ACFM.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>4</u> OF <u>6</u>					
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-117		REV. 0			
						CONTRACT 6J-7877		DATE 3-03-93			
						REQ. P.O.					
						BY	SH	CHK'D	APPR.		
GENERAL	1.	Tag No.	1CCF-FI-2014		1CCF-FI-2015		1CCF-FI-2016		1CCF-FI-2017		
	2.	Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3.	Line No. \ Vessel No.	1CCF-MXX-382		1CCF-MXX-382		1CCF-MXX-382		1CCF-MXX-382		
	4.	Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5.	Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6.	Power Supply	----		----		----		----		
	7.	Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8.	Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	
	9.	Fitting Material	316SS		316SS		316SS		316SS		
	10.	Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11.	Enclosure Type	-----		-----		-----		-----		
METER	12.	Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13.	Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14.	Meter Scale: Length & Type									
	15.	Meter Scale Range		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM	
	16.	Meter Factor		BY MFR.		BY MFR.		BY MFR.		BY MFR.	
	17.	Rated Accuracy		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.	
	18.	Calibration Req'd (NOTE 2)		YES		YES		YES		YES	
	19.	Fluid		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR	
FLUID DATA	20.	Color or Transparency		CLEAR		CLEAR		CLEAR		CLEAR	
	21.	Maximum Flow Rate (NOTE 2)		7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM	
	22.	Norm Flow	Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
	23.	Oper Specific Gravity(Liq)		-----		-----		-----		-----	
	24.	Max. Oper. Viscosity		0.013 cp		0.013 cp		0.013 cp		0.013 cp	
	25.	Oper. Press.	Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
	26.	Oper. Density (Gases)		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.	
	27.	Std. Density	Mol. Wt.	--	--	--	--	--	--	--	--
	28.	Max. Allowable Press. Drop									
	29.										
EXT	30.	Extension Well Mtl.		-----		-----		-----		-----	
	31.	Gasket Mtl.		-----		-----		-----		-----	
XMTR	32.	Transmitter Output		NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D	
	33.	Trans. Enclosure Class		-----		-----		-----		-----	
	34.	Scale Range		-----		-----		-----		-----	
ALARM	35.	No. of Contacts	Form	--	--	--	--	--	--	--	--
	36.	Rating	Housing	--	--	--	--	--	--	--	--
	37.	Action		-----		-----		-----		-----	
	38.										
OPTIONS	39.	Valve Size & Material		-----		-----		-----		-----	
	40.	Valve Location		-----		-----		-----		-----	
	41.	Const. Diff. Relay Mtl.		-----		-----		-----		-----	
	42.	Purge Meter Tubing		-----		-----		-----		-----	
	43.	Airset		-----		-----		-----		-----	
	43a.										
	44.	Manufacturer		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP	
	45.	Model Number		3263-04T0		3263-04T0		3263-04T0		3263-04T0	
	46.	Tube Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.	
	47.	Float Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.	

NOTES: 1.) Vendor to provide SS Tags.

2.) Maximum flow equivalent to 19.47 SCFM. Provide direct reading scales calibrated in ACFM.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>5</u> OF <u>6</u>					
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-117		REV. 0			
						CONTRACT 6J-7877		DATE 3-03-93			
						REQ. P.O.					
						BY SH	CHK'D	APPR.			
GENERAL	1.	Tag No.	1CCF-FI-3010		1CCF-FI-3011		1CCF-FI-3012		1CCF-FI-3013		
	2.	Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3.	Line No. \ Vessel No.	1CCF-MXX-3C1		1CCF-MXX-3C1		1CCF-MXX-3C1		1CCF-MXX-3C1		
	4.	Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5.	Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6.	Power Supply	----		----		----		----		
	7.	Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8.	Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	
	9.	Fitting Material	316SS		316SS		316SS		316SS		
	10.	Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11.	Enclosure Type	-----		-----		-----		-----		
METER	12.	Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13.	Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14.	Meter Scale: Length & Type									
	15.	Meter Scale Range (NOTE 2)		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM	
	16.	Meter Factor		BY MFR.		BY MFR.		BY MFR.		BY MFR.	
	17.	Rated Accuracy		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.	
	18.	Calibration Req'd (NOTE 2)		YES		YES		YES		YES	
	FLUID DATA	19.	Fluid		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR
20.		Color or Transparency		CLEAR		CLEAR		CLEAR		CLEAR	
21.		Maximum Flow Rate (NOTE 2)		7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM	
22.		Norm Flow	Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
23.		Oper Specific Gravity(Liq)		0.92		0.92		0.92		0.92	
24.		Max. Oper. Viscosity		0.013 cp		0.013 cp		0.013 cp		0.013 cp	
25.		Oper. Press.	Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
26.		Oper. Density (Gases)		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.	
27.		Std. Density	Mol. Wt.	--	--	--	--	--	--	--	--
28.		Max. Allowable Press. Drop									
29.											
EXT	30.	Extension Well Mtl.		-----		-----		-----		-----	
	31.	Gasket Mtl.		-----		-----		-----		-----	
XMTR	32.	Transmitter Output		NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D	
	33.	Trans. Enclosure Class		-----		-----		-----		-----	
	34.	Scale Range		-----		-----		-----		-----	
ALARM	35.	No. of Contacts	Form	--	--	--	--	--	--	--	--
	36.	Rating	Housing	--	--	--	--	--	--	--	--
	37.	Action		-----		-----		-----		-----	
	38.										
OPTIONS	39.	Valve Size & Material		-----		-----		-----		-----	
	40.	Valve Location		-----		-----		-----		-----	
	41.	Const. Diff. Relay Mtl.		-----		-----		-----		-----	
	42.	Purge Meter Tubing		-----		-----		-----		-----	
	43.	Airset		-----		-----		-----		-----	
43a											
	44.	Manufacturer		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP	
	45.	Model Number		3263-04T0		3263-04T0		3263-04T0		3263-04T0	
	46.	Tube Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.	
	47.	Float Number		BY MFR.		BY MFR.		BY MFR.		BY MFR.	

NOTES: 1.) Vendor to provide SS Tags.  
2.) Maximum flow equivalent to 19.47 SCFM.  
Dual scale meters req'd. Provide scales calibrated in ACFM & GPM (4 GPM F.S.)

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ROTAMETERS (VARIABLE AREA FLOWMETER)				SHEET <u>6</u> OF <u>6</u>				
		NO.	BY	DATE	REVISION	SPEC. NO. <u>7877-117</u>		REV. <u>0</u>		
						CONTRACT <u>6J-7877</u>		DATE <u>3-03-93</u>		
						REQ. P.O.				
						BY	SH	CHK'D	APPR.	
GENERAL	1. Tag No.	1CCF-FI-3014		1CCF-FI-3015		1CCF-FI-3016		1CCF-FI-3017		
	2. Service	INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		INJECTION MAN.		
	3. Line No.\Vessel No.	1CCF-MXX-3C2		1CCF-MXX-3C2		1CCF-MXX-3C2		1CCF-MXX-3C2		
	4. Function	INDICATING		INDICATING		INDICATING		INDICATING		
	5. Mounting	IN-LINE		IN-LINE		IN-LINE		IN-LINE		
	6. Power Supply	----		----		----		----		
	7. Conn. Size	Type	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.	1" NPT	SCRD.
	8. Inlet Dir.	Outlet Dir.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.	VERT.
	9. Fitting Material	316SS		316SS		316SS		316SS		
	10. Packing or O-Ring Mtl.	TEFLON		TEFLON		TEFLON		TEFLON		
	11. Enclosure Type	-----		-----		-----		-----		
METER	12. Size	Float Guide	1"	316SS	1"	316SS	1"	316SS	1"	316SS
	13. Tube Mtl.	Float Mtl.	GLASS	316SS	GLASS	316SS	GLASS	316SS	GLASS	316SS
	14. Meter Scale: Length & Type									
	15. Meter Scale Range (NOTE 2)	0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		0-7.5 ACFM		
	16. Meter Factor	BY MFR.		BY MFR.		BY MFR.		BY MFR.		
	17. Rated Accuracy	+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		+/- 2% F.S.		
	18. Calibration Req'd (NOTE 2)	YES		YES		YES		YES		
	19. Fluid	NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		NH3/H2O VAPOR		
FLUID DATA	20. Color or Transparency	CLEAR		CLEAR		CLEAR		CLEAR		
	21. Maximum Flow Rate (NOTE 2)	7.5 ACFM		7.5 ACFM		7.5 ACFM		7.5 ACFM		
	22. Norm Flow	Min Flow	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM	4 ACFM	1 ACFM
	23. Oper Specific Gravity(Liq)	0.92		0.92		0.92		0.92		
	24. Max. Oper. Viscosity	0.013 cp		0.013 cp		0.013 cp		0.013 cp		
	25. Oper. Press.	Oper. Temp.	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F	49.7PSIA	217 F
	26. Oper. Density (Gases)	0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		0.19 Lb/CuFt.		
	27. Std. Density	Mol. Wt.	--	--	--	--	--	--	--	--
	28. Max. Allowable Press. Drop									
	29.									
EXT	30. Extension Well Mtl.	-----		-----		-----		-----		
	31. Gasket Mtl.	-----		-----		-----		-----		
XMTR	32. Transmitter Output	NOT REQ'D		NOT REQ'D		NOT REQ'D		NOT REQ'D		
	33. Trans. Enclosure Class	-----		-----		-----		-----		
	34. Scale Range	-----		-----		-----		-----		
ALARM	35. No. of Contacts	Form	--	--	--	--	--	--	--	
	36. Rating	Housing	--	--	--	--	--	--	--	
	37. Action	-----		-----		-----		-----		
	38.									
OPTIONS	39. Valve Size & Material	-----		-----		-----		-----		
	40. Valve Location	-----		-----		-----		-----		
	41. Const. Diff. Relay Mtl.	-----		-----		-----		-----		
	42. Purge Meter Tubing	-----		-----		-----		-----		
	43. Airset	-----		-----		-----		-----		
	43a									
	44. Manufacturer	ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		ERDCO ENG.CORP		
	45. Model Number	3263-04T0		3263-04T0		3263-04T0		3263-04T0		
	46. Tube Number	BY MFR.		BY MFR.		BY MFR.		BY MFR.		
	47. Float Number	BY MFR.		BY MFR.		BY MFR.		BY MFR.		

NOTES: 1.) Vendor to provide SS Tags.  
2.) Maximum flow equivalent to 19.47 SCFM.  
Dual scale meters req'd. Provide scales calibrated in ACFM & GPM (4 GPM F.S.)





Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		TRAPS and STRAINERS				SHEET 1 OF 2					
		NO.	BY	DATE	REVISION		SPEC. NO.	REV.			
		1	SCH	6/09/93	MFG. & MODEL #,		7877-120	1			
					ADDED LCV-119A		CONTRACT	DATE			
					6J-7877	02-18-93					
					REQ. P.O.						
					BY	CHK'D	APPR.				
					SCH						
	1.	Tag No.	LCV-119		FX-119		LCV-126		FX-126		
	2.	Service	Steam Trap		Strainer		Steam Trap		Strainer		
	3.	Line No.	STM-201-CSL		STM-201-CSL		STM-203-CSL		STM-203-CSL		
	4.	Line Size/Schedule	1-1/2"/Sch 80		1-1/2"/Sch 80		1-1/2"/Sch 80		1-1/2"/Sch 80		
	5.	Exchanger Number	MAIN STEAM		MAIN STEAM		1CCF-RVR-1		1CCF-RVR-1		
	6.	Type	Thermodynamic				Thermodynamic				
BODY	7.	Material	St Stl				St Stl				
	8.	Size: Inlet	Outlet	1/2"	1/2"		1/2"	1/2"			
	9.	End Connections	NPT				NPT				
	10.	Press. & Temp. Rating	600 psig\752 F				600 psig\752 F				
	11.	Equalizing Conn. Size									
	12.	Conn. Orientation	Horizontal				Horizontal				
	13.										
TRIM	14.	Trim Material	St. Steel				St. Steel				
	15.										
OPTIONS	16.	Internal Check Valve	No				No				
	17.	Internal Bimetallic Vent	No				No				
	18.	Thermostatic Vent	Mtl.	No			No				
	19.	Gage Glass	No				No				
	20.	Vacuum Breaker	None				None				
	21.										
	22.										
STRAINER	23.	Internal or External	Internal		External		Internal		External		
	24.	Type & Size			1-1/2"				1-1/2"		
	25.	Body Material			Cast Steel				Cast Steel		
	26.	Press. & Temp. Rating			603psi/				603psi/		
	27.	End Connections			300 lb RF				300 lb RF		
	28.	Blowoff Connections	1/2 NPT		3/4" NPT		1/2 NPT		3/4" NPT		
	29.	Mesh Size & Material			20 MESH/316SS				20 MESH/316SS		
	30.										
PROCESS DATA	31.	Fluid	Stm Cond.		Steam		Stm Cond.		Steam		
	32.	Normal Flow (lb\hr)	18		1040		18		1040		
	33.	Load Safety Factor	26		-----		26		-----		
	34.	Maximum Capacity (lb\hr)	500 @200psid		1500		500 @200psid		1500		
	35.	Oper. Temp.	oSuperheat	490	100	490 F	100 F		F	F	
	36.	Press: In	Out	PSIG	200	Atm	200	---	110	51	110
	37.	Allow Press. Diff:	Max	Norm							
	38.	Oper. sp. gr.	Top	Bottom							
	39.										
	40.										
	41.	Calc. Orifice Size									
	42.	Selected Orifice Size	Mfr Std				Mfr Std				
	43.										
	44.	Manufacturer	Armstrong		Armstrong		Armstrong		Armstrong		
	45.	Model Number	1/2"CD-61A		1 1/2"BXFL-		1/2"CD-61A		1 1/2"BXFL-		
	46.				1 1/2-300				1 1/2-300		

NOTES: 1. All items to be furnished with stainless steel tags.  
2. Steam trap to be furnished with optional blowdown valve.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		TRAPS and STRAINERS				SHEET 2 OF 2	
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.
		1	SCH	6/09/93	ADDED LCV-119A	7877-120	1
						CONTRACT 6J-7877	DATE 06-09-93
		REQ. P.O.					
		BY SCH		CHK'D		APPR.	
	1.	Tag No.		LCV-119A			
	2.	Service		Steam Trap			
	3.	Line No.		STM-201-CSL			
	4.	Line Size/Schedule		1-1/2"/Sch 80			
	5.	Exchanger Number		MAIN STEAM			
	6.	Type		Thermodynamic			
BODY	7.	Material		St Stl			
	8.	Size: Inlet	Outlet	1/2"	1/2"		
	9.	End Connections		NPT			
	10.	Press. & Temp. Rating		600 psig\752 F			
	11.	Equalizing Conn. Size					
	12.	Conn. Orientation		Horizontal			
	13.						
TRIM	14.	Trim Material		St. Steel			
	15.						
OPTIONS	16.	Internal Check Valve		No			
	17.	Internal Bimetallic Vent		No			
	18.	Thermostatic Vent	Mtl.	No			
	19.	Gage Glass		No			
	20.	Vacuum Breaker		None			
	21.						
STRAINER	22.						
	23.	Internal or External		Internal			
	24.	Type & Size					
	25.	Body Material					
	26.	Press. & Temp. Rating					
	27.	End Connections					
	28.	Blowoff Connections		1/2 NPT			
29.	Mesh Size & Material						
PROCESS DATA	30.						
	31.	Fluid		Stm Cond.			
	32.	Normal Flow (lb\hr)		18			
	33.	Load Safety Factor		26			
	34.	Maximum Capacity (lb\hr)		500 @200psid			
	35.	Oper. Temp.	oSuperheat	490	100		
	36.	Press: In	Out PSIG	200	Atm		
	37.	Allow Press. Diff:Max		Norm			
	38.	Oper. sp. gr. Top	Bottom				
	39.						
40.							
41.	Calc. Orifice Size						
	Selected Orifice Size		Mfr Std				
	Manufacturer		Armstrong				
	Model Number		1/2"CD-61A				

NOTES: 1. All items to be furnished with stainless steel tags.  
2. Steam trap to be furnished with optional blowdown valve.

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES				SHEET 1 OF 6		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	
		1	SCH	4/07/93	ZS TAG #	7877-121	2	
		2	SCH	6/09/93	SWITCHES	CONTRACT 6J-7877	DATE 2-12-93	
						REQ. P.O.		
		BY	CHK'D	APPR.				
Tag Number : 1CCF-ABV-1001					P & ID : D-7877-01-02			
Service : Ammonia Valve Rack Feed for Boiler 1A								
1	SERVICE CONDITIONS	Fluid: 17% Water Vapor, 83% Ammonia Vapor			Fluid State: Vapor			
2		S E R V I C E C O N D I T I O N S			NORMAL	MAXIMUM	OTHER	SHUT-OFF
3		Flow Rate - ACFM			29	40		-----
4		Inlet Pressure - Norm (psia)			65	65		150
5		Inlet Pressure - Max. (psig)						-----
6		Service Temp. - Norm ( Deg. F)			217			
7		Service Temp. - Max. ( Deg. F)			300			
8	PIPE LINE	Pipe Line: Size In : 2"		42	Type : Rack and Pinion Mfr & Model: Automax Size: By Mfr Eff. Area: By Mfr On/Off : Yes Modulating : No Spring Action: Close Valve Max. Allow Press: 150 psig Min Req'd Press: 60 psig Actuator Sizing Pressure: 60 psig Avail Air Supply: 60 psig Actuator Orientation: Top Hand Wheel: Not Required Other: Anodized Pistons and Body with special Epoxy Painting for corrosion protection and 316 SS adjusting bolts			
9		Out: 2"		43				
10		Pipe Line Insulation : Heat Conservation		44				
11	Line No.: P-1001-CSP		45	ACTUATOR POSITIONER SWITCHES RELAYS				
12	Type : Ball Valve		46					
13	Size : 2" ANSI CLASS : 150 lb		47					
14	Max Allow. Press./Temp.: 220 psig @ 300 F		48					
15	Mfr/Model: Worcester 2" 466 R T BW1 Miser		49					
16	Body / Ball/Plug Mat'l: 316 SS / 316 SS		50					
17	Liner Material : None		51					
18	End Connection: In : 2" Butt Weld (Sch 10)		52					
19	Out: 2" Butt Weld (Sch 10)		53					
20	Flg Face Finish : N.A.		54					
21	End Extension & Mat'l: ----		55					
22	Flow Direction : Straight Through		56					
23	Type of Bonnet : Plain		57					
24	Lube / Iso Valve : --- / ---		58					
25	Packing Mat'l: Reinforced TFE		59					
26	Packing Type: Ring		60					
27	Special Bolting Required : NO		61					
28	Type : Std. Port Ball Valve		62	SWITCHES RELAYS				
29	Size : 2"		63					
30	Characteristic : Quick-Opening		64					
31	Rated Cv : 120 FL : ----- XT : -----		65					
32	Plug/Ball/Stem Mat'l: 316 SS		66					
33	Sleeve Mat'l: ----		67					
34	Shaft Mat'l: ----		68					
35	Leakage Class : Class VI		69					
36								
37	OPTIONS	Electrical Area Classification:		70	OPTIONS Solenoid Valve: ASCO EFHT 8320G202 Tag No. SV-1001 1/4" Pipe, SS Body, Universal Oper. 120 VAC Coil, High Temp (Class H) Explosion Proof enclosure When Sol. Valve is De-Energized Spring Drives Valve Closed			
38		Cl I - Grp D - Div. 2		71				
39				72				
40				73				
41				74				

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
 3. Tag "open" switch as ZS-1002 and "closed" switch as ZS-1003.  
 4. Prewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
 5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES				SHEET 2 OF 6	
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.
		1	SCH	4/07/93	ZS TAG #	7877-121	2
		2	SCH	6/09/93	SWITCHES	CONTRACT 6J-7877	DATE 2-12-93
					REQ. P.O.		
					BY	CHK'D	
					APPR.		
Tag Number : 1CCF-ABV-2001					P & ID : D-7877-01-03		
Service : Ammonia Valve Rack Feed for Boiler 1B							
1	SERVICE CONDITIONS	Fluid: 17% Water Vapor, 83% Ammonia Vapor				Fluid State: Vapor	
2		S E R V I C E C O N D I T I O N S		NORMAL	MAXIMUM	OTHER	SHUT-OFFFF
3		Flow Rate - ACFM		29	40		-----
4		Inlet Pressure - Norm (psia)		65	65		150
5		Inlet Pressure - Max. (psig)					-----
6		Service Temp. - Norm ( Deg. F)		217			
7		Service Temp. - Max. ( Deg. F)		300			
8	PIPE LINE	Pipe Line: Size In : 2"		42	Type : Rack and Pinion		
9		Out: 2"		43	Mfr & Model: Automax		
10		Pipe Line Insulation : Heat Conservation		44	Size: By Mfr Eff. Area: By Mfr		
11	Line No.: P-2001-CSP		45	On/Off : Yes Modulating : No			
12	VALVE AND BONNET	Type : Ball Valve		46	Spring Action: Close Valve		
13		Size : 2" ANSI CLASS : 150 lb		47	Max. Allow Press: 150 psig		
14		Max Allow. Press./Temp.: 220 psig @ 300 F		48	Min Req'd Press: 60 psig		
15		Mfr/Model: Worcester 2" 466 R T BW1 Miser		49	Actuator Sizing Pressure: 60 psig		
16		Body / Ball/Plug Mat'l: 316 SS / 316 SS		50	Avail Air Supply: 60 psig		
17		Liner Material : None		51	Actuator Orientation: Top		
18		End Connection: In : 2" Butt Weld (Sch 10)		52	Hand Wheel: Not Required		
19		Out: 2" Butt Weld (Sch 10)		53	Other: Anodized Pistons and Body with special Epoxy Painting for corrosion protection and 316 SS adjusting bolts		
20		Flg Face Finish : N.A.		54			
21		End Extension & Mat'l: ----		55			
22	Flow Direction : Straight Through		56	Type: None			
23	Type of Bonnet : Plain		57	Mfr & Model :			
24	Lube / Iso Valve : --- / ---		58	On Incr Signal Output:			
25	Packing Mat'l: Reinforced TFE		59	Gages : Bypass :			
26	Packing Type: Ring		60	Cam Characteristic:			
27	Special Bolting Required : NO		61	Other:			
28	TRIM	Type : Std. Port Ball Valve		62	Type: Proximity Quant : 2		
29		Size : 2"		63	Mrf. & Model: Namco EA700		
30		Characteristic : Quick-Opening		64	Contacts / Rating: DPDT		
31		Rated Cv : 120 FL : ----- XT : -----		65	Actuation Points: (Note 3)		
32		Plug/Ball/Stem Mat'l: 316 SS		66	Mfr & Model: None		
33		Sleeve Mat'l: ----		67	Set Press:		
34		Shaft Mat'l: ----		68	Filter : Gage :		
35	Leakage Class : Class VI		69				
36							
37	OPTIONS	Electrical Area Classification:		70	Solenoid Valve: ASCO EFHT 8320G202		
38		Cl I - Grp D - Div. 2		71	Tag No. SV-2001		
39				72	1/4" Pipe, SS Body, Universal Oper.		
40				73	120 VAC Coil, High Temp (Class H) Explosion Proof enclosure		
41			74	When Sol. Valve is De-Energized Spring Drives Valve Closed			

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
3. Tag "open" switch as ZS-2002 and "closed" switch as ZS-2003.  
4. Prewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES				SHEET 3 OF 6		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	
					7877-121	2		
					1	SCH	4/07/93	ZS TAG #
					2	SCH	6/09/93	SWITCHES
					CONTRACT 6J-7877		DATE 2-12-93	
					REQ. P.O.			
					BY	CHK'D	APPR.	
Tag Number : 1CCF-ABV-3001					P & ID : D-7877-01-04			
Service : Ammonia Valve Rack Feed for Boiler 1C								
1	D I Z O N	Fluid: 17% Water Vapor, 83% Ammonia Vapor				Fluid State: Vapor		
2		S E R V I C E C O N D I T I O N S			NORMAL	MAXIMUM	OTHER	SHUT-OFFFF
3		Flow Rate - ACFM			29	40		-----
4		Inlet Pressure - Norm (psia)			65	65		150
5		Inlet Pressure - Max. (psig)						-----
6		Service Temp. - Norm ( Deg. F)			217			
7		Service Temp. - Max. ( Deg. F)			300			
8	P I P E	Pipe Line: Size In : 2"		42	Type : Rack and Pinion			
9		Out: 2"		43	Mfr & Model: Automax			
10		Pipe Line Insulation : Heat Conservation		44	Size: By Mfr Eff. Area: By Mfr			
11	Line No.: P-3001-CSP		45	On/Off : Yes Modulating : No				
12	V A L V E	Type : Ball Valve		46	Spring Action: Close Valve			
13		Size : 2" ANSI CLASS : 150 lb		47	Max. Allow Press: 150 psig			
14		Max Allow. Press./Temp.: 220 psig @ 300 F		48	Min Req'd Press: 60 psig			
15		Mfr/Model: Worchester 2" 466 R T BW1 Miser		49	Actuator Sizing Pressure: 60 psig			
16		Body / Ball/Plug Mat'l: 316 SS / 316 SS		50	Avail Air Supply: 60 psig			
17		Liner Material : None		51	Actuator Orientation: Top			
18		End Connection: In : 2" Butt Weld (Sch 10)		52	Hand Wheel: Not Required			
19		Out: 2" Butt Weld (Sch 10)		53	Other: Anodized Pistons and Body with special Epoxy Painting for corrosion protection and 316 SS adjusting bolts			
20		Flg Face Finish : N.A.		54				
21		End Extension & Mat'l: ----		55				
22	P O S I T I O N E R	Flow Direction : Straight Through		56	Type: None			
23		Type of Bonnet : Plain		57	Mfr & Model :			
24		Lube / Iso Valve : --- / ---		58	On Incr Signal Output:			
25		Packing Mat'l: Reinforced TFE		59	Gages : Bypass :			
26		Packing Type: Ring		60	Cam Characteristic:			
27	Special Bolting Required : NO		61	Other:				
28	S W I T C H S	Type : Std. Port Ball Valve		62	Type: Proximity Quant : 2			
29		Size : 2"		63	Mrf. & Model: Namco EA700			
30		Characteristic : Quick-Opening		64	Contacts / Rating: DPDT			
31		Rated Cv : 120 FL : ----- XT : -----		65	Actuation Points: (Note 3)			
32		Plug/Ball/Stem Mat'l: 316 SS		66	Mfr & Model: None			
33		Sleeve Mat'l: ----		67	Set Press:			
34		Shaft Mat'l: ----		68	Filter : Gage :			
35		Leakage Class : Class VI		69				
36	O P T I O N S	Electrical Area Classification:		70	Solenoid Valve: ASCO EFHT 8320G202			
37		Cl I - Grp D - Div. 2		71	Tag No. SV-3001			
38				72	1/4" Pipe, SS Body, Universal Oper.			
39				73	120 VAC Coil, High Temp (Class H)			
40				74	Explosion Proof enclosure			
41				When Sol. Valve is De-Energized Spring Drives Valve Closed				

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
3. Tag "open" switch as ZS-3002 and "closed" switch as ZS-3003.  
4. Prewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES				SHEET 4 OF 6	
		NO.	BY	DATE	REVISION	SPEC. NO. 7877-121	REV. 2
					CONTRACT 6J-7877		
					DATE 2-12-93		
					REQ. P.O.		
					BY	CHK'D	
					APPR.		
Tag Number : 1CCF-ABV-1009					P & ID : D-7877-01-02		
Service : Purge Air to Ammonia Valve Rack for Boiler 1A							
1	SIZE	Fluid: Air			Fluid State: Gas		
2		SERVICE CONDITIONS			NORMAL	MAXIMUM	OTHER
3		Flow Rate - ACFM					-----
4		Inlet Pressure - Norm (psia)					
5		Inlet Pressure - Max. (psig)					-----
6		Service Temp. - Norm ( Deg. F)					
7		Service Temp. - Max. ( Deg. F)					
8	FINISH	Pipe Line: Size In : 1"		42	Type : Rack and Pinion Mfr & Model: Automax Size: By Mfr Eff. Area: By Mfr On/Off : Yes Modulating : No Spring Action: Open Valve Max. Allow Press: 150 psig Min Req'd Press: 60 psig Actuator Sizing Pressure: 60 psig Avail Air Supply: 60 psig Actuator Orientation: Top Hand Wheel: Not Required Other: Anodized Pistons and Body with Epoxy Painted End Caps and 316 SS adjusting bolts		
9		Out: 1"		43			
10		Pipe Line Insulation : None		44			
11		Line No.: P-1100-CSA		45			
12		Type : Ball Valve		46			
13	Size : 1" ANSI CLASS : 150 lb		47	ACTUATOR	POSITIONER		
14	Max Allow. Press./Temp.: 220 psig @ 300 F		48				
15	Mfr/Model: Worcester 1" 466 R T BW1 Miser		49				
16	Body / Ball/Plug Mat'l: 316 SS / 316 SS		50				
17	Liner Material : None		51				
18	End Connection: In : 1" Butt Weld (Sch 40)		52				
19	Out: 1" Butt Weld (Sch 40)		53				
20	Flg Face Finish : N.A.		54				
21	End Extention & Mat'l: ----		55				
22	Flow Direction : Straight Through		56				
23	Type of Bonnet : Plain		57				
24	Lube / Iso Valve : --- / ---		58				
25	Packing Mat'l: Reinforced TFE		59				
26	Packing Type: Ring		60				
27	Special Bolting Required : NO		61	SWITCHES			
28	Type : Std. Port Ball Valve		62				
29	Size : 1"		63				
30	Characteristic : Quick-Opening		64				
31	Rated Cv : 32 FL : ----- XT : -----		65	GEEG			
32	Plug/Ball/Stem Mat'l: 316 SS		66				
33	Sleeve Mat'l: ----		67				
34	Shaft Mat'l: ----		68				
35	Leakage Class : Class VI		69	OPTIONS			
37	Electrical Area Classification:		70				
38	Cl I - Grp D - Div. 2		71				
39			72				
40			73				
41			74				

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
3. Tag "open" switch as ZS-1010 and "closed" switch as ZS-1011.  
4. Rewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES			SHEET 5 OF 6			
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.	
		1	SCH	4/07/93	SPRING ACTION &	7877-121	2	
					ZS TAG #	CONTRACT	DATE	
				6J-7877	2-12-93			
				REQ. P.O.				
				BY	CHK'D	APPR.		
Tag Number : 1CCF-ABV-2009				P & ID : D-7877-01-03				
Service : Purge Air to Ammonia Valve Rack for Boiler 1B								
1	OPERATION	Fluid: Air			Fluid State: Gas			
2		SERVICE CONDITIONS			NORMAL	MAXIMUM	OTHER	SHUT-OFFFF
3		Flow Rate - ACFM						-----
4		Inlet Pressure - Norm (psia)						
5		Inlet Pressure - Max. (psig)						-----
6		Service Temp. - Norm ( Deg. F)						
7		Service Temp. - Max. ( Deg. F)						
8	PIPE LINE	Pipe Line: Size In : 1"		42	Type : Rack and Pinion			
9		Out: 1"		43	Mfr & Model: Automax			
10		Pipe Line Insulation : None		44	Size: By Mfr Eff. Area: By Mfr			
11	Line No.: P-2100-CSA		45	On/Off : Yes Modulating : No				
12	VALVE	Type : Ball Valve		46	Spring Action: Open Valve			
13		Size : 1" ANSI CLASS : 150 lb		47	Max. Allow Press: 150 psig			
14		Max Allow. Press./Temp.: 220 psig @ 300 F		48	Min Req'd Press: 60 psig			
15		Mfr/Model: Worcester 1" 466 R T BW1 Miser		49	Actuator Sizing Pressure: 60 psig			
16		Body / Ball/Plug Mat'l: 316 SS / 316 SS		50	Avail Air Supply: 60 psig			
17		Liner Material : None		51	Actuator Orientation: Top			
18		End Connection: In : 1" Butt Weld (Sch 40)		52	Hand Wheel: Not Required			
19		Out: 1" Butt Weld (Sch 40)		53	Other: Anodized Pistons and Body with Epoxy Painted End Caps and 316 SS adjusting bolts			
20		Flg Face Finish : N.A.		54				
21		End Extension & Mat'l: ----		55	Type: None			
22	POSITIONER	Flow Direction : Straight Through		56	Mfr & Model :			
23		Type of Bonnet : Plain		57	On Incr Signal Output:			
24		Lube / Iso Valve : --- / ---		58	Gages : Bypass :			
25		Packing Mat'l: Reinforced TFE		59	Cam Characteristic:			
26		Packing Type: Ring		60	Other:			
27	Special Bolting Required : NO		61					
28	TRIM	Type : Std. Port Ball Valve		62	Type: Proximity Quant : 2			
29		Size : 1"		63	Mrf. & Model: Namco EA700			
30		Characteristic : Quick-Opening		64	Contacts / Rating: DPDT			
31		Rated Cv : 32 FL : ----- XT : -----		65	Actuation Points: (Note 3)			
32		Plug/Ball/Stem Mat'l: 316 SS		66	Mfr & Model: None			
33		Sleeve Mat'l: ----		67	Set Press:			
34		Shaft Mat'l: ----		68	Filter : Gage :			
35		Leakage Class : Class VI		69				
36								
37	SPECIALS	Electrical Area Classification:		70	Solenoid Valve: ASCO EFHT 8320G202			
38		Cl I - Grp D - Div. 2		71	Tag No. SV-2009			
39				72	1/4" Pipe, SS Body, Universal Oper.			
40				73	120 VAC Coil, High Temp (Class H) Explosion Proof enclosure			
41			74	When Sol. Valve is De-Energized Spring Drives Valve Closed				

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
 3. Tag "open" switch as ZS-2010 and "closed" switch as ZS-2011.  
 4. Prewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
 5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid

Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves  
ISA S20

GLITSCH PACKAGE PLANTS 1055 PARSIPPANY BLVD. SUITE #503 PARSIPPANY, NJ 07054		ACTUATED QUARTER TURN VALVES			SHEET 6 OF 6		
		NO.	BY	DATE	REVISION	SPEC. NO.	REV.
		1	SCH	4/07/93	SPRING ACTION &	7877-121	2
					ZS TAG #	CONTRACT	DATE
		2	SCH	6/09/93	SWITCHES	6J-7877	2-12-93
				REQ. P.O.			
				BY	CHK'D	APPR.	
Tag Number : 1CCF-ABV-3009				P & ID : D-7877-01-04			
Service : Purge Air to Ammonia Valve Rack for Boiler 1C							
1	SERVICE CONDITIONS	Fluid: Air			Fluid State: Gas		
2		S E R V I C E C O N D I T I O N S			NORMAL	MAXIMUM	
3		Flow Rate - ACFM				OTHER	
4		Inlet Pressure - Norm (psia)				SHUT-OFFFF	
5		Inlet Pressure - Max. (psig)				-----	
6		Service Temp. - Norm ( Deg. F)					
7		Service Temp. - Max. ( Deg. F)					
8	PIPE LINE	Pipe Line: Size In : 1"		42	Type : Rack and Pinion Mfr & Model: Automax Size: By Mfr Eff. Area: By Mfr On/Off : Yes Modulating : No Spring Action: Open Valve Max. Allow Press: 150 psig Min Req'd Press: 60 psig Actuator Sizing Pressure: 60 psig Avail Air Supply: 60 psig Actuator Orientation: Top Hand Wheel: Not Required Other: Anodized Pistons and Body with Epoxy Painted End Caps and 316 SS adjusting bolts		
9		Out: 1"		43			
10		Pipe Line Insulation : None		44			
11		Line No.: P-3100-CSA		45			
12	VALVE AND BONNET	Type : Ball Valve		46			
13		Size : 1" ANSI CLASS : 150 lb		47			
14		Max Allow. Press./Temp.: 220 psig @ 300 F		48			
15		Mfr/Model: Worcester 1" 466 R T BW1 Miser		49			
16		Body / Ball/Plug Mat'l: 316 SS / 316 SS		50			
17		Liner Material : None		51			
18		End Connection: In : 1" Butt Weld (Sch 40)		52			
19		Out: 1" Butt Weld (Sch 40)		53			
20		Flg Face Finish : N.A.		54			
21		End Extension & Mat'l: ----		55			
22	Flow Direction : Straight Through		56				
23	Type of Bonnet : Plain		57				
24	Lube / Iso Valve : --- / ---		58				
25	Packing Mat'l: Reinforced TFE		59				
26	Packing Type: Ring		60				
27	Special Bolting Required : NO		61				
28	TRIM	Type : Std. Port Ball Valve		62	Type: Proximity Quant : 2 Mfr.& Model: Namco EA700 Contacts / Rating: DPDT Actuation Points: (Note 3)		
29		Size : 1"		63			
30		Characteristic : Quick-Opening		64			
31		Rated Cv : 32 FL : ----- XT : -----		65			
32		Plug/Ball/Stem Mat'l: 316 SS		66			
33		Sleeve Mat'l: ----		67			
34		Shaft Mat'l: ----		68			
35		Leakage Class : Class VI		69			
36	OPTIONS	Electrical Area Classification:		70	Solenoid Valve: ASCO EFHT 8320G202 Tag No. SV-3009 1/4" Pipe, SS Body, Universal Oper. 120 VAC Coil, High Temp (Class H) Explosion Proof enclosure When Sol. Valve is De-Energized Spring Drives Valve Closed		
37		Cl I - Grp D - Div. 2		71			
38				72			
39				73			
40				74			

- Notes: 1. Vendor to Supply Stainless Steel Instrument Tags. 2. All tubing and fittings shall be St Stl  
 3. Tag "open" switch as ZS-3010 and "closed" switch as ZS-3011.  
 4. Prewire, mount, pipe and test entire valve as a complete assembly. Vendor shall size actuator.  
 5. The use of zinc, copper or copper bearing alloys is prohibited in contact with process fluid





**SECTION G**  
**REFERENCE DRAWING LIST**

**REFERENCE DRAWING LIST**

**PYROPOWER CORPORATION**

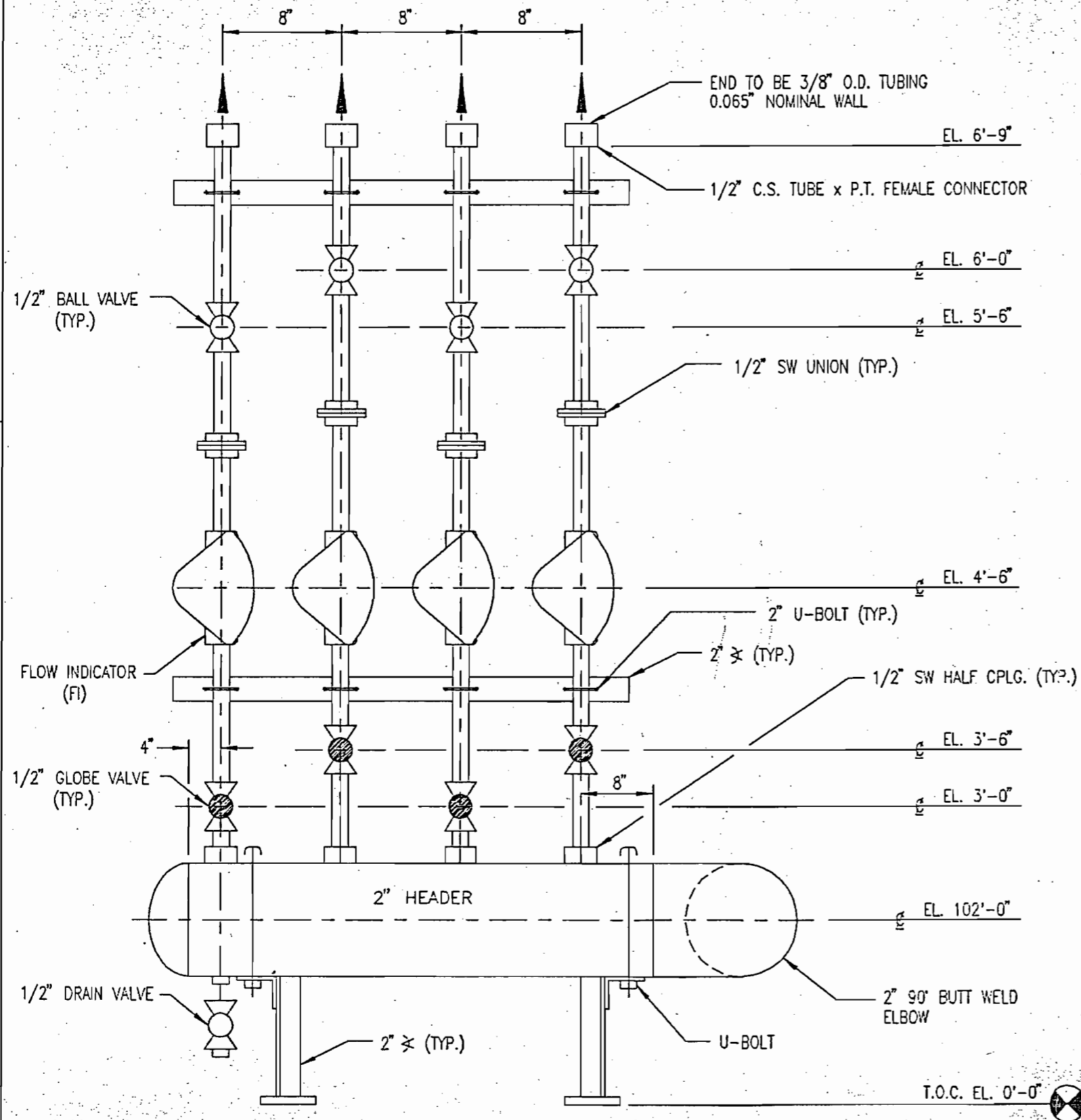
**6J-7877**

**DRAWING NUMBER**

**DESCRIPTION**

DRAWING NUMBER	DESCRIPTION
D-7877-00-01	PROCESS FLOW DIAGRAM
D-7877-01-01	PIPING & INSTRUMENTATION DIAGRAM
D-7877-01-02	PIPING & INSTRUMENTATION DIAGRAM
D-7877-01-03	PIPING & INSTRUMENTATION DIAGRAM
D-7877-01-04	PIPING & INSTRUMENTATION DIAGRAM
D-7877-02-01	GENERAL ARRANGEMENT
D-7877-03-01	PIPING PLAN
D-7877-03-02	PIPING ELEVATION
D-7877-03-03	NOZZLE CHART
D-7877-04-01	INJECTION MANIFOLD
D-7877-04-02	REC./TRANSFER STATION
D-7877-04-03	AMMONIA VALVE RACK-1A
D-7877-04-04	AMMONIA VALVE RACK-1B
D-7877-04-05	AMMONIA VALVE RACK-1C
D-7877-05-01	INSTRUMENT JUNCTION BOX
D-7877-05-02	INSTRUMENT JUNCTION BOX
D-7877-05-03	INSTRUMENTATION INSTALLATION DETAILS
D-7877-05-04	SCHEMATIC LOOP DIAGRAMS
D-7877-05-05	SCHEMATIC LOOP DIAGRAMS
D-7877-05-06	SCHEMATIC LOOP DIAGRAMS
D-7877-05-07	ELECTRICAL SCHEMATIC LOOP DIAGRAMS
D-7877-05-08	ELECTRICAL SCHEMATIC LOOP DIAGRAMS
D-7877-06-01	GENERAL NOTES & LEGEND
D-7877-06-02	ELECTRICAL JUNCTION BOX
D-7877-06-03	ELECTRICAL JUNCTION BOX
D-7877-06-04	ELECTRICAL SCHEMATIC & PHYSICAL ARRANGEMENT
D-7877-06-05	ELECTRICAL SCHEMATIC & PHYSICAL ARRANGEMENT



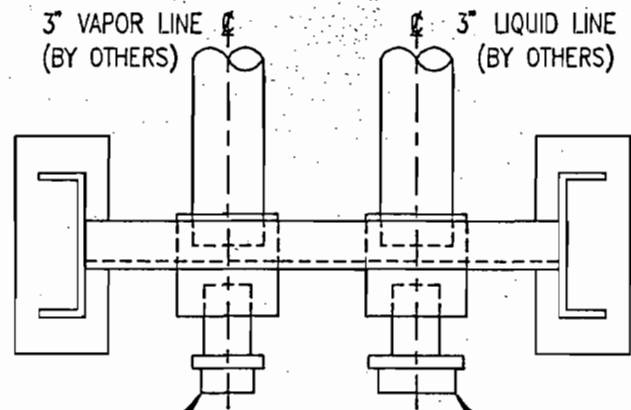


INJECTION	LINE NO.	FI'S	GLOBE VALVES	BALL VALVES	DRAIN VALVES
1CCF-MXX-3A1	2"-P-1002-CSP	FI-1010	BV-1139	BV-1140	BV-1138
		FI-1011	BV-1141	BV-1142	
		FI-1012	BV-1143	BV-1144	
		FI-1013	BV-1145	BV-1146	
1CCF-MXX-3A2	2"-P-1003-CSP	FI-1014	BV-1149	BV-1150	BV-1148
		FI-1015	BV-1151	BV-1152	
		FI-1016	BV-1153	BV-1154	
		FI-1017	BV-1155	BV-1156	
1CCF-MXX-3B1	2"-P-2002-CSP	FI-2010	BV-2139	BV-2140	BV-2138
		FI-2011	BV-2141	BV-2142	
		FI-2012	BV-2143	BV-2144	
		FI-2013	BV-2145	BV-2146	
1CCF-MXX-3B2	2"-P-2003-CSP	FI-2014	BV-2149	BV-2150	BV-2148
		FI-2015	BV-2151	BV-2152	
		FI-2016	BV-2153	BV-2154	
		FI-2017	BV-2155	BV-2156	
1CCF-MXX-3C1	2"-P-3002-CSP	FI-3010	BV-3139	BV-3140	BV-3138
		FI-3011	BV-3141	BV-3142	
		FI-3012	BV-3143	BV-3144	
		FI-3013	BV-3145	BV-3146	
1CCF-MXX-3C2	2"-P-3003-CSP	FI-3014	BV-3149	BV-3150	BV-3148
		FI-3015	BV-3151	BV-3152	
		FI-3016	BV-3153	BV-3154	
		FI-3017	BV-3155	BV-3156	

REV. 0	APPROVED FOR CONSTRUCTION	DATE 4/7/93	REV. 2	DATE	LINE No.
REV. 1		BY SCH	REV. 3	BY	MEDIA
				DATE	INSUL.
				BY	

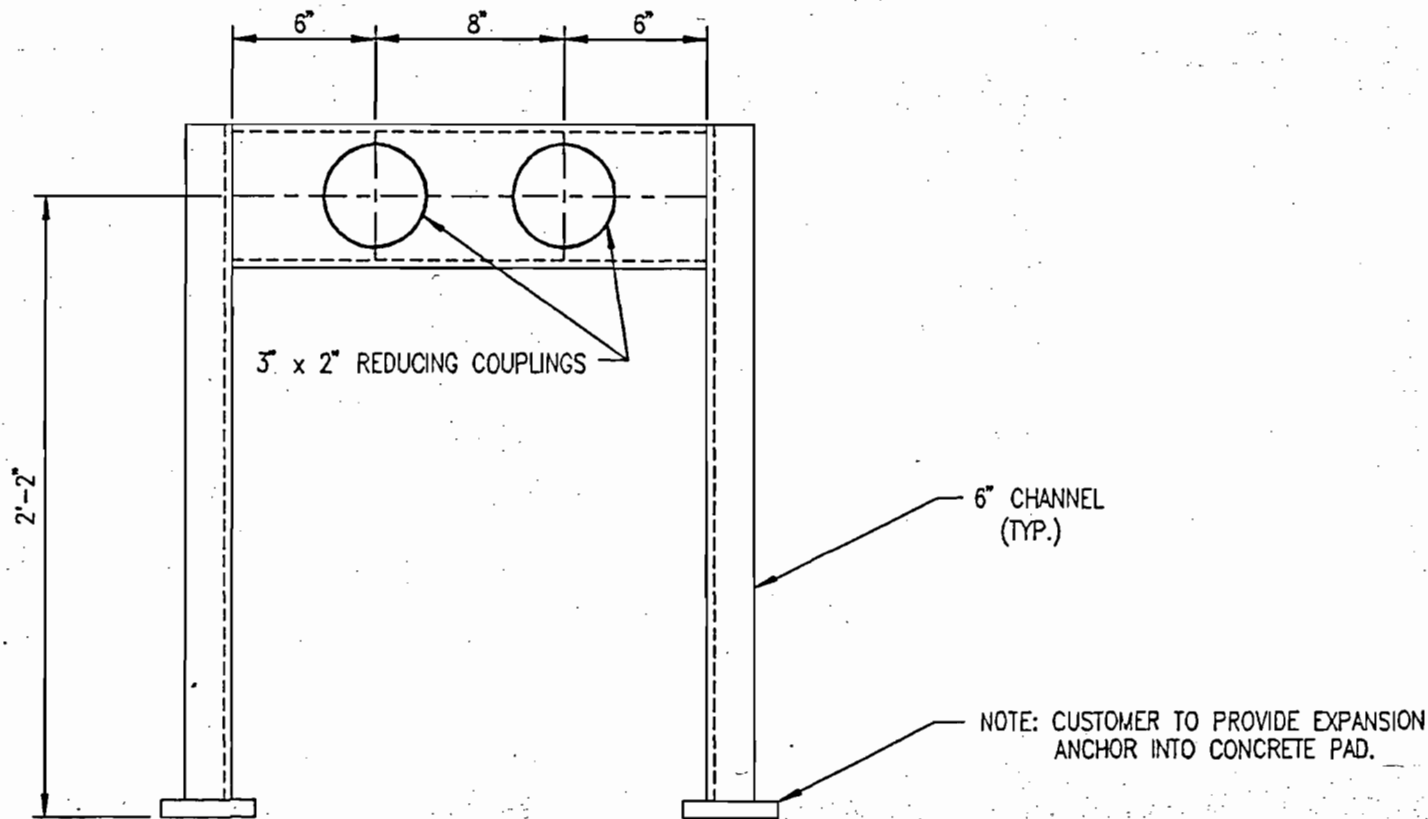
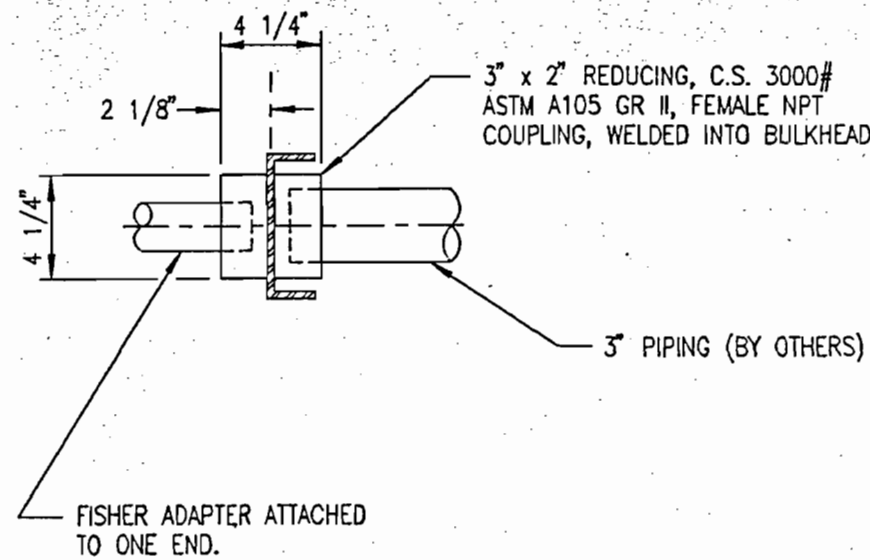
**GLITSCH, INC.**  
Package Plants Division

DWG. BY BENDEROTH	DATE 3-16-93	APP'D. BY SCH	JOB No. 6J-7877
DWG. TITLE INJECTION MANIFOLD	DWG. No. D-7877-04-01	REV. 0	



2" MNPT x 2 1/4"  
M. ACME ADAPTER  
W/CAP.

2" MNPT x 3 1/4"  
M. ACME ADAPTER  
W/CAP.

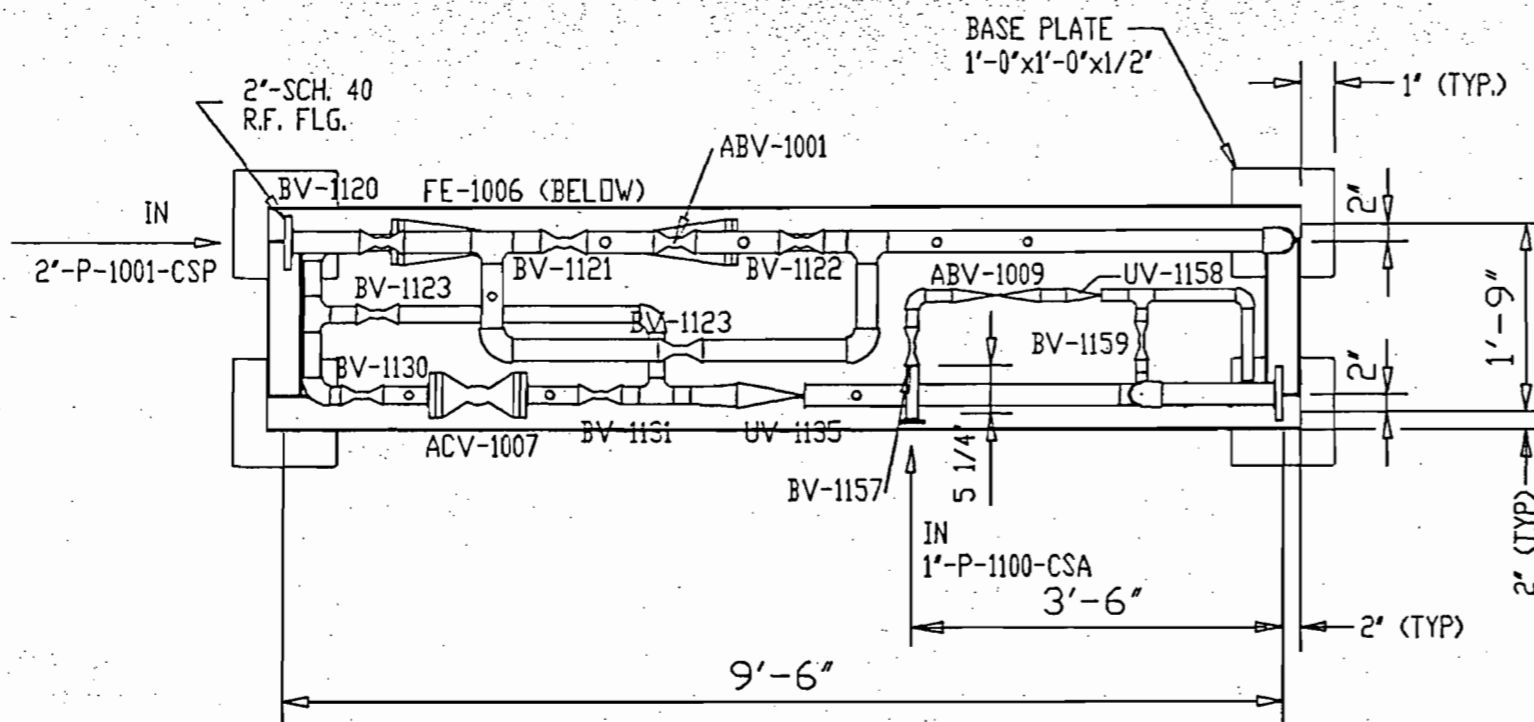


NOTE: CUSTOMER TO PROVIDE EXPANSION ANCHOR INTO CONCRETE PAD.

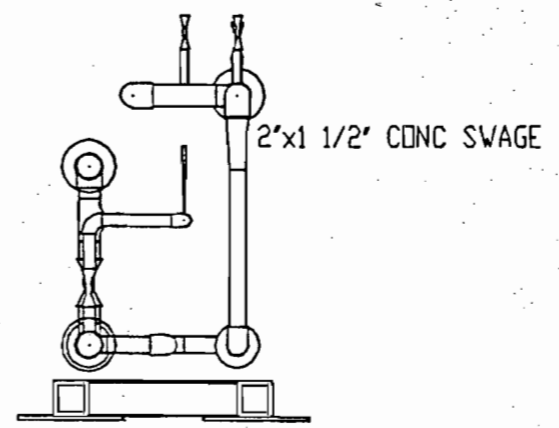
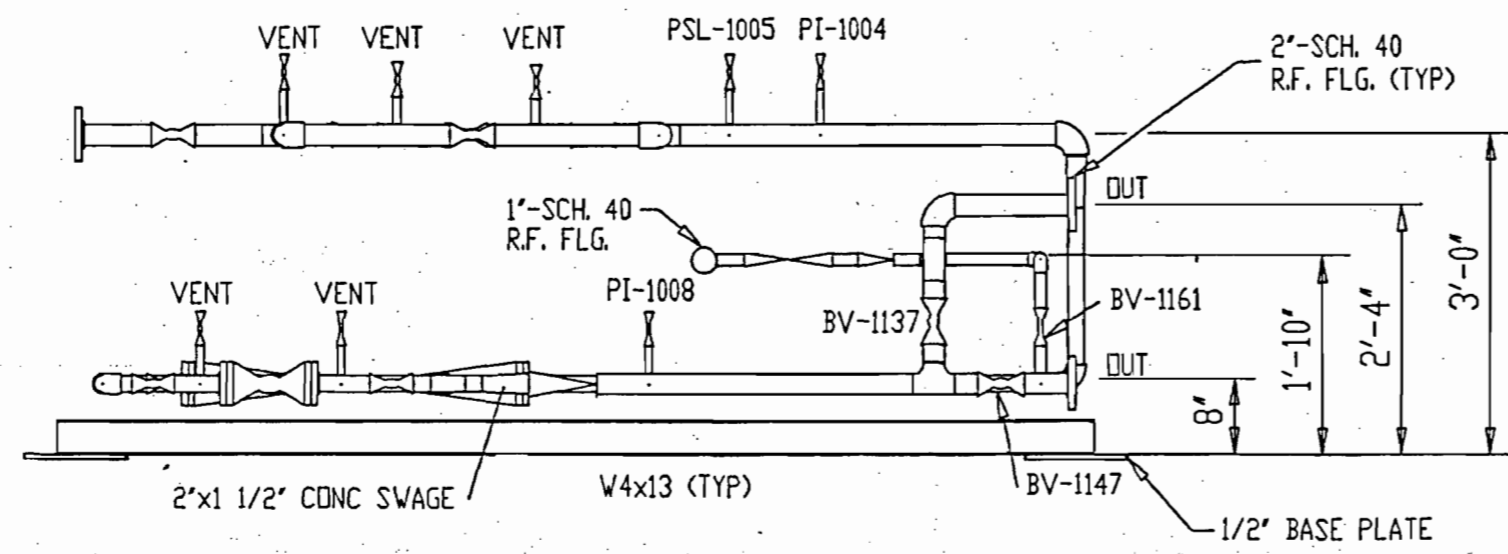
REV. 0	APPROVED FOR CONSTRUCTION	DATE 4-7-93	REV. 2	DATE	LINE No.
		BY SCH		BY	-
REV. 1	DELETED REDUCER IN PLAN	DATE 4-27-93	REV. 3	DATE	MEDIA
		BY SCH		BY	-
				DATE	INSUL.
				BY	-

**GLITSCH, INC.**  
Package Plants Division

DWG. BY	DATE	APP'D. BY	JOB No.
BENDEROTH	3-16-93	SCH	6J-7877
DWG. TITLE	RECEIVING/ TRANSFER STATION	DWG. No.	REV.
		D-7877-04-02	1



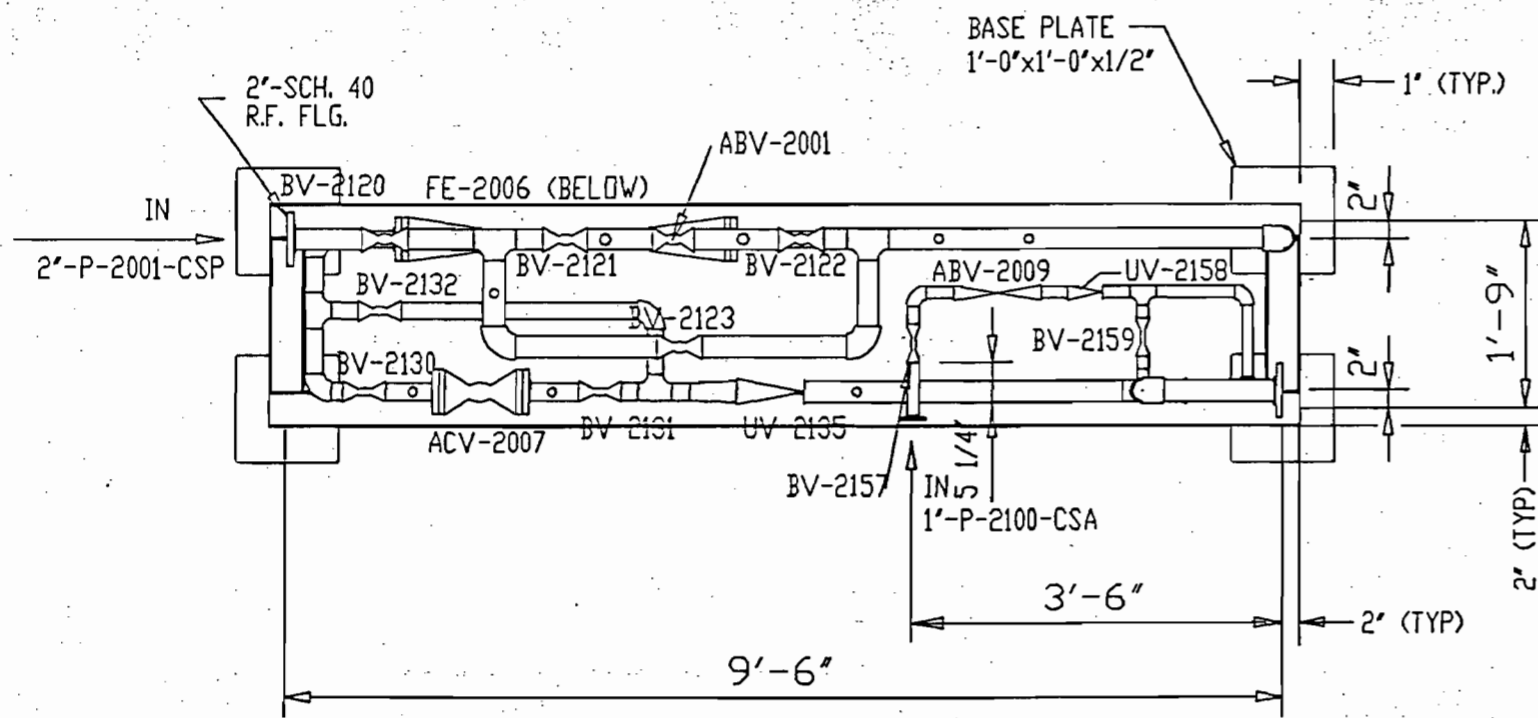
NOTE:  
1. ALL TIE-IN FLANGES ARE 150#.



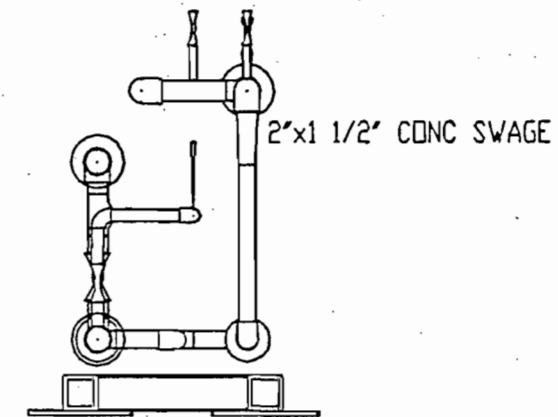
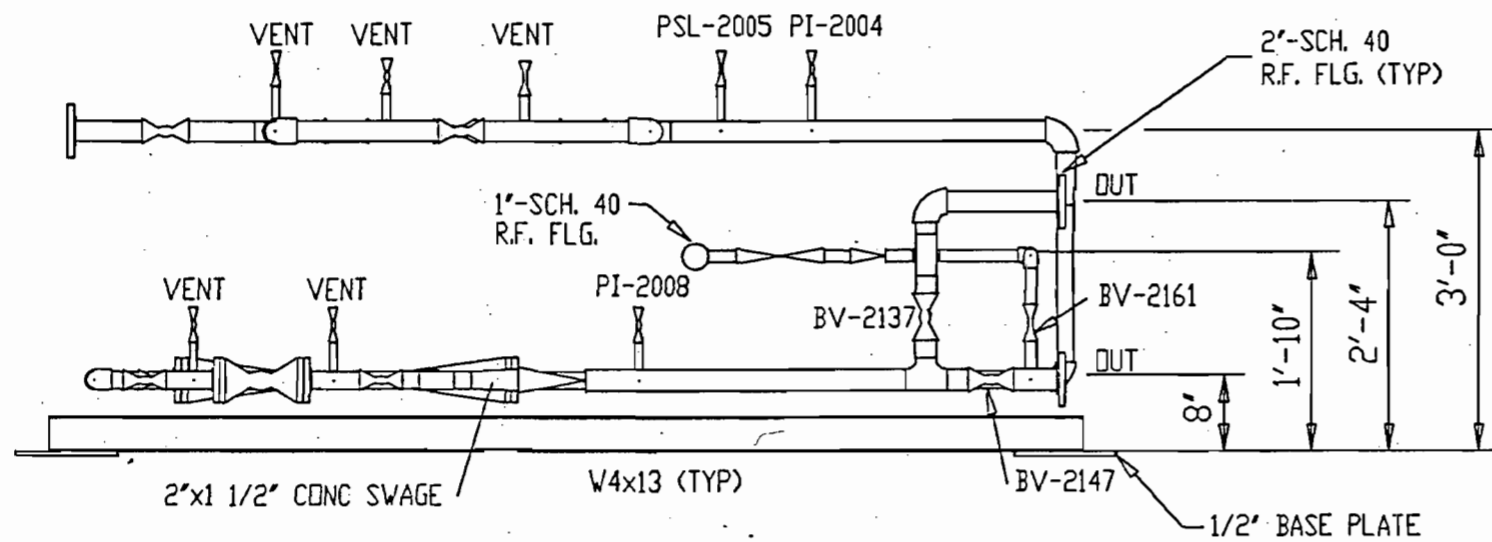
REV. 0	APPROVED FOR CONSTRUCTION	DATE 4/7/93	REV. 2	DATE	LINE No.
		BY SCH		BY	MEDIA
REV. 1	ADDED NOTE 1	DATE 5/7/93	REV. 3	DATE	INSUL.
		BY SCH		BY	

**GLITSCH, INC.**  
Package Plants Division

DWG. BY	DATE	APP'D. BY	JOB No.
BENDEROTH	3-16-93	SCH	6J-7877
DWG. TITLE	DWG. No.	REV.	
AMMONIA VALVE RACK 1A	D-7877-04-03	1	



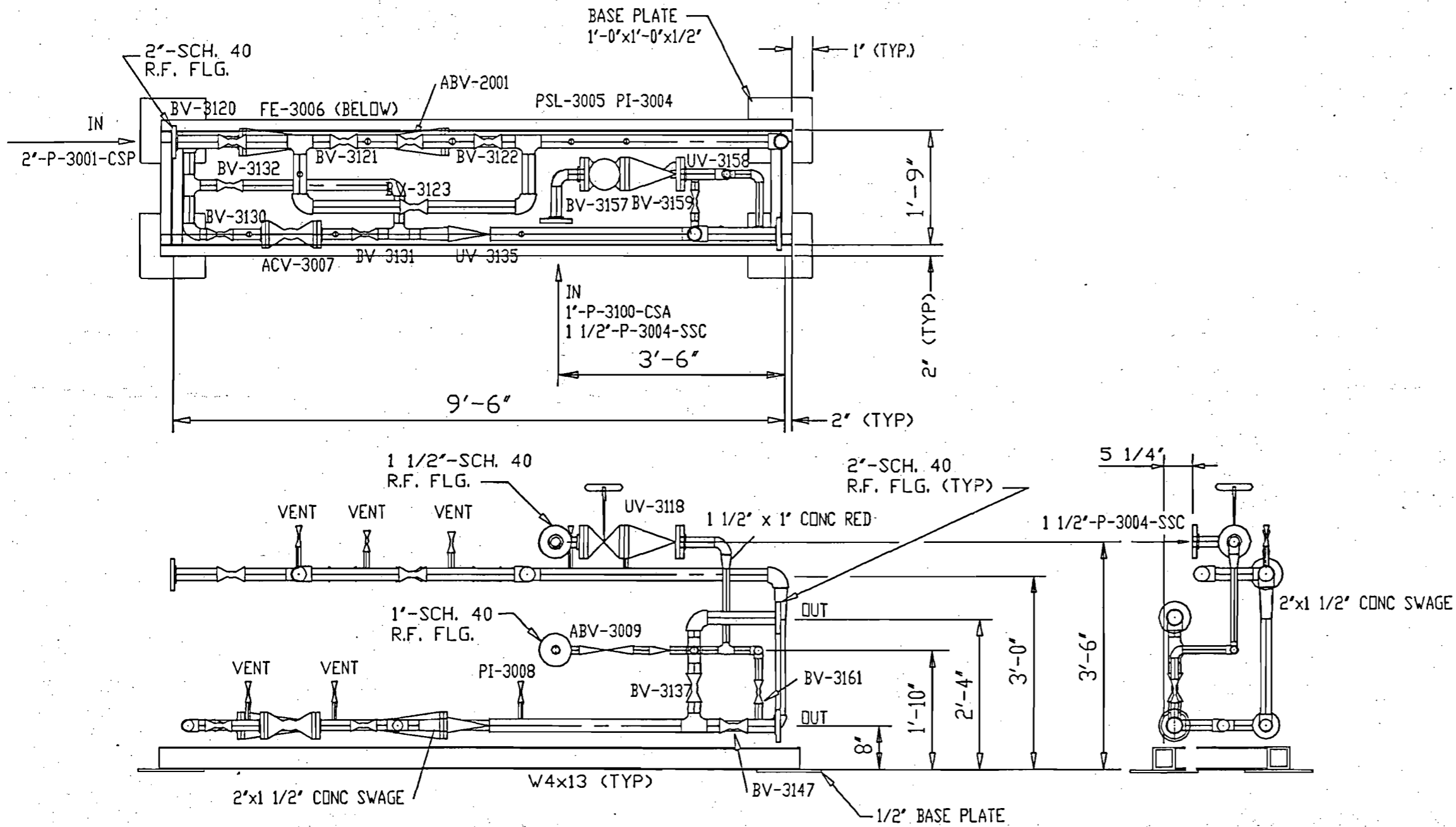
NOTE:  
1. ALL TIE-IN FLANGES ARE 150#.



REV. 0	APPROVED FOR CONSTRUCTION	DATE 4/7/93	REV. 2	DATE	LINE No.	GLITSCH, INC. Package Plants Division	DWG. BY	DATE	APP'D. BY	JOB No.
		BY SCH		BY	MEDIA		BENDEROTH	3-16-93	SCH	6J-7877
REV. 1	ADDED NOTE 1	DATE 5/7/93	REV. 3	DATE	INSUL.		DWG. TITLE	AMMONIA VALVE RACK 1B	DWG. No.	REV.
		BY SCH		BY				D-7877-04-04	1	



NOTE:  
1. ALL TIE-IN FLANGES ARE 150#.



REV. 0	APPROVED FOR CONSTRUCTION	DATE 4/7/93	REV. 2	DATE	LINE No.
		BY SCH		BY	-
REV. 1	ADDED NOTE 1	DATE 5/7/93	REV. 3	DATE	MEDIA
		BY SCH		BY	-
				DATE	INSUL.
				BY	-

**GLITSCH, INC.**  
Package Plants Division

DWG. BY	DATE	APP'D. BY	JOB No.
BENDEROTH	3-16-93	SCH	6J-7877
DWG. TITLE	DWG. No.	REV.	
AMMONIA VALVE RACK 1C	D-7877-04-05	1	

**McAbee**  
CONSTRUCTION, INC.



5724 21st Street  
P.O. Drawer 1460  
Tuscaloosa, Alabama 35403

---

INDUSTRIAL CONTRACTORS • PIPING FABRICATORS • TANK FABRICATORS • EQUIPMENT ERECTION • HVAC & PLUMBING

---

GLITSCH, INC.

P.O.# 18979

ITEM# 1CCF-TNK-1

AQUEOUS AMMONIA STORAGE TANK

S.O.# 217120

---

TELEPHONE (205) 349-2212 • FAX (205) 758-0762

---

**FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS**  
 (Alternative Form for Single Chamber, Completely Shop-Fabricated Vessels Only)  
 As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by McAbee Construction, Inc. - 5724 21st Street - Tuscaloosa, AL  
(Name and address of manufacturer)

2. Manufactured for Glitsch Package Plants - Parsippany, NJ  
(Name and address of purchaser)

3. Location of installation PyroPower - Jacksonville, FL  
(Name and address)

4. Type Horizontal 217120 --- 217120 744 1993  
(Horiz. or vert. tank) (Mfg.'s serial No.) (CIN) (Drawing No.) (Nat'l. Id. No.) (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 1992  
Year

to N/A N/A N/A  
As-fabricated (Date) Code Case Nos. Special Service per UG-120(d)

6. Shell: SA-516-70 .3125" .063" 11'-6" 32'-0"  
Mat'l. (Spec. No., Grade) Nom. Thk. (in.) Corr. Allow. (in.) Diam. I.D. (ft. & in.) Length (overall) (ft. & in.)

7. Seams: Wld, Dbl, Butt Spot 85 None --- Wld, Dbl, Butt Spot 4  
Long (Welded, Dbl., Singl., Lap, Butt) H.T. (Spot or Full) Eff. (%) H.T. Temp. (°F) Time (hr) Girth (Welded, Dbl., Singl., Lap, Butt) H.T. (Spot, Partial, or Full) No. of Courses

8. Heads: (a) Mat'l. SA-516-70 (b) Mat'l. ---  
(Spec. No., Grade) (Spec. No., Grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	<u>Ends</u>	<u>.237"</u>	<u>.063"</u>	<u>138"</u>	<u>8.28"</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>Convex</u>
(b)										

If removable, bolts used (describe other fastenings) N/A  
(Mat'l., Spec. No., Gr., Size, No.)

9. MAWP 25 psi at max. temp. 300 °F  
 Min. design metal temp. -20 °F at 25 psi. Hydro., pneu., or comb. test pressure 38 psi.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No.	Diam. or Size	Type	Mat'l.	Nom. Thk.	Reinforcement Mat'l.	How Attached	Location
<u>In/Out</u>	<u>6</u>	<u>1.0"</u>	<u>150#Flg'd</u>	<u>SA-106-B</u>	<u>.133"</u>	<u>Inherent</u>	<u>Welded</u>	<u>HD&amp;Shell</u>
"	<u>1</u>	<u>1.5"</u>	"	"	<u>.145"</u>	"	"	<u>Shell</u>
"	<u>1</u>	<u>2.0"</u>	"	"	<u>.154"</u>	"	"	"
"	<u>2</u>	<u>3.0"</u>	"	"	<u>.214"</u>	"	"	"

\* Cont. line 12  
 11. Supports: Skirt No Lugs --- Lugs --- Other Saddles Attached Weld to Shell  
(Yes or no) (No.) (No.) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: None  
(Name of part, item number, Mfg.'s name and identifying stamp)

Aqueous Ammonia Storage Tank P.O. No. 18979 Item No. 1CCF-TNK-1  
Impacts exempt per UG-20(F)

\* M'way 1 24.0" 150#Flg'd SA-516-70 .375" Inherent Welded Head

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 1A, 540 expires 4/4/93  
 Date 4-8-93 Co. name McAbee Construction, Inc. Signed L. Barry Linton  
(Manufacturer) (Inspector)

**CERTIFICATE OF SHOP INSPECTION**

Vessel constructed by McAbee Construction, Inc. at Tuscaloosa, AL  
 I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of New York and employed by Commercial Union Insurance have inspected the component described in this Manufacturer's Data Report on 4-8, 19 93, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.  
 Date 4-8-93 Signed L. Barry Linton Commissioners NY# 2182 NB# 5446A  
(Authorized Inspector) (Nat'l Board (incl. endorsements), State, Prov. and No.)

**McAbee Construction Inc.**  
**Material Identification**

Customer: GLITSCH INC.

P.O. Number: 18979

Job No.: 217120

Item No.: 1CCF-TNK-1

Description AQUEOUS AMMONIA STORAGE TANK

MARK	USE	DESCRIPTION	SPECIFICATION	HEAT NUMBER
1	HEAD	ASME F&D .312 NOM. THK	SA-516-70	7417643-1958 (FIGL)
2	SHELL	.312" PL ROLLED TO 136" OD	"	7418737-N021901
3	"	"	"	"
4	"	"	"	"
5	"	"	"	"
6	HEAD	ASME F&D .312 NOM. THK	"	7424566-2084 (FIGM)
7	NOZZ NECK A & C	3" SCH 40 PIPE	SA-106-B	N48106
8	NOZZ NECK B	1 1/2" SCH 40 PIPE	"	263492
9	NOZZ NECK D.L1&2	1" SCH 40 PIPE	"	423922
10	NOZZ NECK P1	"	"	"
11	NOZZ NECK S2 & S3	"	"	"
12	NOZZ NECK S1	"	"	"
13	MANWAY M	.375 PL ROLLED TO 24" OD	SA-516-70	7417354-6354

# McABEE

## BEST AVAILABLE COPY

Construction Inc.

MATERIAL IDENTIFICATION SKETCH

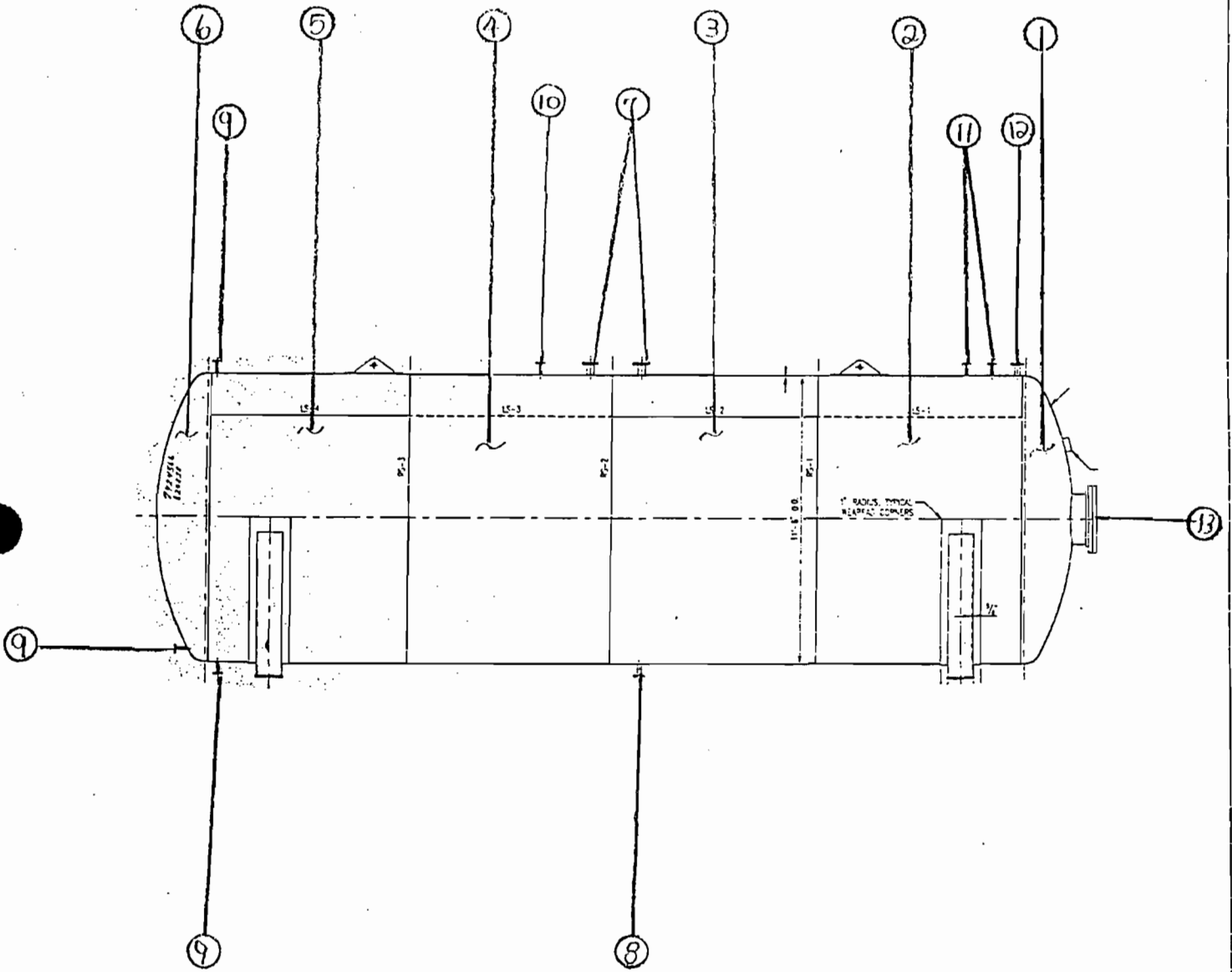
DATE: 3-2-93

CUSTOMER: GLITSCH INC.

P.O. NO. 18979

S.O. NO. 217120

ITEM NO. ICCF - TANK - 1



FIGL

CONTROL CARD 32-C171-01	REQ. JOB CONTRACT NO.	PURCHASE ORDER DATE 09/03/92	PURCHASE ORDER NO. E 23163-GS
CERTIFICATE OF TESTS		CUSTOMER IDENTIFICATION	GSS ORDER NO. NUMBER 26838
		DIST. G	MFG. NO. 743
		OFFICE DIST. 110	INVOICE DATE
		INVOICE NUMBER 742-19654	
		LE ACCOUNT NUMBER 75378301	TERMS 30-3/4-10

TRINITY INDUSTRIES  
HEAD DIVISION  
11861 MOSTELLER RD  
CINCINNATI OH 45241

TRINITY INDUSTRIES  
HEAD DIVISION  
916 19TH AVE EAST  
TUSCALOOSA AL 35404

DATE SHIPPED 10 22 92	FROM ALA CITY	ROUTE/VEHICLE IDENTIFICATION J & M TRPT	SHEET NO.
--------------------------	------------------	--	-----------

I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

LEONARD A. TROMAN  
DIR. QUALITY ASSURANCE AND METALLURGY

ITEM NO	MATERIAL DESCRIPTION	P/C	QUANTITY SHIPPED
01	PLATE CARBON ASTM A-516-90 GRD 70 ASME SA 516 DATE 07 01 89 GRD 70 AS ROLLED PVQ ADDITIONAL TEST NORM TEST SPECIMENS CUST ID: 120-116 P243000A 3125 X 75.7500 SHEARED EDGE X 151.5000 IN P243000A HT 7417643 T 1958 3PCS HT 7424565 T 2082 6PCS HT 7424565 T 2083 6PCS HT 7424565 T 2084 5PCS	A	20340
CH	C 27MX MN 85/1.20 P 035MX S 035MX SI 15/40 AL 020 MIN CU 40MX NI 40MX CR 30MX MO 12MX CB 02MX V 03MX		
NR	YLD 38000 MIN TEN 70/90000 % ELONG MIN 2 IN 21 OR 3 IN 17 PHY ON AR & NORM TST SPEC		
TI	3 TR TO S/A 1 U/SHIPMENT		
TOTAL WT. 20,340 PCS		20	

McAbee  
4  
Head  
McAbee Const. (1) Head  
S.# 217120

The plates as listed are furnished in the "as rolled" condition. The test results shown are those obtained on coupons after they were normalized by heating to 1650 degrees F. and held at temperature for 60 minutes per inch of thickness, followed by air cooling to 300°F or below.

ANALYSIS	ITEM NO.	HEAT NO.	GRAIN	CARBON	MANG	PHOS	SUL	SIL	COPPER	NICKEL	CHROME	MOLY	VAN	CB	AL	
																YIELD KSI
	01	7417643		.13	1.07	.012	.017	.220	0.03	0.03	0.15	.04	.000	.003	.034	
	01	7424565		.20	1.02	.010	.016	.195	0.03	0.01	0.03	.01	.000	.003	.034	
	01	7424566		.21	1.10	.011	.099	.211	0.03	0.01	0.02	.02	.000	.005	.040	
TEST RESULTS	01	7417643	1958	50	74	24	AR									
				49	70	30	NM									
				52	77	27	AR									
				52	73	26	NM									
				53	76	27	AR									
KH		7424565	2082	53	74	26	NM									
				53	77	26	AR									
				53	75	23	NM									

APPROVED  
Q. A. DEPT.  
OCT 27 1992  
INITIALS

# Gulf States Steel, Inc.

MOBILE, AL 36688-1000

67-7353-01

ORDER NUMBER 20009	ITEM NO. 01	QTY 712	DATE 12 21 92	CERTIFICATE OF TESTS	ACCOUNT NUMBER 00000004	PACK NO.	INVOICE NUMBER 702-62330
SHIP TO 7038			SHIP FROM ALA CITY		DATE SHIPPED 02 08 93	SHIPMENT TYPE VICTORY TRI	

WE HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS SPECIFIED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

G. T. DEANEN, JR.  
MGR. TECHNOLOGY AND  
QUALITY - PLATE PRODUCTS

SABEL INDUSTRIAL INC  
P.O. BOX 4747  
MONTGOMERY AL 36103

SABEL STEEL SERVICE  
DIVISION OF SABEL INC  
2104 4TH STREET

TUSCALOOSA AL 30402

MATERIAL DESCRIPTION: PLATE CARBON ASTM A-516-90 GRD 70 ASME SA-516 BIN 07 01 07 GRD 70 FV4 QUANTITY SHIPPED: 7

3125 X 96.0000 SHEARED EDGE X 480.0000 IN  
 7418737 1 NO21901 1 PCS  
 7418737 1 NO21902 1 PCS  
 7418737 1 NO21903 1 PCS  
 7418737 1 NO21904 1 PCS  
 7418737 1 NO21905 1 PCS

20420

CH C 27HX MH 80/1.20 P 03HX 8 03HX SI 15/90 AL 020HX CU 40HX NI 40HX  
 CR 30HX MO 12HX CB 02HX U 03HX

HR YLD 38000 MIN TEN 70/90000 % ELONG MIN 2 LR 21 OR 8 IN 17

McAbee Const. (2) Shell  
 (3) Shell  
 (4) Shell  
 (5) Shell

S.O.# 217120

HAZ NUMBER	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	CB	V	Al	N	B	Ca	Ti
7418737	19	1.13	.010	.010	.230	0.06	0.01	0.04	.02	.002	.000	.034				

HAZ NUMBER	TEST OR FINCH IDENTITY NO.	YIELD KSI	TENSILE KSI	ELONG	HAZ TEST	HEAT TREAT	WELD RATIO	ALPHA AREA	DALC COATING	DIE	WELD	WELD	WELD	WELD	WELD	WELD
7418737	NO21901	58	78	23												
"	NO21902	58	78	26												
"	NO21903	56	77	25												
"	NO21904	56	77	26												
"	NO21905	56	78	27												

HAZ NUMBER	TEST OR FINCH IDENTITY NO.	TREAT	SIZE	DIR	THICK	ENERGY	HAZ TEST	HEAT TREAT	WELD RATIO	ALPHA AREA	DALC COATING	DIE	WELD	WELD	WELD	WELD

McAbee  
4

FIGM

CONTROL CARD	REQ. JOB CONTRACT NO.	PURCHASE ORDER DATE	PURCHASE ORDER NO.
32-C171-01		09/03/92	E 23168-GS
CERTIFICATE OF TESTS		CUSTOMER IDENTIFICATION	
		GSS ORDER NO. NUMBER	MFG. ITEM NO.
		OFFICE DIST	INVOICE DATE
		INVOICE NUMBER	742-19654
		ACCOUNT NUMBER	TERMS
		75378301	30-3/4-10

TRINITY INDUSTRIES  
 HEAD DIVISION  
 11861 MOSTELLER RD  
 CINCINNATI OH 45241

TRINITY INDUSTRIES  
 HEAD DIVISION  
 916 19TH AVE EAST  
 TUSCALOOSA AL 35404

SHIPTON

DATE SHIPPED	FROM	ROUTE/VEHICLE IDENTIFICATION	SHEET NO.
10 22 92	ALA CITY	J & M TRPT	

I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

LEONARD A. TROMAN  
 DIR. QUALITY ASSURANCE  
 AND METALLURGY

ITEM NO	MATERIAL DESCRIPTION	QTY	QUANTITY SHIPPED
01	PLATE CARBON A516 70 GRD 70 ASME SA 516 DATE 07 01 89 GRD 70 AS ROLLED PVQ ADDITIONAL TEST NORM TEST SPECIMENS CUST ID: 120-116 P243000A .3125 X 75.7500 SHEARED EDGE X 151.5000 IN P243000A HT 7417643 T 1958 3PCS HT 7424565 T 2082 6PCS HT 7424565 T 2093 6PCS HT 7424566 T 2084 5PCS		20340
CH	C 27MX MI 85/1.20 P 035MX S 035MX SI 15/40 AL 0201IN CU 40MX NI 40MX CR 30MX MO 12MX CB 02MX V 03MX		
MR	YLD 38000 MIN TEN 70/90000 % ELONG MIN 2 IN 21 OR 8 IN 17 PHY ON AR & NORM TST SPEC		
TI	3 TR TO S/A 1 W/SHIPMENT		
TOTAL WT. 20,340 PCS		20	

McAbee  
 4

McAbee Const. 6 Head  
 SO # 217120

The plates as listed are furnished in the "as rolled" condition. The test results shown are those obtained on coupons after they were normalized by heating to 1650 degrees F. and held at temperature for 60 minutes per inch of thickness, followed by air cooling to 300°F or below.

ITEM NO.	HEAT NO.	TEST PIECE IDENTITY NO.	YIELD KSI	TENSILE SIG KSI	ELONG		GALV. COATING	BEND TEST	HARD.	CHARPY IMPACT VIBRICH FT. LBS. AT			
					2"	8"				TEST NO.	SPEC SIZE	1	2
01	7417643	1958	50	74	24	AR							
			49	70	30	NA							
			52	77	27	AR							
			52	73	26	MM							
			53	76	27	AR							
K4	7424565	2082	53	74	26	MM							
			53	77	26	AR							
			53	75	27	MM							

APPROVED  
 Q. A. DEPT.  
 OCT 27 1992  
 INITIALS





Division of USX Corporation

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TUBULAR PRODUCTS

METALLURGICAL TEST REPORT

PAGE 1 2

WHS

10.27.12

07/16/90

JOB, CONTRACT NO.

P.O. DATE

PURCHASE ORDER NO.

4161-USS

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFG., SAMPLED, TESTED, AND/OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS. APPROVED BY OFFICE OF: D.S. DABKOWSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

VENDOR

USS TUBULAR PRODUCTS

SHIPPERS NO.

R12172

MILL ORDER NO.

DS84480 06

INVOICE NO.

92/11/29

VEHICLE IDENTITY

LT8307

SOLD TO

DIXIE PIPE SALES INC  
PO BOX 300650  
HOUSTON TX 77230-0650

DIXIE PIPE SALES INC  
PO BOX 300650  
HOUSTON TX 77230-0650

MAIL TO

PIPING AND EQUIPMENT CORPORATION

2/16/93

DATE 12/11/92

REC. & ISP.

DATE

THIS MILL TEST REPORT APPLIES TO YOUR PURCHASE ORDER NUMBER

McAbee 217140-3806

Mill Test Reports furnished by DIXIE PIPE SALES, INC.

Apply to your Order No. 068470

ITEM NO.	MATERIAL DESCRIPTION			MATL	HEAT/LOT NO.	MIN. HYDRO PSI	YIELD STR. PSI	TENSILE STR. PSI	ELONG. % IN 2"	GAGE WIDTH IN.	FLAT	BEND
	SIZE	WALL	SPECIFICATION & GRADE									
06	3 1/2	.216	ASTM A53-90BGR.B ASME SA53 GR.B 89ED.91 ADD ASTM A106 91 GR.B ASME SA106 GR.B 89ED.91 ADD. API 5L GR.B/X42 39TH ED. 6/91	SML	N48016	3000	47500	73200	35.0	3/4	OK	
06	3 1/2	.216	ASTM A53-90BGR.B ASME SA53 GR.B 89ED.91 ADD ASTM A106 91 GR.B ASME SA106 GR.B 89ED.91 ADD. API 5L GR.B/X42 39TH ED. 6/91	SML	N48019	3000	46800	72500	37.0	3/4	OK	

ITEM NO.	HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO	
06	N48016	HEAT	18	102	010	006	24	01	02	05	02				002					
06	N48016	PROD	18	103	007	009	25	01	02	04	02				001					
06	N48019	HEAT	18	103	011	007	25	01	01	04	01				002					
06	N48019	PROD	16	105	008	008	26	01	01	05	02				002					
** END OF DATA THIS SHEET ** ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.																				

CE=.36  
HRB=78.0  
CE=.36  
HRB=77.0  
McAbee  
4

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ROSENBERG CORPORATION  
HOUSTON, TEXAS

190

GULF STATES TUBE DIVISION ROSENBERG, TEXAS 77471

ORDER NUMBER	CUSTOMER ORDER NUMBER	DATE	OFC	COM	DI	WI	NET SLS	GR SLS	ACCOUNT NUMBER	US	PAGE
054003	3612-Q	03/01/91	23	00	16	20	01		00172007DPD	EP	JDW

DIXIE PIPE SALES

P O BOX 300650  
HOUSTON TX 77230

DIXIE PIPE SALES  
2407 BROILLER ST  
HOUSTON TX 77054

SN-TR-INV

ROUTING

COLLECT TRUCK - USE DIXIE TRUCK 01-30-0800 COLL TRUCK

ANALYSIS	SHAPE	PRODUCT	FC	HEAT TREATMENT	REQUESTED
PER SPEC	ROUND	HOT FINISH		PER SPEC	APRIL 1991
SEAMLESS	ASTM/ASME A/SA 106 B 89	HE CARBON PIPE			04/30/91

SPECIAL INSTRUCTIONS:

PLAIN ENDS - LACQUER COAT

Mill Test Reports furnished by  
DIXIE PIPE SALES, INC.

Apply to your Order No. P68462

ITEM	QUANTITY	O.D.	I.D.	WALL	LENGTH	WT/FT	WEIGHT	REMARKS
1	20,000'	1.900	1-1/2" SCH 40	.145 AVG	RAND 17' 24'	2.718	54,360	PARTIAL 740 PCS. 16156'-4"

SHIPPING NOTE: NO TRUCKS ACCEPTED AFTER 12:00 NOON. NOTIFY SALES 24 HOURS BEFORE SHIPPING.

PIPING AND EQUIPMENT CORPORATION  
DATE 2/16/93  
THIS MILL TEST REPORT APPLIES TO YOUR PURCHASE ORDER NUMBER 21120  
McAbee 21140-3806

HEAT NO.	C	Mn	P	S	SI	Fe	Cr	Mo	Cu	Pb	REMARKS
274162	.17	.75	.011	.019	.17	.07	.04	.01	.13		V .001
	.17	.74	.012	.019	.16	.07	.04	.01	.12		V .001
268422	.16	.72	.013	.107	.18	.07	.07	.01	.20		V .001
	.17	.73	.013	.017	.19	.07	.08	.01	.21		V .001
268492	.17	.69	.009	.017	.14	.08	.06	.01	.22		V .001
	.18	.71	.010	.019	.13	.08	.06	.02	.23		V .001

McAbee  
4

FLATTEN	FLARE	FLANGE	REV. FLATTEN	HYDRO TEST	BEND	EDDY CURRENT
				2500 psi OK	OK	

HEAT NO.	ULT. STRL PSI	YIELD PSI	ELONG 2"	HARDNESS	HEAT NO.	ULT. STRL PSI	YIELD PSI	ELONG 2"	HARDNESS
274162	67800	44500	52.0						
268422	72700	46500	48.0						
268492 ✓	68900	44000	52.0						

I CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE ORDERED SPECIFICATION AND THAT THIS TEST INFORMATION IS CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.

*[Signature]*  
TECHNICAL ANALYST

SWORN TO AND SUBSCRIBED BEFORE ME THIS

3rd DAY OF April 1991

BEST AVAILABLE COPY HOUSTON, TEXAS

01-30-0600

GULF STATES TUBE DIVISION ROSENBERG, TEXAS 77471

ORDER NUMBER	CUSTOMER ORDER NUMBER	DATE	OFC	COM	DI	WT	NET SLS	GR SLS	ACCOUNT NUMBER	US	PAGE
260310	4050-Q	06/22/92	23	00	16	20	01	00172007DPD	FP	JW	1

DIXIE PIPE SALES

P O BOX 300650  
HOUSTON TX 77230

DIXIE PIPE SALES  
2407 BROILLER ST  
HOUSTON TX 77087

SN 4  
TR 4  
INV 3

UTING

COLLECT TRUCK - DIXIE TRUCK

ROLL TRUCK REQUESTED

ANALYSIS	SHAPE	PRODUCT	FC	HEAT TREATMENT	ROLL TRUCK REQUESTED
ER SPEC	ROUND	HOT FINISH		PER SPEC	SEPTEMBER 92
SEAMLESS		ASTM/ASME A/SA 106 B 90	CMST	DESCRIPTION	PROMISE
SPECIAL INSTRUCTIONS:				HF CARBON PIPE	09/30/92

MAIN ENDS - LACQUER COAT  
ACCEPTABLE PER NACE MRO 175 TABLE 3

Mill Test Reports furnished by  
DIXIE PIPE SALES, INC.

Apply to your Order No. PL66645

QTY	QUANTITY	O.D.	I.D.	WALL	LENGTH	WT/FT	WEIGHT	REMARKS
4,000'	1.315			.133	RAND 17'	1.679	6,716	Comp. 183 pcs. 4165'7"
	1" SCH 40			AVG	24'			

PIPING AND EQUIPMENT CORPORATION  
2/16/93  
DATE

THIS MILL TEST REPORT APPLIES TO YOUR PURCHASE ORDER NUMBER  
McAbee 217140-3806

SHIPPING NOTE: NO TRUCKS ACCEPTED AFTER 12:00 NOON. NOTIFY SALES 24 HOURS BEFORE SHIPPING.

HEAT NO.	C	Mn	P	S	SI	NI	Cr	Mo	Cu	Pb	REMARKS
423922	.18	.85	.014	.011	.24	.08	.09	.02	.22		V .001
	.18	.83	.016	.011	.24	.08	.09	.02	.22		V .001

McAbee  
4

FLATTEN	FLARE	FLANGE	REV. FLATTEN	HYDRO TEST	BEND	EDDY CURRENT
				2500 psi OK	OK	

HEAT NO.	ULT. STR. PSI	YIELD PSI	ELONG 2"	HARDNESS	HEAT NO.	ULT. STR. PSI	YIELD PSI	ELONG 2"	HARDNESS
423922	76100	50800	46.0						

I CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE ORDERED SPECIFICATION AND THAT THIS TEST INFORMATION IS CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.

Al Zbranek  
AL ZBRANEK  
TECHNICAL ANALYST

SWORN TO AND SUBSCRIBED BEFORE ME THIS

September 1992  
NOTARY PUBLIC

S.O. # 217140

189



# McAbee

Construction Inc.

## Radiographic Inspection Report

Job Number: 217120

Item No. 1CCF-TNK-1

XR #	Stat	Loc.	Loc.#	Date	Welder ID	Accept	Comments	Repair Acc
1		HEAD	LS	2/16/93	BBB	N	6-7,8-9,9-10 R1 ACCEPTED ON 2-17-93	Y
2		HEAD	LS	2/18/93	BBB	N	2-3,7-8 R1 ACCEPTED ON 2-19-93	Y
3		RS	1	3/9/93	VVV	Y	ACCEPTED ON 3-16-93	
4		LS	2	3/9/93	PPP	Y		
5		LS	3	3/9/93	999	N	R1,P1,P2 ACCEPTED ON 3-16-93	Y
6		RS	3	3/9/93	PPP	Y		
7		RS	5	3/16/93	ZZZ	N	R1,P1,P2 ACCEPTED ON 3-17-93	Y
8		RS	5	3/16/93	ZZZ	Y		



# SPACE SCIENCE SERVICES, INC.

ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: DOTHAN

CUSTOMER: McABEE CONST ADDRESS: TUSCALOOSA AL.  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 2-16-93 PART NAME: 100% SEAM ON PLATE OF VESSEL PART NUMBER: 217120  
 PURCHASE ORDER NO. SPECIFICATION: U.W. 51 SUBMITTED BY: B. Reece

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<u>✓</u>	<u>C.S.</u>	<u>1/2"</u>	<u>Bar</u>	<u>BBB</u>	<u>NO</u>	

### RADIOGRAPHIC TECHNIQUE

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	UG
<u>IR192</u>	<u>51</u>	<u>—</u>	<u>—</u>	<u>9.00</u>	<u>ASTM WIRE</u>		<u>3</u>	<u>79"</u>	<u>SAIN</u>	<u>680</u>	<u>.01</u>	<u>.4</u>	<u>35</u>	<u>NOT</u>	<u>100</u>	<u>.03</u>

FILM USED: 14 x 17      7 x 17      13 (4 1/2 x 17)      8 x 10      4 1/2 x 10      5 x 7

Pipe Diameters	WELD NO. AND/OR STATION MARKERS	CRACKS			POROSITY			MISC.			RESULTS			DENSITY		REMARKS	SET UP	
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE ELUSION	WITHHELD	ACCEPTED	PENE.			AREA OF INTEREST
<u>1/2" PLATE</u>	<u>1-2</u>													<u>✓</u>	<u>31</u>	<u>31</u>		
<u>VR #1</u>	<u>2-3</u>													<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>3-4</u>													<u>✓</u>	<u>21</u>	<u>31</u>		
	<u>4-5</u>													<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>5-6</u>													<u>✓</u>	<u>29</u>	<u>29</u>		
	<u>6-7</u>													<u>✓</u>	<u>30</u>	<u>30</u>		<u>Gas Pocket - 3</u>
	<u>7-8</u>													<u>✓</u>	<u>29</u>	<u>29</u>		
	<u>8-9</u>								<u>3</u>					<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>9-10</u>								<u>3</u>					<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>10-11</u>													<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>11-12</u>													<u>✓</u>	<u>30</u>	<u>30</u>		
	<u>12-13</u>													<u>✓</u>	<u>30</u>	<u>30</u>		

CODE: 1. ACCEPTABLE      2. QUESTIONABLE      3. REJECTABLE      4. SURFACE DEFECT  
 QUANTITY X-RAYED 12 ACCEPTED 9 WITHHELD 3 INSPECTED BY William J. Reese DATE 2-16-93

SKETCH

**McAbee**  
 CONSTRUCTION, INC.

ASNT-TC-1A

REVIEW AND INTERPRETATION  
 By: Ch. Reed II  
 Date: 2-17-93

WORK ORDER 70-10990

**BEST AVAILABLE COPY**

**SPACE SCIENCE SERVICES, INC.**

ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan AL

CUSTOMER: McAbee

ADDRESS: Tuscaloosa AL  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 2/17/95 PART NAME: 100% seam on Plate of Vessel PART NUMBER: 212120  
 PURCHASE ORDER NO. SPECIFICATION: UW 51 SUBMITTED BY: B. Reum

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<u>✓</u>	<u>CS</u>	<u>7/2"</u>	<u>Butt</u>	<u>—</u>	<u>—</u>	

**RADIOGRAPHIC TECHNIQUE**

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	UG
<u>IR-192</u>	<u>51</u>	<u>—</u>	<u>—</u>	<u>5700</u>	<u>ASTM</u>	<u>—</u>	<u>5</u>	<u>78"</u>	<u>5min</u>	<u>68°</u>	<u>101</u>	<u>01</u>	<u>35</u>	<u>NDT</u>	<u>100</u>	<u>025</u>

FILM USED: 14 x 17      7 x 17      4 (1/2 x 17)      8 x 10      4 1/2 x 10      5 x 7

Pipe Diameter	WELD NO. AND/OR STATION MARKERS	CHACKS			POHO SITY			MISC.			HERUITB			DENSITY		REMARKS	SET UP	
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE FUSION	WITHHELD	ACCEPTED	PENE.			AREA OF INTEREST
<u>1/2" Plate</u>	<u>XR-1(R1)</u>																	
	<u>6-7</u>													<u>✓</u>	<u>25</u>	<u>25</u>		
	<u>8-9</u>													<u>✓</u>	<u>27</u>	<u>27</u>		
	<u>9-10</u>													<u>✓</u>	<u>26</u>	<u>26</u>		

CODE: 1. ACCEPTABLE      2. QUESTIONABLE      3. REJECTABLE      4. SURFACE DEFECT  
 QUANTITY X-RAYED 3      ACCEPTED 3      WITHHELD      INSPECTED BY William H. Reum      DATE 2-17-95

SKETCH

ASTM-TC-11A

**McAbee**  
 CONSTRUCTION INC.



REVIEW AND INTERPRETATION  
 By: [Signature]

WORK ORDER 70-10991



SPACE SCIENCE SERVICES, INC.  
 ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan AL

CUSTOMER McABEE ADDRESS Truca  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE 2-18-93 PART NAME 100% Low Seam on Vessel PART NUMBER 2121  
 PURCHASE ORDER NO. SPECIFICATION CCW51 SUBMITTED BY B Reem

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<u>✓</u>	<u>C.S.</u>	<u>1/2"</u>	<u>Butt</u>	<u>—</u>	<u>—</u>	

RADIOGRAPHIC TECHNIQUE

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOUR
									TIME	TEMP.	FRT.	BCK.	TYPE	BRAND	
<u>XR-192</u>	<u>51</u>	<u>—</u>	<u>—</u>	<u>21:00</u>	<u>15mm</u>		<u>3</u>	<u>18"</u>	<u>5min</u>	<u>60°</u>	<u>.01</u>	<u>.01</u>	<u>55</u>	<u>NDT</u>	<u>100.</u>

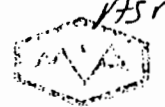
FILM USED: 14 x 17 7 x 17 13 4 1/2 x 17 8 x 10 4 1/2 x 10 5 x 7

Pipe Diameter	WELD NO. AND/OR STATION MARKERS	CRACKS							POROSITY		MISC.			RESULTS		DENSITY		REMARKS	SET UP
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE FUSION	WITHIELD	ACCEPTED	PENE.	AREA OF INTEREST			
																	INCOMPLETE FUSION		
<u>1/2"</u>	<u>XR-2</u>																		
<u>Plate</u>	<u>1-2</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>2-3</u>												<u>3</u>	<u>✓</u>	<u>29</u>	<u>29</u>		<u>Gas Pocket</u>	
	<u>3-4</u>													<u>✓</u>	<u>28</u>	<u>28</u>			
	<u>4-5</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>5-6</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>6-7</u>													<u>✓</u>	<u>28</u>	<u>28</u>			
	<u>7-8</u>													<u>✓</u>	<u>29</u>	<u>29</u>		<u>Gas Pocket - 3</u>	
	<u>8-9</u>													<u>✓</u>	<u>30</u>	<u>30</u>			
	<u>9-10</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>10-11</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>11-12</u>													<u>✓</u>	<u>29</u>	<u>29</u>			
	<u>12-13</u>													<u>✓</u>	<u>29</u>	<u>29</u>			

CODE: 1. ACCEPTABLE 2. QUESTIONABLE 3. REJECTABLE 4. SURFACE DEFECT  
 QUANTITY X-RAYED 12 ACCEPTED 10 WITHIELD 2 INSPECTED BY William H. Reave DATE 2-18-93

SKETCH

McAbee  
 INSPECTION, INC.



INSPECTED AND APPROVED BY  
W. H. Reave II  
 DATE 2-19-93

WORK ORDER 70-1099

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SPACE SCIENCE SERVICES, INC.

ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan AL

CUSTOMER: McAfee Cast

ADDRESS: Tuscaloosa AL

RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 2-19-93 PART NAME: 10% Long seam on Vessel PART NUMBER: 217120



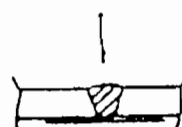


PURCHASE ORDER NO. SPECIFICATION SUBMITTED BY: B Reem

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>HWTs</u>	<u>✓</u>	<u>C.S.</u>	<u>1/2"</u>	<u>BUTT</u>			

RADIOGRAPHIC TECHNIQUE

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	U
<u>IR-192</u>	<u>57</u>			<u>3:00</u>	<u>ASPT</u>		<u>5'</u>	<u>18"</u>	<u>8mm</u>	<u>60°</u>	<u>.01</u>	<u>.01</u>	<u>55</u>	<u>100</u>	<u>20.0</u>	

FILM USED: 14 x 17 7 x 17 3 (4 1/2 x 17) 8 x 10 4 1/2 x 10 5 x 7

Pipe Diameters	WELD NO. AND/OR STATION MARKERS	CRACKS			PORO SITY		MISC.		RESULTS			DENSITY	REMARKS	SET UP			
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION				INCOMPLETE FUSION	WITHHELD	ACCEPTED
<u>1/2" Plate</u>	<u>XR. 2</u> <u>2-3 (R-1)</u> <u>7-8 (R-1)</u>													<u>✓</u>	<u>29 29</u>	<u>F.A.</u>	1. 
														<u>✓</u>	<u>29 29</u>	<u>F.A Crimp</u>	2. 
																	3. 
																	4. 
																	5. 

CODE: 1. ACCEPTABLE 2. QUESTIONABLE 3. REJECTABLE 4. SURFACE DEFECT

QUANTITY X-RAYED 2 ACCEPTED 2 WITHHELD INSPECTED BY William H Reem DATE 2-19-93

SKETCH ASNT-TC-1A

McAfee  
RADIOGRAPHIC INSPECTION



REVISIONS LIST AND INTERPRETATION

Date: 2-20-93

WORK ORDER 70-10996

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 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan

CUSTOMER: McABEE Const

ADDRESS: Towco base AL  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 3-9-93 PART NAME: Vessel PART NUMBER: 217120  
 PURCHASE ORDER NO. SPECIFICATION: WUS2 SUBMITTED BY: B. Keen

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>AW-70</u>	<u>V</u>	<u>C.S.</u>	<u>3/8"</u>	<u>BL-TT</u>			

**RADIOGRAPHIC TECHNIQUE**

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	UG
<u>IR-192</u>	<u>42</u>	<u>-</u>	<u>-</u>		<u>13.5m</u> <u>Wire</u>		<u>3</u>	<u>10"</u>	<u>AW-70</u>	<u>.01</u>	<u>.01</u>	<u>CS</u>	<u>NDT</u>	<u>100</u>	<u>10</u>	

FILM USED: 14 x 17      7 x 17      4 1/2 x 17      8 x 10      5 (4 1/2 x 10)      5 x 7

Pipe Diameter	WELD NO. AND/OR STATION MARKERS	CRACKS			POROSITY		MISC.			RESULTS			DENSITY		REMARKS	SET UP	
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE FUSION	WITHHELD	ACCEPTED			PENE.
	<u>XR-3</u> <u>1-2</u>																1.
	<u>XR-4</u> <u>1-2</u>													<u>3.0</u> <u>3.0</u>			2.
	<u>XR-5</u> <u>1-2</u>													<u>3.2</u> <u>3.2</u>			3.
	<u>XR-6</u> <u>1-2</u>													<u>3.0</u> <u>3.0</u>			4.
																	5.

CODE: 1. ACCEPTABLE      2. QUESTIONABLE      3. REJECTABLE      4. SURFACE DEFECT

QUANTITY X-RAYED: 4 ACCEPTED: 2 WITHHELD: 2 INSPECTED BY: William J. Ruff DATE: 3-9-93

SKETCH

**McAbee**  
 CONSTRUCTION, INC.



REVIEW AND INTERPRETATION  
 By: [Signature]

Date: 3-10-93

WORK ORDER 70-11012

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**SPACE SCIENCE SERVICES, INC.**

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 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan

CUSTOMER: McAbee Corp

ADDRESS: Tuscaloosa AL  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 3-15-93 PART NAME: Vessel PART NUMBER: 217120  
 PURCHASE ORDER NO. SPECIFICATION: W52 SUBMITTED BY: B Revere

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<u>V</u>	<u>C.S.</u>	<u>3/8</u>	<u>Butt</u>			

**RADIOGRAPHIC TECHNIQUE**

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	UG
<u>IRK92</u>	<u>38</u>	<u>-</u>	<u>-</u>	<u>4:00</u>	<u>15mm</u> <u>15</u>		<u>3</u>	<u>15"</u>	<u>5min</u>	<u>68°</u>	<u>.01</u>	<u>.01</u>	<u>55</u>	<u>NDT</u>	<u>100</u>	<u>03</u>

FILM USED: 14 x 17      7 x 17      5 (4 1/2 x 17)      8 x 10      4 1/2 x 10      5 x 7

Pipe Diameter	WELD NO. AND/OR STATION MARKERS	CRACKS			POROSITY			MISC.			RESULTS			DENSITY		REMARKS	SET UP
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE ELUSION	WITHHELD	ACCEPTED	PENE.		
<u>3/8"</u>	<u>XR-3</u>																    
	<u>1-2</u>													<u>32</u>	<u>32</u>		
	<u>XR-5(R)</u>													<u>29</u>	<u>29</u>	<u>FA.</u>	
	<u>1-2</u>													<u>32</u>	<u>32</u>	<u>Inline Porosity</u>	
	<u>XR-5(P1)</u>													<u>33</u>	<u>33</u>	<u>Inline Porosity</u>	

CODE: 1. ACCEPTABLE      2. QUESTIONABLE      3. REJECTABLE      4. SURFACE DEFECT  
 QUANTITY X-RAYED: 4 ACCEPTED: 2 WITHHELD: 2 INSPECTED BY: William D Revere II DATE: 3-15-93

SKETCH: ASNT-TC-1A

PREPARED AND INTERPRETATION BY: W. Revere II  
 Date: 3-16-93

WORK ORDER: 70-11016

SPACE SCIENCE SERVICES, INC.

ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan

CUSTOMER: McABEE Const

ADDRESS: TWCAVOSA AC  
 RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 3-16-93 PART NAME: Vessel PART NUMBER: 217120  
 PURCHASE ORDER NO. SPECIFICATION: UW52 SUBMITTED BY: B. Rumm

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<u>✓</u>	<u>C.S.</u>	<u>3/8</u>	<u>BUTT</u>	<u>-</u>	<u>-</u>	

RADIOGRAPHIC TECHNIQUE

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND	SIZE	UG
<u>FR192</u>	<u>38</u>	<u>-</u>	<u>-</u>	<u>4100</u>	<u>ASTM 15</u>		<u>3</u>	<u>12"</u>	<u>5min</u>	<u>68°</u>	<u>01</u>	<u>01</u>	<u>35</u>	<u>NDT</u>	<u>100</u>	<u>03</u>

FILM USED: 14 x 17      7 x 17      3 (1/2 x 17)      8 x 10      4 1/2 x 10      5 x 7

Pipe Diameters	WELD NO. AND/OR STATION MARKERS	CRACKS			POROSITY		MISC.		RESULTS			DENSITY		REMARKS	SET UP	
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE FUSION	WITHHELD			ACCEPTED
<u>3/8"</u>	<u>XR-7</u>															
<u>Plate</u>	<u>1-2</u>															
	<u>XR-8</u>															
	<u>1-2</u>															

CODE: 1. ACCEPTABLE      2. QUESTIONABLE      3. REJECTABLE      4. SURFACE DEFECT

QUANTITY X-RAYED: 2 ACCEPTED: 1 WITHHELD: 1 INSPECTED BY: William J. Rumm II DATE: 3-16-93

SKETCH: ASAT-TC-11A



REVIEW AND REPRESENTATION  
 By: W. Rumm II  
 Date: 3-17-93

WORK ORDER: 70-11017

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SPACE SCIENCE SERVICES, INC.

ORLANDO, FLORIDA 32814 - TEL. (407) 894-1751  
 NAPIER FIELD - DOTHAN, ALABAMA 36303 - TEL. (205) 983-4531  
 JACKSONVILLE, FLORIDA 32257 - TEL. (904) 730-3213

BRANCH OFFICE: Dothan

CUSTOMER: McABEE Const.

ADDRESS: Tuscaloosa AL

RADIOGRAPHIC INSPECTION - CASTINGS & WELDMENTS

DATE: 3-17-93 PART NAME: Vessel PART NUMBER: 217120

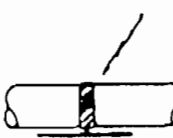
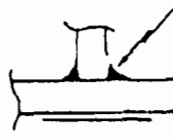



PURCHASE ORDER NO. SPECIFICATION: UW 52 SUBMITTED BY: B. R...

WELD. PROC.	AWS JOINT	MATERIAL	THICKNESS	TYPE WELD	WELDER NO.	BACKING	REMARKS
<u>Auto</u>	<input checked="" type="checkbox"/>	<u>C.S.</u>	<u>3/8"</u>	<u>butt</u>	<u>-</u>	<u>-</u>	

RADIOGRAPHIC TECHNIQUE

ISOTOPE	CURIES	KVP	MA	TIME	PENE.	SHIM	SET UP	SFD	DEV.		SCREENS		FILM		SOURCE	
									TIME	TEMP.	FRT.	BCK	TYPE	BRAND		SIZE
<u>IR-192</u>	<u>38</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>1.575</u> <u>1.8</u>	<u>-</u>	<u>3</u>	<u>18"</u>	<u>-</u>	<u>-</u>	<u>.01</u>	<u>.01</u>	<u>55</u>	<u>1807</u>	<u>120</u>	<u>C</u>

FILM USED: 14 x 17 7 x 17 4 (14x17) 8 x 10 4 1/2 x 10 5 x 7

Pipe Diameter	WELD NO. AND/OR STATION MARKERS	CRACKS			POROSITY			MISC.			DEFECTS			DENSITY	REMARKS	SET UP	
		RADIAL	LONGITUDINAL	TRANSVERSE	CRATER	BASE METAL	SCATTERED	LINEAR	INCLUSION	TUNGSTEN	INCOMPLETE PENETRATION	INCOMPLETE FUSION	WITHELD				ACCEPTED
<u>3/8"</u>	<u>XR-7 (R1)</u> <u>1-2</u>						<u>3</u>							<u>30</u>	<u>30</u>		
	<u>XR-7 (P-1)</u> <u>1-2</u>					<u>3</u>								<u>30</u>	<u>30</u>		
	<u>XR-7 (P2)</u>													<u>30</u>	<u>30</u>	<u>In-line Porosity - 3</u>	
																	
																	

CODE: 1. ACCEPTABLE 2. QUESTIONABLE 3. REJECTABLE 4. SURFACE DEFECT

QUANTITY X-RAYED 3 ACCEPTED WITHHELD 3 INSPECTED BY William D. R... DATE 3-17-93

SKETCH

**McAbee**  
CONSTRUCTION, INC.



REVIEW AND INTERPRETATION

By: W. D. R...

Date: 3-18-93

WORK ORDER 70-11018



INDUSTRIAL CONTRACTORS • PIPING FABRICATORS • TANK FABRICATORS • EQUIPMENT ERECTION • HVAC & PLUMBING

HYDROSTATIC TEST RECORD

Shop Order: 217120 Date: 4-8-93

Customer: GLITSCH INC.

Gauge No.: \_\_\_\_\_ Calibration Date: 6-1-93

Hydrostatic Test Pressure: 38 PSIG Hold Time: 1 hr +

Remarks: P.O. NO. 18979 Item NO. 1CCF-TNK-1

Mcabee Approval: *R. Barry Latham*

Customer Approval: \_\_\_\_\_



NAT'L BD NO. 7771

CERTIFIED BY

McABEE CONSTRUCTION INC  
TUSCALOOSA, ALABAMA

PT. SHELL 25 PSI AT 300  
MAX ALLOWABLE WORKING PRESSURE

COIL \_\_\_\_\_ PSI AT \_\_\_\_\_  
MAX ALLOWABLE WORKING PRESSURE

HEAD/TUBE \_\_\_\_\_ PSI AT \_\_\_\_\_  
MAX ALLOWABLE WORKING PRESSURE

MIN DESIGN METAL TEMP. -20 PSI AT 25

PRV. NO. 217120 YEAR BUILT 1993

MANUFACTURER CLATSCH, INC.

LO. NO. 18979 ITEM NO. 100F-TNK-1



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NAT'L BD NO 7471



CERTIFIED BY  
MCABEE CONSTRUCTION INC  
TUSCALOOSA ALABAMA

RT4 SHELL 25 PSI MAX 300  
MAX ALLOWABLE WORKING PRESSURE

COIL --- PSI MAX ---  
MAX ALLOWABLE WORKING PRESSURE

W/INTUBE --- PSI MAX ---  
MAX ALLOWABLE WORKING PRESSURE

-20 F AT 25 PSI  
MIN DESIGN METAL TEMP

SERIAL NO 217120 YEAR BUILT 1993

MFG BY GLITSCH INC

PO NO 18979 ITEM NO 100F-TNK-1