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SUBJECT: Forwards comments,clarifications & agreements re implementation of NRC 880506 SER related to 10CFR50,App J. 566 prints

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TITLE: OR Submittal: Append J Containment Leak Rate Testing

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/301 PLAINFIELD ROAD, SYRACUSE, N.Y. 13212/TELEPHONE (315) 474-1511

July 28, 1988
NMP1L 0288

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Gentlemen:

On June 9, 1988, representatives of Niagara Mohawk met with members of the Nuclear Regulatory Commission staff to discuss their comments and seek clarifications regarding the Safety Evaluation Report (SER) related to 10 CFR 50 Appendix J dated May 6, 1988. As a result of that meeting, Niagara Mohawk was requested to submit a letter describing the clarifications and agreements reached at the meeting regarding the implementation of the SER. Enclosure 1 to this letter is responsive to this request.

Also included in this letter are three other enclosures. These enclosures contain information requested by the Nuclear Regulatory Commission at the meeting or during subsequent discussions. Enclosure 2 contains justification of the Niagara Mohawk position related to the Shutdown Cooling System. Enclosure 3 includes information and a discussion pertaining to containment penetrations which Niagara Mohawk has determined do not require Type B testing. Enclosure 4 provides the additional information that will be included in the current Containment Spray System Operating Procedure (#N1-OP-14) to assure that a water seal is established and maintained during a LOCA at the isolation valves.

A schedular exemption to 10 CFR 50 Appendix J for the Emergency Cooling System condensate return valves was requested in a separate letter dated June 23, 1988 (NMP1L 0274). In addition, as discussed at the June 9 meeting, revised Technical Specifications consistent with the Nuclear Regulatory Commission's Safety Evaluation Report dated May 6, 1988, and the clarifications contained in this letter would be submitted between 60 to 90 days after the meeting. They will be submitted during August 1988.

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DRAWINGS TO REG FILES

In summary, Niagara Mohawk and the Nuclear Regulatory Commission have now reached agreement on the interpretation and application of Type B and Type C test requirements of 10 CFR 50, Appendix J, relative to Nine Mile Point Unit 1. Moreover, since all the requested clarification and additional information has been submitted, no further action on the part of Niagara Mohawk Power Corporation is planned prior to plant startup. The proposed Technical Specification changes, reflecting the agreed upon interpretations, are not needed for plant startup or operation. However, as noted previously, they will be submitted to the Nuclear Regulatory Commission during August 1988. We understand that the Nuclear Regulatory Commission action on the exemption request is expected by August 1, 1988.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

C. D. Terry
Vice President
Nuclear Engineering and Licensing

JWP/pns
5200G
Enclosure

xc: Regional Administrator, Region I
Mr. R. A. Capra, Director
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ENCLOSURE 1

COMMENTS, CLARIFICATIONS AND AGREEMENTS
RELATIVE TO THE
NRC-SER ON THE PROPOSED TECHNICAL SPECIFICATIONS AND EXEMPTION REQUESTS
RELATED TO 10 CFR 50 - APPENDIX J REQUIREMENTS

The following SER sections and technical issues were discussed and resolved in the NRC/NMPC meeting held on June 9, 1988, in Washington, D.C. The comments, clarifications, observations and agreements related to each area are included below.

Reactor Cleanup System-Relief Valve Discharge (IV 63.1-01 and -02)

NMPC has no comments on this section of the SER and will comply with the interpretations of the SER. Niagara Mohawk concurs with the NRC staff that the relief valve discharge line will not lead to an atmospheric release path outside containment. Thus, it is not required to be subject to Type C testing. This is primarily due to the fact that the discharge check valves are included in the water-sealed extension of the containment (in the Torus) and that the system is composed of safety-related components.

Core Spray System-Pump Discharge (IV 40-05 and -06)

These valves are on the core spray test line to the Torus and are not currently identified in the NMP1 Technical Specifications as being tested per Appendix J requirements. However, they are tested with the core spray high pressure/low pressure interface check valves in accordance with Technical Specification 3.2.7.1. Since the keep-fill system is on the upstream side of these valves, they are being tested in the reverse direction from their normal isolation function (from the vessel side instead of from the containment side). The NRC indicated that this was acceptable and that they understood the test configuration. Niagara Mohawk will specify leakage rate acceptance criteria for these valves in the future revision to Table 3.2.7.1 of the Technical Specifications.

Control Rod Drive (CRD) System (IV 301-112 and -113)

The SER allows credit for a water seal relative to the valve leakage path. However, it was not clear if a water test was still required for these valves. In sections of the SER where the water test was being required, it was specifically stated. For the CRD system, the SER indicates simply that a water seal is provided. No additional testing was specified. The NRC staff reviewers indicated that for those cases where a potentially unlimited water supply is available to provide a water seal, no additional testing is required. The NRC stated that no leak testing is required for these valves.

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Shutdown Cooling System-Suction & Discharge (IV 38-01, -02, -12 and -13)

The SER states that since a forward direction Type C test for each valve cannot be performed without a modification, an air test between the valves is an acceptable alternate. NMPC initially expressed concern with this air test approach. NMPC indicated that this reverse accident flow test might not be consistent with the regulations and might not be viewed as a conservative test for the inner valves (38-01, 38-13). Since the inside isolation valves in the shutdown cooling supply and return lines (38-01 and 38-13) are double seat, solid wedge gate valves, reverse testing might not be indicative of accident situation leakage. It is not currently possible to test the inside isolation valves in the shutdown cooling supply and return lines as there are no manual block valves between the reactor vessel and the inside valves. Additionally, there is insufficient room inside the containment to install a valve on the line.

Another potential issue associated with the return line was discussed. The outside isolation valve in this line is a check valve. Therefore, it might be difficult to pressurize between the valves in the shutdown cooling return line if this check valve is not tightly seated. A commitment at the meeting was made to supply the NRC with more detailed information about the system design and operation, the valving arrangements, alternative means of performing the tests and a proposed NMPC approach to meeting Appendix J requirements.

Enclosure 2 contains the requested design information about the shutdown cooling supply and return line isolation valves. It includes: the system/valve operating functions before, during and after a design basis loss-of-coolant accident; the water seal aspects of the system and the valves; and the testing capabilities of the current design configuration and the ramifications of the modifications that would be necessary in order to provide any new special leakage tests. It also includes the proposed NMPC approach to meeting Appendix J requirements.

Containment Spray System-Suction (IV 80-01, -02, -21 and -22)

The containment spray suction isolation valves are located on the line which takes suction from the bottom of the Torus. The valves are, therefore, provided with a substantial water seal between any radioactive source inside the containment, the pump suction point, the system loop itself, and its discharge path back into the primary containment atmosphere. Niagara Mohawk questioned why a water test on these valves was required since they are similar to the control rod drive hydraulic system, which has a similar water seal; yet does not require a water test. NMPC also indicated that to do the test in accordance with Appendix J requirements for a water test (this requires pressurizing the test cell to 1.10 P_a), the licensee would have to perform a major piping modification, including the installation of a blocking valve and test tap between the suction valves and the Torus.

The NRC staff reviewers indicated that for these particular valves, the testing requirements were not based on 10 CFR 50 Appendix J. Some type of leakage testing is required under the Inservice Testing (IST) Program. The NRC staff concern in this regard focused on the containment spray piping downstream from an isolation valve. If this piping were to fail, the staff must be assured that the valve could be closed and that minimal leakage would occur so as to not drain the Torus. Therefore, it was agreed that an IST test and not an Appendix J Type C test should be performed on these valves. Accordingly, a commitment at the meeting was made to revise the Technical Specifications to indicate that these valves will be tested in accordance with the IST Program. These tests would assure that the valve will close and, thus, reduce the risk of Torus drainage through it.

Containment Spray System-Other Valves (IV 80-15, -16, -17, -18, -35, -36, -37 and -38)

Regarding the other valves in the Containment Spray System, Niagara Mohawk indicated that if a Type C test were required to be performed on these valves, significant modifications would be necessary, such as installation of test taps and blocking valves. This would necessitate a request for a schedular exemption until 1990. It was also indicated that revisions to the containment spray operating procedure were being developed which would assure a water seal in these lines at all times following a design basis loss-of-coolant accident. Based on discussions related to other valves and systems, Niagara Mohawk concluded that if a water seal was provided, no testing would be required for these valves. The NRC staff reviewers indicated that this was correct and acceptable. Niagara Mohawk committed at the meeting to provide the subject procedure to the Resident Inspector.

A discussion of the proposed changes to the current procedure to assure water seal conditions exist during a DBA-LOCA at the isolation valves is contained in Enclosure 4.

Emergency Cooling System-Condensate Return Valves and the Drain & Vent Valves (IV 39-03, -04, -05 and -06)

It was agreed that a schedular exemption to 10 CFR 50 Appendix J for the Emergency Cooling System condensate return valves until 1990 would be submitted as soon as possible. A 30-day review and approval timetable was noted as being reasonable. This exemption is necessary in order to comply with the SER requirements imposed on the EC System isolation valves 39-03, -04, -05 and -06. The commitment to include these valves into the Appendix J testing category will allow the removal of current emergency condenser vent and drain valves from the Appendix J Program. This is because they are no longer viewed as system/containment/primary coolant isolation valves.

Previous (May 31, 1978) Submittal on Type B Penetrations Classifications (See Table 1 of May 31, 1978 Submittal)

Niagara Mohawk indicated in a May 31, 1978 submittal, that a number of penetrations were excluded from receiving a Type B test. Niagara Mohawk indicated that although the NRC's SER referenced the NMPC May 31, 1978 submittal, the submittal is not specifically discussed in the NRC's SER. The NRC staff members indicated that they would review this submittal and provide feedback if they had a problem with its content.

Subsequent to our June 9, 1988 meeting, the NRC has requested additional information relative to the Type B penetrations. Specifically, NMPC was requested to provide the bases for not performing a Type B test on those penetrations identified in Table 1 of Niagara Mohawk's letter from Mr. D. P. Dise to G. Lear, dated May 31, 1978, as "not subject to Type B testing."

This subject is discussed in Enclosure 4. The requested information is attached to that enclosure.

Future Actions Items and Responses to Them

Niagara Mohawk agreed to the following action items with the response date noted in parenthesis:

a) to submit a schedular exemption for the Emergency Cooling System condensate return isolation valves (submitted on June 24, 1988),

b) to provide additional information relative to the Shutdown Cooling System and its isolation valves (included in Enclosure 2),

c) to provide additional information relative to containment penetrations not subject to Type B testing (Included in Enclosure 3),

d) to provide the Resident Inspector with a copy of the proposed revision to the Containment Spray System test procedure that will assure the establishment and maintenance of a water seal at the subject isolation valves during a DBA-LOCA (provided to Resident Inspector, William Cook, on June 28, 1988, and summarized in Enclosure 4), and

e) to submit the technical specification revisions to reflect the discussions and conclusions cited above (scheduled for submittal in August 1988).

The NRC agreed to:

i) re-review the previously filed NMPC 1978 submittal on Type B penetration testing,

ii) process, approve, and issue a schedular exemption within a reasonable 30-day time period relative to the Emergency Cooling System valves, and to

iii) review and concur with the agreements cited in this clarification enclosure.

ENCLOSURE 2

ADDITIONAL SHUTDOWN COOLING SYSTEM VALVING INFORMATION

Introduction

The purpose of this enclosure is to provide additional information on the existing Shutdown Cooling System and its isolation valve configuration. The information includes:

a) A brief description of the design basis and the function of the system and the subject valves before, during and after a Design Basis Loss-of-Coolant Accident (DBA-LOCA).
b) A discussion of the inherent system/valve water seal aspects under accident conditions with special attention directed to dose reduction and allowable leakages.
c) More definitive information about the valves (pictorial cut-aways, vendor component data, equipment qualifications, etc.).
d) A discussion of the adequacy of the existing testing approach and the significant modifications needed to conduct air only leakage testing.

System Design Basis

The Shutdown Cooling System forms a closed loop with the reactor recirculation system (primary coolant system). The system takes suction from one of the five recirculation loop suction lines and transports the reactor coolant through three parallel cooling loops. Each loop is made up of a pump, heat exchanger and associated loop instrumentation. The reactor coolant is cooled (decay heat removed) and returned to a different recirculation loop. The Shutdown Cooling System piping from the external isolation valves (on both suction and discharge headers) to the reactor recirculation pump connections is designed for 1200 psig at 525°F. Piping between the suction and discharge, external to the isolation valves, is designed for 1200 psig at 350°F. The system, when in operation, is an extension of both the primary coolant system and the primary containment. However, this operation occurs only during low pressure, normal shutdown conditions.

The system is located within the area serviced by the Secondary Containment System (Secondary Containment-Reactor Building, Emergency Ventilation System [referred to generically as the Standby Gas Treatment System], and the Main Stack). Any significant leakages within or between other systems and the shutdown cooling system are monitored and controlled by the operator in the Main Control Room. The system is subjected to piping integrity monitoring, component availability/reliability surveillances and major equipment operability tests. Equipment in the system is designed to the plant design basis seismic and environmental conditions, and quality standards. This system is a well designed and operated plant auxiliary system. The subject valves in the system have provided reliable service.

Refer to Figure 2-1 for a simplified system flow diagram. The subject isolation valves (IV 38-01, -02, -12 and -13) are identified. A more detailed P&ID is included as an attachment to this enclosure.

System/Valve Function Description

The Shutdown Cooling System is designed to cool reactor water (remove decay heat) from 350°F to 125°F within a 24-hour period using two of the three parallel loops. It then maintains the reactor coolant temperature at 125°F using one of the three loops. During normal plant shutdown operations, the Shutdown Cooling System is manually actuated from the Main Control Room. The four system isolation valves (38-01, -02, -12 and -13) are normally closed both during normal operation and a Design Basis Loss-of-Coolant Accident (DBA-LOCA). In addition, the isolation valves automatically close and isolate the system on low-low reactor water level, on high reactor pressure (above 120 psig) and on system area high temperature. Furthermore, the two supply line isolation valves (38-01 and 38-02) are interlocked so that only one of them can be opened at a time for testing purposes while the reactor is at pressures above 120 psig. This is to assure that proper isolation from the primary coolant system is always maintained during high pressure conditions. One of the two series return line valves (CV-38-12) is a check valve which provides the necessary high pressure isolation while the motor operated valve is tested. In addition to the system isolation capabilities cited above, each individual loop is, in itself, capable of being independently monitored, controlled and isolated. (Refer to BV-38-02, -03, -04 and CB-38-06, -07 and -08.)

In addition to the above, a system integrity verification is performed per Technical Specification 6.14. This specification requires the system to be checked for leakage in a manner which meets or exceeds the requirements and recommendations of Section 2.1.6.a of NUREG 0578. The leakage integrity of the Shutdown Cooling System will also be maintained throughout the operating cycle. Significant intra-system leakages through the system valving, which could be of concern, can be monitored by the system temperature recorders. In addition, any significant leakage from the system can be monitored by the area temperature detectors.

System/Valve-Inherent Water Seal/Dose Reduction/Allowable Leakage

During a DBA-LOCA, this system is not required to perform any safety function. It may be utilized as an alternate or supplemental long-term decay heat removal cooling system under less severe accident conditions. It is used as the primary low pressure decay heat removal system under normal shutdown conditions.

The system is expected to be isolated during an accident, thus maintaining the integrity of the system and its loops. This ensures the retention of its coolant and its availability for future accident recovery services. Any accident radiological releases emanating from the system at any time would be negligible for a number of reasons. First of all, the system is a closed loop. Second, as cited above, it is not in operation during the DBA-LOCA. Third, any radioactivity from the reactor coolant or the primary containment systems must pass through a series of valves and piping systems prior to any release. These include the recirculation loop and/or its isolation valves, the system subject isolation valves, and the individual shutdown loop blocking valves. Most of the Shutdown Cooling System piping will be filled with water. The system, itself, is further isolated from other systems also by water seal aspects (e.g., the Shutdown Cooling System-Heat Exchangers are

water sealed by the Reactor Building Closed Cooling Water System). During a DBA-LOCA, the shutdown system is not expected to lose any of its coolant inventory. The minor system leakages from components to the environs will be treated by the Secondary Containment System. Leakages from or through the isolation valves will be contained within the Primary or Secondary Containment Systems. Significant dose reduction credits for water scrubbing, piping and valve plateout, transportation delay/decay, and Reactor Building environmental dilution, treatment, control and elevated release would certainly minimize any radiological impact from system isolation valve leakage far above the allowable Appendix J levels. The NRC is now giving substantial credit for the above cited dose reduction factor considerations. Historically, little, if any, credit for the above was considered in earlier Appendix J regulatory interpretations. The recent NRC BWR-Main Steam Line Isolation Valve Leakage study, NUREG 1169, recognizes, quantifies and allows significant decontamination factors relative to steam/radiation/leakage transport processes. The Main Steam Line system is an open-loop, steam transport, unprotected, direct environs release process. The subject system is a closed loop, water medium system housed inside a seismically qualified structure. It is serviced by an engineered/safety feature radiation leakage treatment-release process. Certainly, credit should be taken for a water seal medium when evaluating the isolation valves in the Shutdown Cooling System.

Valve Selection/Duty Consideration

Gate valves are widely-used valves throughout the nuclear industry for plant piping systems. A very high percentage of process system valves are gate-type. The gate valve is designed for on/off service -- that is, completely "open" or completely "closed" operation. As such, it is used to isolate piping system by blocking flow from one component to another. Because of its singular service function, the leak tightness of the seal at the disc/seat interface is an important design parameter. Most gate valves (like the subject isolation valves) have an electric motor operator downward driven disc motion. The disc has two faces, both of which engage the seats at closure. Disc guides ensure proper alignment of the disc. The two-faced disc, referred to as a wedge, can be solid or flexible. The subject valves have a solid wedge in order to enhance higher strength capabilities. A gate valve was chosen for the shutdown cooling system isolation function based on the system operating profile. That is, totally "open" at low pressure with a minimum of flow resistances and totally "closed" at high pressure, offering a maximum of flow resistance and shut-off capabilities. The choice of the solid wedge configuration was again based on closure strength rather than valve split wedge designs which offer more leak tightness.

Limitorque operators control the subject gate valves. The electric operator is sized to provide the torque and total thrust needed to assure a leak-tight valve shut-off function. The combination of motor size and speed, gear ratio and stem thread assure the tight shut-off within a specified time interval. The minimum required torque/thrust to assure tight closure is specified by the valve manufacturer and used by the valve maintenance personnel. By experience and reputation, the Limitorque operator is one of the most reliable motor operators in use. Backing up this electric operator experience is the MOVATS (Motor Operated Valve Analysis and Testing System) program. The program regularly analyzes the behavior of the electrical operator system in terms of limit and torque switch actuation, excursion time and thrust. The

valve/operator operating signatures can be compared with prior tests to determine operational performance trends and to reasonably predict how the valve will perform within specifications in the future.

In summary, the subject valves are not only mechanically designed to be leak-tight components, but they are also electrically operated and electronically monitored to assure that their tight shut-off function is guaranteed. Crane valves have in the past and still have an excellent reputation for good service, reliability and minimum maintenance. These particular valves have required little attention at NMP1.

System Isolation Valves-Hardware Information

A collection of definitive information relative to the hardware aspects of isolation valves (38-01, 38-02 and 38-13) is enclosed or attached here.

General Characteristics

- Crane Valves, Chapman Division - Indian Orchard, Massachusetts
- Cast Steel - Gate Valve
- Class 900 - 316 Stainless Steel
- 14" pipe diameter
- Pressure/Temperature Rated: 2220 psi @ -20°F to 100°F or 1235 psi @ 800°F
- Bolted Bonnet
- Solid Wedge Disc-with tee head disc stem connection prevents lateral strain on stem; this assures accurate seating
- Seal Welded Seat Rings-eliminates leakage path behind rings
- Seal Seat Material: #6 Stellite Facing on all surfaces of Port, Wedge, Backseat, Wedge Guide
- Limitorque Electrical Operator
- Design/Manufactured Valve Seat Leakage Rate Allowances and Tests
  - 300 cc/hr/inch of seat diameter @ 15, 25, 35 psig - air test
  - 2 cc/hr/inch of seat diameter @ 1875 psig - water hydro test
- Complies with:
  - ANSI-B-16.5
  - ANSI-B-16.10
  - ANSI-B-16.25
  - ANSI-B-16.34
  - API-600
  - API-598
  - MSS-SP-61
- Physicals:
  - Weight = 4170 lbs.
  - Valve (Body only) 40" x 80" x 36"
  - (Motor-Operator Only) 30" x 60" x 15"

Specific Valve Vendor Information-Applicable Information Extractions (attached)

- Crane/Chapman Bulletin #VC-1300A
- Crane/Chapman Bulletin #VC-1900A
- Crane/Chapman Catalog #120-C
- Limitorque Bulletin #SMB1-82B

NMP-1 Valve Drawings (attached)

- C-18018-C (Rev. 6) [11/28/82] (System P&ID)
- PB-132371 - (Rev. 1) [1/17/66] (38-02)
- PB-136353 - (Rev. 2) [1/7/83] (38-01) (38-13)
- PA-138333 - (Rev. 1) [4/1/68] (38-13)
- PA-138333 - (Rev. 1) [4/1/68] (38-01) (38-02)

Specific NMP-1 Valve - Manufacturer Test Documentation (attached)

- Certificate of Test

Adequacy of Current Testing Approach/Ramifications of Change Modifications

Niagara Mohawk maintains that the subject valves should be exempt from Appendix J requirements or an exemption from specific Appendix J Type C air testing should be granted. The maintenance of a water seal is more than sufficient to protect the health and safety of the public. The Niagara Mohawk position is based, first, on the fact that the system is a closed loop with the primary coolant and containment systems. Second, that the system is not in operation before, during, or following a DBA-LOCA. Third, the potential subject valve leakage path is through a number of other valves before and after the isolation valves and the entire path is water filled and maintained so throughout the accident. The fourth consideration is related to the fact that the original Appendix J leakage requirements regarding leakage did not give credit for many currently recognized BWR features. Credit for these would substantially reduce the radiological effects cited in the FSAR, Regulatory Guides, Safety Evaluation Reports, etc. The NRC has (a) recently recognized, quantified and approved the use of dose reduction factors (e.g., plateout, aerosols, transportation phenomena), (b) given credit for inherent plant features (e.g., secondary containment systems and mitigators, such as reactor building effects delay/decay/plateout) and standby gas treatment (including filtering/diluting/ elevated release), and (c) taken into account valve leakage pathway attenuation characteristics (like water seals, pressure assisted valve seat leakage reduction).

The recently issued NRC Appendix J SER gives several allowances and credits specifically to the Control Rod Drive System, Reactor Cleanup System and Containment Spray System. The NRC granted credit for the following features or test allowances:

a) water seal credit arrangements at the subject isolation valves/based on the availability of adequate make-up sources,
b) credit for the closed loop pathways concept,
c) credit for quality system designs and components (inherent in ESF systems),
d) acceptable valve leakage tests in reverse directions (as allowed by regulations),
e) water leakage testing at reduced pressures, and
f) potential allowance for reverse valve seat pressure assistance.

Similarly, Niagara Mohawk believes that the Shutdown Cooling System qualifies for these considerations.

The gate valve, being a universal flow/stop device (that is, has the ability to allow or stop flow in either direction) appears to exhibit the same leakage characteristic also in either direction. The forces exerted upon the symmetrical wedge-type gate on flow interruption are the same from either direction. The double seat wedge design assures two barriers to flow or leakage. The symmetrical wedge is designed to provide this two barrier concept regardless of the flow direction. Valve designers/application engineers feel that a test in the reverse direction will give similar results as one from the opposite direction, if conducted under similar conditions. Therefore, a test in the non-accident (reverse accident) leakage flow direction will yield results similar to those in the accident test flow direction.

A series of water tests (Procedure #N1-ST-C13) were conducted at NMP1 within recent weeks (6/27-28/88) to investigate the leakage tightness of the subject valves. The water volume between valves (IV 38-01 and IV 38-02) was continuously pressurized (at ~ 140 psig, which is 4X accident pressure) from a seal water source and the leakage through the valve (IV 38-01) seats was recorded. The leak rate was 0.256 gallons/minute. A similar test was conducted on valve (IV 38-13). Its leak rate was 1.321 gallons/minute. This leakage measurement technique indicates that the subject valves are very tight in either direction. They are, thus, able to maintain a water seal under accident conditions. These tests also confirm/assure that the existing shutdown cooling system water inventory will be able to provide and maintain a reliable water seal on the subject isolation valves for a significant time after the accident. Niagara Mohawk will continue to periodically conduct these tests to assure that the system is maintained within its design basis envelope.

If, however, Niagara Mohawk were required to perform individual valve air or water leakage tests and meet the stringent leakage allocations while testing under simulated accident conditions (that is, in the direction of accident flows), significant modifications to the Shutdown Cooling System would be necessary. The installation of new isolation valves and/or the introduction of new system block valves and test taps would be required. The introduction of additional valving in an already operationally sensitive, single loop Shutdown Cooling System is viewed as being counterproductive. The addition of new block valves and taps do not appear to enhance either plant safety or system availability. They would contribute little to the further reduction of an already insignificant plant coolant leakage/loss. The existing valves and their configurations have been proved to be a very reliable and effective arrangement. A major system disruption (modifications to install new valves, etc., or even valve leakage testing) may result in added operational considerations (such as higher man-rem exposures, new equipment support and installation problems, new and additional training, new procedures and tests, etc.). These do not appear to be safety-cost beneficial.

Summary

In summary, it is Niagara Mohawk's position that the current valving configuration is adequate and desirable. Niagara Mohawk proposes that the subject Shutdown Cooling System valves be considered in accordance with the approach found acceptable on the CRD and the reactor cleanup systems. Niagara Mohawk is proceeding to pursue this basic approach. Test and Technical Specifications are being developed to conform to those Appendix J requirements cited earlier in Enclosure #1 for the CRD and reactor cleanup systems. The NRC review and concurrence with this approach is solicited.

ENCLOSURE 3

CONTAINMENT PENETRATIONS-NOT INCLUDED IN TYPE "B" TESTS - DESIGN/CONSTRUCTION DETAILS

Introduction

During the course of the June 9, 1988 meeting, Niagara Mohawk requested additional NRC clarification as to the acceptability of a NMPC submittal made in August of 1978 relative to the classification of NMP-1 containment penetrations. The classification listing is also attached here. The review of the subject submittal was again requested. Subsequent to this meeting, the NRC has requested additional information relative to the penetrations not subject to Type "B" testing. The information requested was:

a) Basis for exclusion from Type "B" testing,
b) Typical Detailed Design/Construction Drawing of the subject non-test penetration, and
c) Information as to whether the excluded testable penetrations were "vented" during Type "A" test.

Basis for NMP-1 Type "B" Classification

One of the conditions of operating licenses, as specified in 10 CFR 50.54(o), is that primary containments shall meet the containment leakage test requirements set forth in 10 CFR 50 Appendix J. These test requirements include periodic verification by tests of the leak-tightness of the total containment itself and individual tests of the selective systems and components which penetrate the containment. These periodic verifications are defined on Type "A", "B" or "C" tests.

Each of the Type-tests are further specifically defined. In the regulation it states:

> "Type "B" Tests" means tests intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary for the following primary reactor containment penetrations:
>
> 1. Containment penetrations whose design incorporates resilient seals, gaskets, or sealant compounds, piping penetrations fitted with expansion bellows, and electrical penetrations fitted with flexible metal seal assemblies.
>
> 2. Air lock door seals, including door operating mechanism penetrations which are part of the containment pressure boundary.

3. Doors with resilient seals or gaskets except for seal-welded doors.

4. Components other than those listed in II.G.1, II.G.2 or II.G.3 which must meet the acceptance criteria in III.B.3.

The penetrations listed for Type "B" testing are required by the regulation cited above. The excluded penetrations are tested during the Type "A" test. A number of the excluded Type "B" penetrations do have local leakage test connections. These connections can indeed be used to individually test that penetration. A number of the excluded penetrations do not have a integral test connection.

Requested Additional Detailed Design/Construction Information

The following listed drawings cover a full spectrum of typical penetration type, size, design features (e.g., testability) and design/construction features.

a) Drywell Mechanical Penetrations (X)

Penetration	System	Drawing (attached)
X-131	Liquid Poison	C-18415-C
X-156, -157	RB-CCWS	C-18301-C
X-80, -74	Leak Rate Testing	C-18198-C
X-239A, B, C	CRD	C-18697-C
X-40	O2 Analyses	C-18474-C
X-121, -122	Breathing Air	C-18578-C
X-139	Reactor Water Sample	C-18347-C
X-34, -35, -36, -37, -43, -75, -81, -32, -28, -29, -30, -31, -32, -38, -41, -42, -44, -47	Many Systems	C-18474-C
X-48, -49, -50	I&C System (Water Level)	C-18474-C
X-51, -53, -54, -71	I&C System *Water Level)	C-18470-C

b) Drywell Electrical Penetrations (XE)

(None Excluded)

c) Suppression Chamber Mechanical Penetration (XS)

XS-316	Vacuum Breaker	C-18158-C
XS-349, -356, -357	- Spares -	C-18697-C
XS-322, -338	Suppression Pool Temp	C-18178-C

d) Suppression Chamber Electrical Penetrations (XS-E)

(None Excluded)

A copy of a Type "B" tested penetration (design/construction) drawing is also attached for information purposes.

X-3A, -3B Emergency Condenser Piping C-18359-C

Testable Penetrations-Test Connections

Many of the penetrations which are not subject to the Type "B" test do indeed have testable connections. These connections can be used to monitor or individually test that particular penetration. The test caps are left on during Type "A" and, therefore, they must also remain in place during normal operation. If, however, these penetrations were vented during the "A" test, then they could be likewise left open during normal operation.

Summary

The basis for the exclusion of these penetrations from Type B testing is directly related to the definition of containment penetrations which are subject to Type B testing and to the fact that they are collectively tested during a Type A test. The regulations (that is, 10 CFR 50, Appendix J, Sections II.G1 thru 4) do not require penetrations of welded design -- regardless of whether testable connections are available -- to be tested. Only penetrations whose designs incorporate resilient seals, gaskets or sealant compounds, piping penetrations fitted with expansion bellows and electrical penetrations fitted with flexible metal seal assemblies are required to be Type B tested.

ENCLOSURE 4

CONTAINMENT SPRAY SYSTEM-WATER SEAL PROCEDURE

In response to the NRC's position that the Containment Spray System isolation valve - water seal feature must be established and maintained during a DBA-LOCA, Niagara Mohawk agreed to specifically establish in the current operational procedure a requirement and/or instruction to address this condition. The current Containment Spray System Procedure N1-OP-14 is now in the process of being amended to include this as well as several other changes.

The procedure will specifically require that a water seal be established and maintained on the Containment Spray Inlet Discharge Isolation Valves for the Containment Spray loop(s) that are not in operation during a DBA-LOCA. A seal water is guaranteed in the operating loop(s) in that the loop(s) are pressurized by the operating pump and the flow of water through the system.

The NMP-1 procedure change process will require a formal review of the subject proposed revision. Final approval of this change is anticipated prior to startup.

A draft copy of the entire procedure now under modification was given to the Resident Inspector (William Cook) on June 28, 1988. When the formal procedure revision is issued, a copy will also be given to the Resident Inspector.

A copy of the new procedural instructions being added to the current NMP1 Containment Spray System Nos. 80 and 93 - Operating Procedure #N1-OP-14 (Revision 27 dated 6/16/86) is attached.

ATTACHMENT TO ENCLOSURE 4

ADDITIONAL REQUIREMENTS BEING ADDED TO N1-OP-14

Add the following to the Off-Normal Procedures Section:

H. Off-Normal Procedures (Cont.)

Establishing A Water Seal On The Containment Spray Discharge Isolation Valves.

NOTE: This procedure is to be performed if a Loss-of-Coolant Accident (LOCA) occurs. A water seal must be established on the Containment Spray Inlet Discharge Isolation Valves for the Containment Spray loop(s) that are not in operation. Per Appendix J of 10 CFR 50, this water seal must be maintained for a minimum of thirty days to prevent any radioactive release through these lines.

1. If no Containment Spray pump is in operation, THEN start the Containment Spray System in the Torus Cooling Mode of operation, using one pump, per the Off-Normal section of this procedure (paragraph H.5.0, page [later]).

2. Shut the following valves for the loop(s) that are not in operation in the Containment Spray Mode:

Loop	Containment Isolation Valve
111	CTN-SP Inlet IV-111
112	CTN-SP Inlet IV-112
113	CTN-SP Inlet IV-113
114	CTN-SP Inlet IV-114

3. Cross-connect the idle loops of Containment Spray with the operating loop by opening, or verifying open the following Bypass to Torus valves (one of the valves will already be open if in the Torus Cooling Mode):

   BV-AOV-80-40, Bypass to Torus for Loop #111

   BV-AOV-80-41, Bypass to Torus for Loop #121

   BV-AOV-80-44, Bypass to Torus for Loop #112

   BV-AOV-80-45, Bypass to Torus for Loop #122

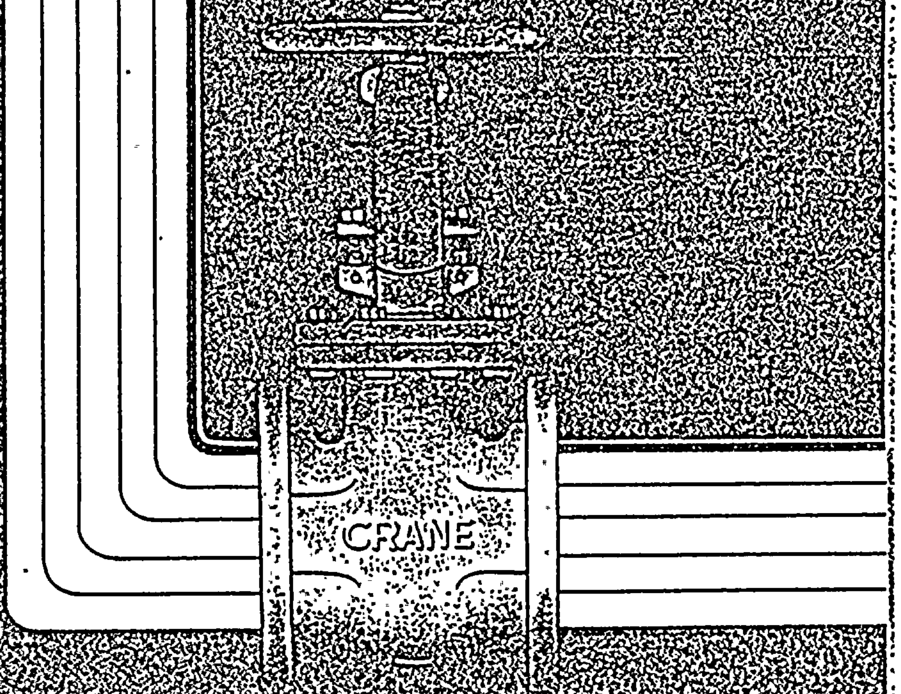
ENCLOSURE 2 ATTACHMENTS

- Crane/Chapman Bulletin #VC-1300A - Extractions
- Crane/Chapman Bulletin #VC-1900A - Extractions
- Crane/Chapman Catalog #120-C - Extractions
- Limitorque Bulletin #SMB1-82B - Extractions
- NMP1 Drawing P6-132371
- NMP1 Drawing PB-136353
- NMP1 Drawing PA-138333
- NMP1 Drawing PA-138333
- NMP1 Crane Valve - Certificate of Test
- NMP1 Drawing C-18018-C
- Simple, one line, System Flow Diagram

VC-1300A

CRANE

STEEL VALVES



Crane Valves
For performance in any application

In any fluid handling system, valves are the controlling element: starting or stopping flow, regulating or throttling flow, preventing backflow, or relieving and regulating pressure.

Crane valves are universally accepted by industry for virtually every application. They are regularly manufactured in sizes ranging from ⅛-in. to 48-inches, for service conditions ranging from vacuum pressures and cryogenic temperatures to elevated pressures and temperatures.

Since Crane valves are used in a variety of applications, the following descriptions may provide a basic guideline in the selection of steel valves:

Bolted Bonnet Joint

a practical and commonly used joint which is adaptable to different types of gasketing between the joints. Multiple bolting permits application of equalized sealing pressure. Has practically no limitation for size. Only the highest pressures and temperatures tax its capacity to permanently hold tight. Most valves in this catalog are of this design.

Pressure-Seal Bonnet Joint

most effective bonnet joint, adapted by Crane, for sealing the highest pressures and temperatures, especially in steam service. Crane has two types available. Tightness of seal does not depend on nuts, bolts, and threads as in conventional bonnet joints. Instead, the Crane pressure-seal bonnet joint utilizes line fluid pressure to seal the joint. The greater the pressure, the higher the sealing load. Available in gate, globe, angle, check, conventional and tilting disc, and stop-check valves. Pressure-seal valves are in Catalog VC-1400.

Gate Valves

serve as efficient stop valves with flow in either direction. They are commonly used where a minimum of pressure drop is important because they offer practically no resistance to flow when fully open. Throttling is not recommended because partially open gate valves exhibit flow characteristics not conducive to accurate and consistent flow control. Also the valves may be damaged by the high velocity across the seats. They function best fully open or fully closed. Gate valves are on pages 5 to 14.

Globe Valves

are ideal for throttling service. Their flow characteristics permit accurate and repeatable flow control. However, caution must be exercised to avoid extremely close throttling when pressure drop exceeds 20%. This creates excessive noise, vibration and possibly damage to valves and piping. When these conditions are anticipated, consult Crane for recommendations. Globe valves are described on pages 15 to 21.

Angle Valves

effectively utilize the globe valve seating principle while providing for a 90° turn in piping. They offer less resistance to flow than globe valves. The same cautions for excessive throttling with globe valves apply to angle valves. Additionally, angle valves require fewer joints so make-up time and labor are saved. Angle valves are described on pages 15 to 21.

Swing Check Valves

prevent reversal of flow through pipe lines. Most Crane swing check valves can be installed in horizontal or vertical upward flow piping. They offer low resistance to flow and are particularly suited to low velocity service. Swing check valves are on pages 22 to 28.

Tilting Disc Check Valves

are similar in application to swing check valves. In most installations, slamming is minimized upon reversal of flow so noise and vibration are reduced. Crane tilting disc check valves are described on pages 29 to 34.

Stop Check Valves

are essentially the same as globe and angle valves, except there is no mechanical connection between the stem and disc. However, they are not designed for throttling. They are used in steam boiler outlet piping when two or more boilers are connected to a common header. Valves must be installed with pressure under the disc, and when the stem is raised, only boiler pressure can raise the disc, whenever boiler pressure exceeds header pressure. They prevent steam backflow from the header to the boiler. Stop check valves are on pages 35 to 41.

Ball Valves

feature quarter-turn, on-off operation, straight-through flow, minimum turbulence, low operating torque, tight closure, compact design and light weight. Crane offers three different designs—fixed ball, floating ball and double trunion with top entry, end entry or bottom entry to "job-match" each application. Crane manufactures ball valves in bronze, carbon and stainless steels in sizes from ¼-in. to 2-in. Carbon steel and stainless steel are produced in sizes up to 12-in. They are described on pages 42 and 43 and in Catalog VC-1600.

Slide Valves

have special applications particularly in petroleum refineries. They are essentially throttling valves used to control flows of erosive slurries and flue gases with entrained solids. Special refactory linings make them particularly valuable in controlling erosive flows. Each valve is custom built to specifications. They are usually made of low chrome alloy steel or stainless steel in sizes up to 85-inch. For details, contact Crane Co.

MATERIALS

Cast Steel Bolted Bonnet Valves described in this catalog are regularly made of carbon steel conforming to ASTM Specification A216, grade WCB. When specified, the valves are available in a variety of other alloy steels including those listed below.

Body and Bonnet or Cap Materials

Crane Designation	Cat. No. Suffix	ASTM Spec.	Material Classification	Service Recommendations
Carbon Steel	None	A216, Gr. WCB	Carbon Steel	Steam, water, oil, oil vapor, gas and general services at temperatures −20 to 1000 F. (1) (4) (5)
No. 5 Steel	5	A217, Gr. C5	5% Cr, ½% Mo	Corrosive-erosive Oil Refinery Service at temperatures −20 to 1200 F. (2)
No. 7 Steel	7	A217, Gr. WC6	1¼% Cr, ½% Mo	Steam, water, oil, oil vapor, gas, general services at temperatures −20 to 1200 F. (3) (4) (5)
No. 9 Steel	9	A217, Gr. WC9	2¼% Cr, 1% Mo	
"LCB" Steel	2	A352-LCB	Low Carbon Steel	Low Temperature Service to −50 F. Not for use above 650 F.
"Arctic" Steel	3	A352-LC3	3½% Nickel Steel	Low Temperature Service to −150 F. Not for use above 650 F.

(1) Upon prolonged exposure to temperatures above approximately 800F, the carbide phase of carbon steel may be converted to graphite.

(2) Consideration should be given to the possibility of excessive oxidation (scaling) when used above 1100F.

(3) Consideration should be given to the possibility of excessive oxidation (scaling) when used above 1050F.

(4) Product used within the jurisdiction of Section 1, Power Boilers, of the ASME Boiler and Pressure Vessel Code, is subject to the same temperature limitations placed upon the material in Table PG-23.1.

(5) Product used within the jurisdiction of Power Piping, ANSI Code for *Pressure Piping*, B31.1-1977, is subject to the same maximum temperature limitations placed upon the material in paragraph 123.2.

Seating Trim Description and Service Recommendations

Cat. No. Suffix	Seating Surfaces	Application
U	Hard Facing (1)	Premium Trim—Suitable for severe services to 1200 F.
X	Exelloy (2)	Excellent for oil and oil vapors to 1100 F. Service on steam, gas and general services limited to globe, angle and check valves to 1100 F.
XU	Exelloy to Hard Facing	Excellent for steam, gas and general services to 1000 F; oil and oil vapor to 1100 F; and all services for swing check valves to 1100 F.
XT	Exelloy to "Stellite"	
XR	Exelloy to No. 49 Nickel Alloy (3)	Steam, water, gas and other relatively non-corrosive fluids to 850 F.
L	Austenitic (4) Stainless Steel	For liquids and gases that may be corrosive to Exelloy but not Austenitic Stainless Steel at temperatures to 850 F.
LU	Austenitic Stainless Steel to Hard Facing	
A	Monel	Corrosive services including acids, alkalies, salt solutions, etc.
AU	Monel to Hard Facing	

(1) Hard Facing is weld deposited Cobalt base alloy.

(2) Exelloy is Crane's designation for specially treated 13% Chromium AISI Type 410 Stainless Steel.

(3) No. 49 Nickel Alloy is Crane Nickel Copper Alloy developed for superior wear resistance.

(4) Austenitic Stainless Steel is a Ni-Cr-Mo stainless steel in the AISI Type 316 category.

Crane gate valves offer the ultimate in dependable service for steam, air, gas, oil, oil vapor, and high pressure installation. All have straight-through ports to assure minimum turbulence, erosion, and resistance to flow. They are available in a wide variety of trims.

1 **Body:** is cast to provide liberal strength to meet operating conditions and to permit unobstructed flow. Turbulence, erosion and pressure drop are minimized.

Flanged End: is illustrated here. Crane cast steel gate valves are also available with threaded and butt-welding ends. All flanged and butt-welding end valves are designed to conform to ANSI B16.5 and ANSI B16.34 standards.

2 **Integral Yoke & Bonnet** is shown. Some designs incorporate a two-piece bonnet and yoke. All bonnet assemblies are cast and finished to the same exacting tolerances as the bodies for accurate alignment of stems and ease of sealing. Bonnet joint varies from flat face gasket-joint (shown) to ring-type bonnet joint, depending on Class.

3 **Seat Rings** (not illustrated) are seal welded to eliminate leak path behind rings and for long trouble-free service. The surfaces are precision ground to fit accurately with the disc. Seats are regularly furnished hard faced. All others are optional.

4 **Disc:** Crane's one-piece flexible disc is shown. The merits of this design are attested by its many imitations. Basically, it provides accurate alignment of mating seating surfaces so the valve can absorb piping strains without leakage. Also, it avoids any tendency to stick in the seated position. Valves are also furnished with solid wedge discs that have proved successful in millions of applications.

5 **Stem:** The tee-head disc-stem connection prevents lateral strain on the stem for smooth, easy operation. Accurately cut threads engage the yoke sleeve for positive control of disc position.

6 **Yoke Sleeve**

7 **Handwheel Nut**

8 **Yoke Sleeve Retaining Nut**

9 **Packing:** contains corrosion inhibitor to avoid stem pitting. Stuffing box is deep, assuring long packing life.

10 **Gland:** is a two-piece ball-type which exerts even pressure on the packing without binding the stem.

11 **Gland Flange**

12 **Gland Eye Bolts:** swing aside for ease in repacking the stuffing box.

13 **Gland Eye Bolt Nuts**

14 **Bonnet Gasket:** seals joint from possible leakage.

15 **Bonnet Studs**
16 **Bonnet Nuts**
} number is dependent on valve size and class.

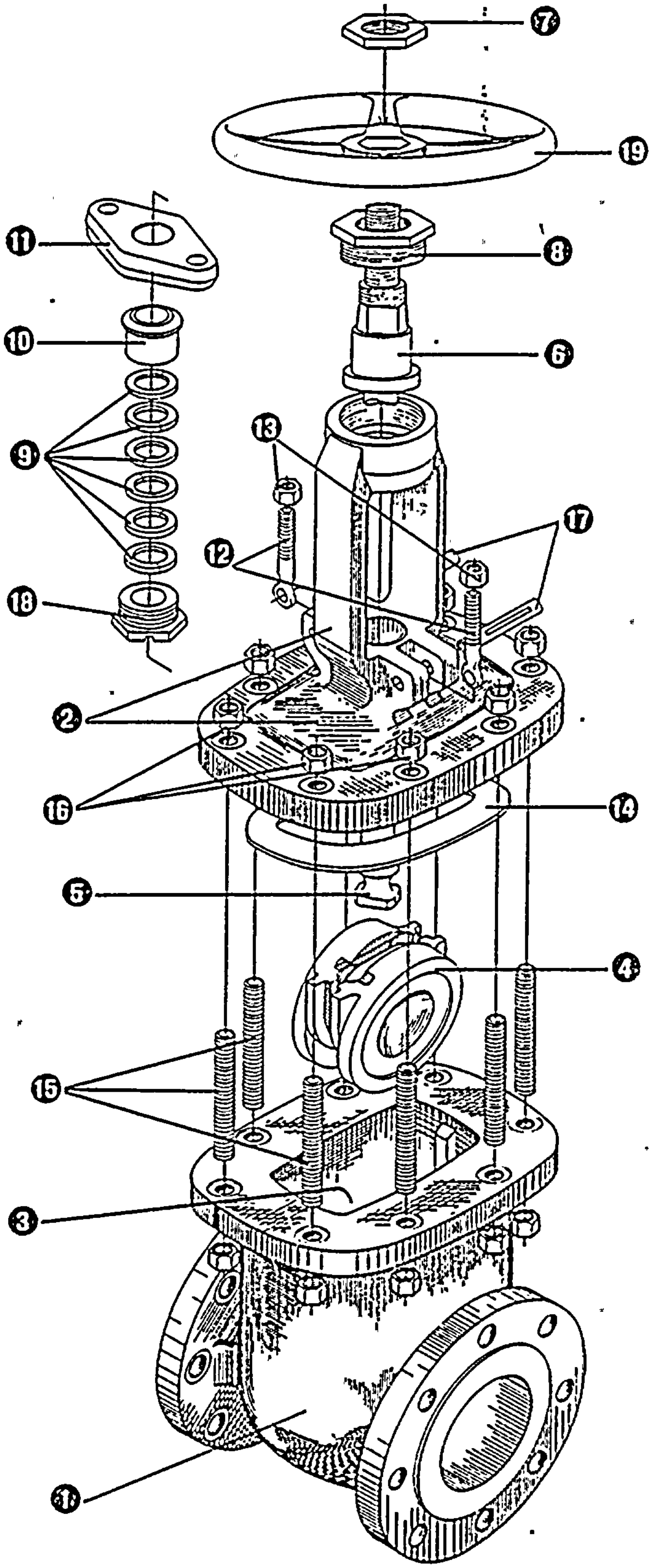
Hydraulic Grease Fitting: provides for lubrication of yoke sleeve bearing surfaces.

17 **Groov-Pin**

18 **Bonnet Bushing**

19 **Handwheel:** Crane gate valves can also be supplied with gear or motor operators. See pages 56 to 65 for details.

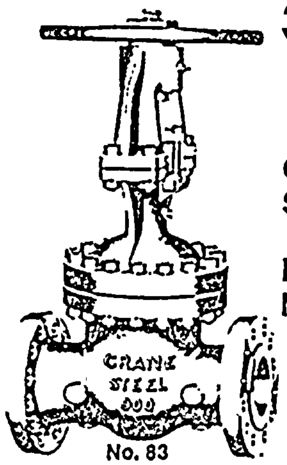
Typical Gate Valve



This illustration represents a typical Crane gate valve. It is not intended to show all the details and construction of all Crane gate valves.

CRANE

GATE VALVI CLASS 900 3" to 16"



No. 83

OS&Y Bolted Bonnet
Solid Wedge Disc

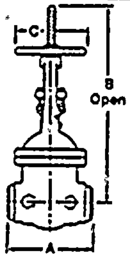
No. 83, Flanged
No. 83½, Butt-Weldin

Pressure-Temperature Rating
Carbon Steel, ASTM A216 Grade WCB
2220 psi @ -20F to 100F

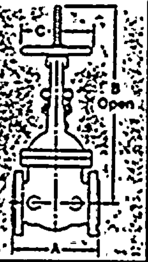
See page 55 for ratings of other materials and temperatu

Design Data and Features:

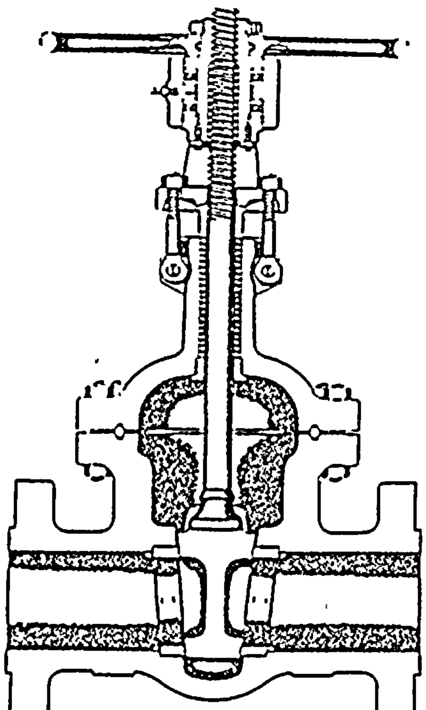
- These valves comply with applicable requirements of Standards: ANSI-B16.5, ANSI-B16.10, ANSI-B16.25, ANSI-B16.34, API 600.
- Solid wedge disc with tee-head disc-stem connection—prevents lateral strain on stem, assures accurate seating.
- Permanent, swing-type eye bolts—prevent loss while easing service of stuffing box.
- Seal welded seat rings—eliminate leak path behind rings.
- Material—carbon steel. Other materials available when specified—Crane No. 5, 7, 9, LCB and "Arctic" steels. See Page 3 for specifications and service recommendations.
- Trim—XU (universal) suitable for broad spectrum of services. Other trims available—X, U, A, L, & LU, also XR in sizes 3" to 8". See page 3 for descriptions.
- Drilling templates are shown on page 51.
- Flange and facing dimensions are shown on page 47.
- Other facings (page 48) can be supplied when specified.
- Butt-welding ends are bored to match the inside diameter of the pipe to be used. Orders must specify the diameter of bore (I.D. of pipe). See page 45.
- Yoke sleeves with anti-friction bearings are regularly furnished on sizes 6" and larger. Torque required to operate valves so furnished is about one-half of that required with plain bearing yoke sleeves.
- Location of by-passes, taps and drains, see page 44.
- Valve Operators—Converto Gear, see page 56.
  Teledyne Motor Operators, see page 60.
  Other operators, see page 65.
- Ring type joint bonnet gasket assures positive seal against leakage and accurate alignment of moving parts.
- For test information—page 54.



Weights and Dimensions



Valve N.P.S.	Weight—Pounds		Dimensions—Inches		
	83	83½	A (83 & 83½)	B	C
3	260	220	15.0	27.25	12.0
4	430	360	18.0	31.50	14.0
5	660	560	22.0	36.75	16.0
6	900	750	24.0	42.75	20.0
8	1560	1300	29.0	52.50	24.0
10	2470	2140	33.0	66.25	30.0
12	3580	2770	38.0	74.50	30.0
14	4925	4170	40.5	80.00	36.0
16	5850	4950	44.5	89.00	36.0


No. 83

CRANE TESTS AND WORKING PRESSURES

Air Testing

The fact that many Crane products are recommended for water, oil, gas, and air does not necessarily indicate that all are air tested. It has been found commercially that our regular stock valves have proven quite satisfactory for air or gas service without an air test; therefore, if an air test is required, it must be definitely specified.

In addition, any valve intended for air, gas, or very volatile fluids, where absolute tightness is essential, should be ordered air tested unless the catalog specifically states it is regularly air tested. Air tested valves are provided with end protectors.

When iron or steel gate valves are to be used in pipe lines on natural dry gas service, orders should so specify, so that they can be suitably packed.

Non-Destructive Testing

All Crane steel foundry practice is developed with the aid of radiography, magnetic particle, or fluid penetrant testing. . . . and these inspections provide continuous control of production. X-Ray and Betatron equipment, radio isotopes, and modern magnetic particle machines are used.

Crane steel pressure containing castings may be qualified by non-destructive examinations on a special order basis when specified.

Hydrostatic and Shock Working Pressures

Crane valves are suitable for liquid working pressures specified on catalog pages only when used in hydraulic installations in which shock is absent or negligible. Sudden closure of a valve in a hydraulic system causes the body of liquid, which may be moving at a rate generally in excess of one foot per second, to stop instantaneously. As liquids are relatively incompressible, the sudden cessation of flow effects a rise in pressure considerably greater than the static working pressure; this pressure increase is termed "SHOCK" and may, in some cases, be sufficient to cause valves or piping to fail.

Pressure increase due to shock is not dependent upon the working pressure in the system but upon the velocity at which the liquid is flowing. This pressure surge, or shock, severely limits design velocities . . . a fact readily understandable if it is remembered that pressure rise resulting from arrest of flow may be as high as 60 psi for each foot per second initial velocity. For example, installations of 100 psi and 1000 psi working pressures, with the same initial velocity of 10 feet per second, will be subject to the same increase in pressure (approximately 600 psi) due to instantaneous closure of a valve.

Shock generally prevails in lines equipped with check or quick-closing valves, or in lines supplied by reciprocating pumps. It may also be produced, to a lesser degree, by rapid closure of gate and globe valves. Therefore, care should be exercised when closing valves installed in liquid lines.

Where shock is likely to occur, the maximum shock pressure should be added to the working pressure of the line to determine working pressure of products in the line . . . also, hydraulic installations should be equipped with air chambers or other types of shock absorbers to eliminate, as much as possible, increase in pressure due to shock.

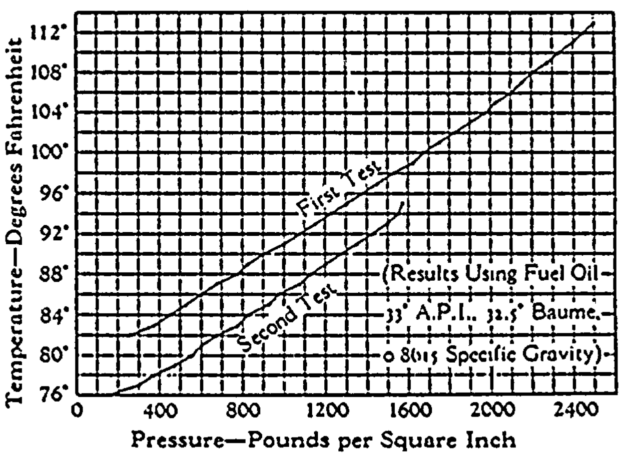
Increase in Pressure Due to Expansion of Liquids

If a vessel is filled with liquid so that no space remains for volumetric expansion, any rise in temperature of the liquid will cause an increase in internal pressure; this is due to the tendency of liquids to change in volume and, as liquids are relatively incompressible, the pressure builds up rapidly with only a slight temperature rise. The increase may be due to the sun's rays or to atmospheric conditions.

Crane tests indicate that when vessels are completely filled with 33° API fuel oil, a rise of 1° F causes an increase in internal pressure of about 75 psi; see chart at right.

In the first test, the 31° increase (from 82° to 113°) caused a total pressure increase of 2250 psi (from 250 to 2500 psi) or about a 73 psi per degree average. In the second test, the 19° increase (from 76° to 95°) caused a total pressure increase of 1425 psi (from 150 to 1575 psi) or about a 75 psi per degree average. While results may vary slightly under actual service conditions, depending upon the kind of oil, its cubical coefficient of expansion, the flexibility, if any, of the vessel, the presence of air in the oil, and other variables, the tests prove conclusively that dangerously high pressures can build up in an oil-containing vessel with only moderate temperature increase.

Thermo-Piezo Effects of Oil at Constant Volume



It is recommended, therefore, on valves installed in liquid lines (particularly oil), that some means be taken to prevent entrapment of liquid in the valve bonnet so as to eliminate possible pressure build-up due to rising temperature.

Crane Steel Valve Pressure Tests

Shell, seat, and backseat tests conducted on all Crane steel valves prior to shipment from the manufacturing plant comply with the applicable requirements of ANSI-B16.34, API 598 and MSS SP-61.

Excerpts from American National Standard ANSI B16.34-1977

Scope
This standard covers pressure-temperature ratings, dimensions, tolerances, materials, non-destructive examination requirements, testing, and marking for cast, forged, and fabricated steel flanged and butt-welding end valves.

Codes and Regulations
A valve used under the jurisdiction of the ASME Boiler and Pressure Vessel Code, the ANSI Code for Pressure Piping, or Governmental Regulations, is subject to any limitation of that code or regulation. This includes any maximum temperature limitation for a material, or rule governing the use of a material at low temperature.

Rating Temperature
The temperature shown for a corresponding pressure rating is the temperature of the pressure containing shell of the component. In general, this temperature is the same as that of the contained fluid. Use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user, subject to the requirements of applicable codes and regulations.

Materials
Consideration should be given to the possibility of graphitization in carbon steel above approximately 800 F.

Consideration should be given to the possibility of excessive oxidation (scaling) on 1¼ Cr-½ Mo (A217-WC6) and 2¼ Cr-1 Mo (A217-WC9) steels above approximately 1050 F . . . and on 5 Cr-½ Mo (A217-C5) steel above approximately 1100 F.

End Dimensions
Unless otherwise specified, the details of the welding end preparation shall be in accordance with ANSI B16.25.

Flanged ends shall be prepared with flange facing, nut bearing surfaces, outside diameter, thickness, and drilling in accordance with ANSI B16.5.

The end-to-end dimensions of welding end valves and the face-to-face dimensions of flanged end valves shall be in accordance with ANSI B16.10 or other dimensions by agreement between manufacturer and purchaser.

Crane Steel Valve Pressure - Temperature Ratings

(comply with ANSI B16.34-1977—Standard Class)

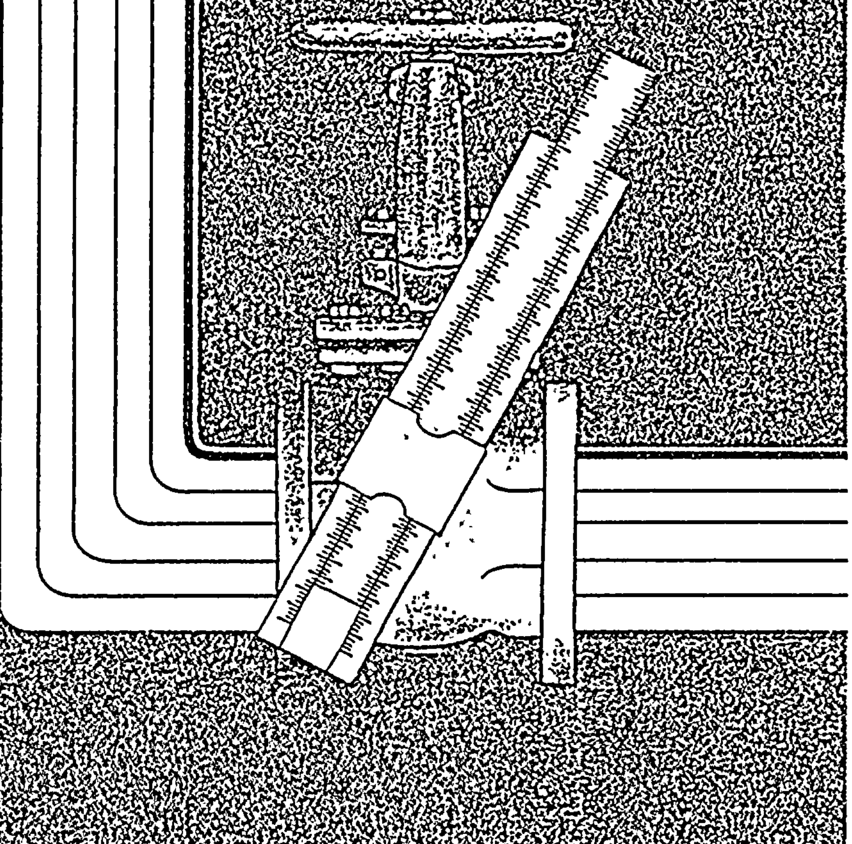
CLASS	TEMP.	WORKING PRESSURES, psig						CLASS	TEMP.	WORKING PRESSURES, psig					
	F	A216 WCB	A217 C5	A217 WC6	A217 WC9	A352 LCB	A352 LC3		F	A216 WCB	A217 C5	A217 WC6	A217 WC9	A352 LCB	A352 LC3
CLASS 150	-20 to 100°	285	290	290	290	265	290	CLASS 600	-20 to 100°	1480	1500	1500	1500	1390	1500
	200	260	260	260	260	250	260		200	1350	1500	1425	1430	1315	1500
	300	230	230	230	230	230	230		300	1315	1455	1345	1355	1275	1455
	400	200	200	200	200	200	200		400	1270	1410	1315	1295	1235	1410
	500	170	170	170	170	170	170		500	1200	1330	1285	1280	1165	1330
	600	140	140	140	140	140	140		600	1095	1210	1210	1210	1065	1210
	650	125	125	125	125	125	125		650	1075	1175	1175	1175	1045	1175
	700	110	110	110	110	...	...		700	1065	1135	1135	1135	...	...
	750	95	95	95	95	...	...		750	1010	1065	1065	1065	...	...
	800	80	80	80	80	...	...		800	825	995	1015	1015	...	...
	850	65[1]	65	65	65	...	...		850	535[1]	880	975	975	...	...
	900	50[1]	50	50	50	...	...		900	345[1]	705	900	900	...	...
	950	35[1]	35	35	35	...	...		950	205[1]	520	755	755	...	...
	1000	20[1]	20	20	20	...	...		1000	105[1]	385	445	535	...	...
	1050	...	20[2]	20[2]	20[2]	...	...		1050	...	280	275	400	...	...
	1100	...	20[2]	20[2]	20[2]	...	...		1100	...	205	190	225	...	...
	1150	...	20[2]	...	...	...	...		1150	...	140	...	...	...	...
	1200	...	20[2]	...	...	...	...		1200	...	90	...	...	...	...
CLASS 300	-20 to 100°	740	750	750	750	695	750	CLASS 900	-20 to 100°	2220	2250	2250	2250	2085	2250
	200	675	750	710	715	655	750		200	2025	2250	2135	2150	1970	2250
	300	655	730	675	675	640	730		300	1970	2185	2020	2030	1915	2185
	400	635	705	660	650	620	705		400	1900	2115	1975	1945	1850	2115
	500	600	665	640	640	585	665		500	1795	1995	1925	1920	1745	1995
	600	550	605	605	605	535	605		600	1640	1815	1815	1815	1600	1815
	650	535	590	590	590	525	590		650	1610	1765	1765	1765	1570	1765
	700	535	570	570	570	...	...		700	1600	1705	1705	1705	...	...
	750	505	530	530	530	...	...		750	1510	1595	1595	1595	...	...
	800	410	500	510	510	...	...		800	1235	1490	1525	1525	...	...
	850	270[1]	440	485	485	...	...		850	805[1]	1315	1460	1460	...	...
	900	170[1]	355	450	450	...	...		900	515[1]	1060	1350	1350	...	...
	950	105[1]	260	380	380	...	...		950	310[1]	780	1130	1130	...	...
	1000	50[1]	190	225	270	...	...		1000	155[1]	575	670	805	...	...
	1050	...	140	140	200	...	...		1050	...	420	410	595	...	...
	1100	...	105	95	115	...	...		1100	...	310	290	340	...	...
	1150	...	70	...	...	...	...		1150	...	205	...	...	...	...
	1200	...	45	...	...	...	...		1200	...	135	...	...	...	...
CLASS 400	-20 to 100°	990	1000	1000	1000	925	1000	CLASS 1500	-20 to 100°	3705	3750	3750	3750	3470	3750
	200	900	1000	950	955	875	1000		200	3375	3750	3560	3580	3280	3750
	300	875	970	895	905	850	970		300	3280	3640	3365	3385	3190	3640
	400	845	940	880	865	825	940		400	3170	3530	3290	3240	3085	3530
	500	800	885	855	855	775	885		500	2995	3325	3210	3200	2910	3325
	600	730	805	805	805	710	805		600	2735	3025	3025	3025	2665	3025
	650	715	785	785	785	695	785		650	2685	2940	2940	2940	2615	2940
	700	710	755	755	755	...	...		700	2665	2840	2840	2840	...	...
	750	670	710	710	710	...	...		750	2520	2660	2660	2660	...	...
	800	550	665	675	675	...	...		800	2060	2485	2540	2540	...	...
	850	355[1]	585	650	650	...	...		850	1340[1]	2195	2435	2435	...	...
	900	230[1]	470	600	600	...	...		900	860[1]	1765	2245	2245	...	...
	950	140[1]	350	505	505	...	...		950	515[1]	1305	1885	1885	...	...
	1000	70[1]	255	300	355	...	...		1000	260[1]	960	1115	1340	...	...
	1050	...	190	185	265	...	...		1050	...	705	685	995	...	...
	1100	...	140	130	150	...	...		1100	...	515	480	565	...	...
	1150	...	90	...	...	...	...		1150	...	345	...	...	...	...
	1200	...	60	...	...	...	...		1200	...	225	...	...	...	...

[1] Permissible, but not recommended for prolonged usage above about 800 F.
[2] Class 150 ratings above 1000 F apply to welding end valves only.

VC-1900A

CRANE

ENGINEERING DATA



CRANE AUSTENITIC STEELS

	CHEMICAL REQUIREMENTS (%)									MECHANICAL PROPERTIES					
	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Nickel	Chromium	Molybdenum	Copper and Columbium	Tensile Strength ksi	Tensile Strength MPa	Yield Strength ksi	Yield Strength MPa	Elongation in 2" (50 mm)	Reduction of Area
FORGED/ROLLED STAINLESS STEEL WITH MOLYBDENUM — ASTM A276, Type 316															
Min.	...	...	...	...	...	10.0	16.0	2.0	...	*	*	*	*	*	*
Max.	0.08	2.00	0.045	0.030	1.00	14.0	18.0	3.0	...	...	...	...	...	...	...
FORGED/ROLLED STAINLESS STEEL WITH MOLYBDENUM — ASTM A479, Type 316															
Min.	...	...	...	...	...	10.0	16.0	2.0	...	75	517	30	207	†40%	†50%
Max.	0.08	2.00	0.045	0.030	1.00	14.0	18.0	3.0	...	...	...	...	...	...	...
CAST STAINLESS STEEL — ASTM A351, Grade CF8															
Min.	...	...	...	...	...	8.0	18.0	...	...	70	483	30	207	35%	...
Max.	0.08	1.50	0.040	0.040	2.00	11.0	21.0	...	...	...	...	...	...	...	...
CAST STAINLESS STEEL — ASTM A351, Grade CF8C															
Min.	...	...	...	...	...	9.0	18.0	...	¶	70	483	30	207	30%	...
Max.	0.08	1.50	0.040	0.040	2.00	12.0	21.0	...	¶	...	...	...	...	...	...
CAST STAINLESS STEEL WITH MOLYBDENUM — ASTM A351, Grade CF8M															
Min.	...	...	...	...	...	9.0	18.0	2.0	...	70	483	30	207	30%	...
Max.	0.08	1.50	0.040	0.040	1.50	12.0	21.0	3.0	...	...	...	...	...	...	...
CAST LOW CARBON STAINLESS STEEL — ASTM A351, Grade CF3															
Min.	...	...	...	...	...	8.0	17.0	...	...	70	483	30	207	35%	...
Max.	0.03	1.50	0.040	0.040	2.00	12.0	21.0	...	...	...	...	...	...	...	...
CAST LOW CARBON STAINLESS STEEL WITH MOLYBDENUM — ASTM A351, Grade CF3M															
Min.	...	...	...	...	...	9.0	17.0	2.0	...	70	483	30	207	30%	...
Max.	0.03	1.50	0.040	0.040	1.50	13.0	21.0	3.0	...	...	...	...	...	...	...
CAST CRANELOY 20 STAINLESS STEEL — ASTM A351, Grade CN7M															
Min.	...	...	...	...	...	27.5	19.0	2.0	3.0**	62	431	25	172	35%	...
Max.	0.07	1.50	0.040	0.040	1.50	30.5	22.0	3.0	4.0**	...	...	...	...	...	...
FORGED/ROLLED CRANELOY 20 STAINLESS STEEL — ASTM B473															
Min.	...	...	...	...	...	32.0	19.0	2.0	‡	85	590	35	240	30%	50%
Max.	0.07	2.00	0.045	0.035	1.00	38.0	21.0	3.0	‡	...	...	...	...	...	...

† ASTM A479 cold-drawn bars permitted 30% min. elongation in 2" (50 mm) and 40% min. reduction of area.

¶ ASTM A351-CF8C requirements include columbium (8 x carbon content min. to 1.00% max.)

**ASTM A351-CN7M requirements include 3.0 to 4.0% copper.

‡ ASTM B473 requirements include copper (3.0 to 4.0%) and columbium plus tantalum (8 x carbon content min. to 1.00% max.)

* Mechanical Properties for ASTM A276, Type 316 Rods and Bars (min.)	¾" (19.05 mm) dia. or less	Over ¾" (19.05 mm) dia. to 1" (25.4 mm)	Over 1" (25.4 mm) dia. to 1¼" (31.8 mm)	Over 1¼" (31.8 mm) dia. to 1½" (38.1 mm)	Over 1½" (38.1 mm) dia. to 1" (44.5 mm)
Tensile strength....ksi (MPa)..	125 (862)	115 (793)	105 (724)	100 (689)	95 (655)
Yield strength.....ksi (MPa)	100 (689)	80 (552)	65 (448)	50 (345)	45 (310)
Elongation in 2" (50 mm).......	12%	15%	20%	28%	28%
Reduction of area	35%	35%	35%	45%	45%

CRANE HARDSURFACING ALLOYS

Hardsurfacing alloys are used on seating surfaces, disc guides, and other wearing surfaces. The materials are available in the form of bare rod, covered electrode, coils, and powder, and may be deposited by any of a number of processes including Oxyacetylene, Shielded Metal-Arc, Gas Metal-Arc, Gas Tungsten-Arc, Submerged Arc, and Plasmarc. Hardsurfacing is also commonly referred to as "Hard Facing".

Hardsurfacing alloys are available in many compositions from various suppliers, but the most commonly used for valve applications is identified as "Co Cr A" in American Welding Society Specification AWS-A5.13. Other cobalt base alloys are employed when more ductility is required. These alloys withstand corrosion and erosion unusually well and display excellent resistance to wear, seizure, galling, and abrasion.

VALVE GASKETS

Types of bonnet joint gaskets and the materials from which they are made are dictated by valve design and the intended end use of the valve.

Although it may be possible to reuse some gaskets and make up satisfactory joints a second or more times, it is not recommended. Whenever a bonnet joint must be reassembled after dismantling for maintenance or any other reason, use of a new gasket will frequently avoid costly rework and system shut-downs.

Flat Gaskets

Many valves for low pressure service use flat full face or ring gaskets. Full face gaskets extend across the entire bonnet flange face and are cut with holes to match the bolt holes in the flange.

Flat ring gaskets are installed on the flange face surface inside the bolts. They may be centered or positioned by the bolts or located in a male and female joint.

Flat gaskets for most bronze and iron (and some corrosion-resistant) flanged bonnet joint gate, globe, angle, and check valves are cut from compressed sheet packing comprised of asbestos fiber with suitable binder. This material is suitable for temperatures up to 750 F and is listed by the Underwriters' Laboratories, Inc., for use on hazardous fluids.

Flat gaskets cut from sheet TFE (tetrafluoroethylene) are used mainly on corrosion-resistant valves.

Flat gaskets of corrugated soft steel are used in Class 150 and 300 steel gate, globe, angle, and check valves.

Spiral-Wound Gaskets

Spiral-wound gaskets for bonnet joints are designed to accommodate the pressure requirements and bolt loading of each specific type of joint.

The gaskets are constructed by wraping alternate plies of a preformed metal strip and a filler material. Corrugations in the metal strip impart tension and resiliency when the gasket is under compression. The edges of the strip create multiple barriers against leakage, and the soft filler material seals minute imperfections in the flange faces.

The metal strip is stainless steel while the filler material is a non-metallic material such as asbestos or TFE, depending upon end use specifications.

Ring Joint Gaskets

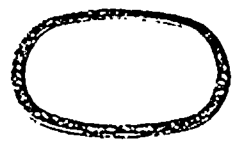
Ring joint gaskets are made of soft steel and have an octagonal or oval cross-section shape. The gasket seats on the tapered flanks of a specially prepared groove in each flange face.

Ring joint gaskets have proven to be very effective in providing joint tightness for long periods of time under difficult service conditions.

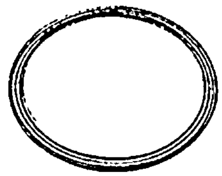
Pressure-Seal Joint Gaskets

As the name implies, the load imposed upon the Pressure-Seal gasket to secure a seal against leakage is provided by the internal pressure in the valve. The seal is made by deformation of the tip of the gasket against the body bore, by the angular force of the bonnet simulating a piston acted upon by the internal pressure.

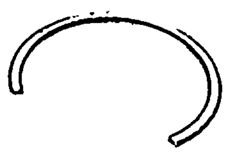
The gaskets are made of soft steel, silver-plated. The silver plating serves as a deterrent to galling as the gasket moves against the body wall under load.



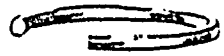
Flat Asbestos Gasket



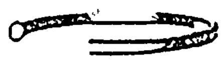
Flat Metallic Gasket



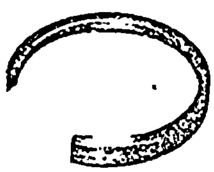
Spiral-Wound Gasket



Octagonal Ring Joint Gasket



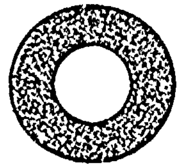
Oval Ring Joint Gasket



Pressure-Seal Joint Gasket

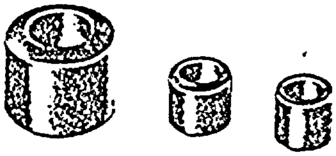
COMPOSITION DISCS

The dependability of the Crane line of renewable type composition discs for use in globe, angle, and check valves is the result of constant research. Crane composition discs are made from high quality materials . . . compounded, cured, and tested for specific services such as steam, hot and cold water, oil, air, gases, including liquid petroleum gases, and gasoline services. Users are urged to choose the type and material best suited to the service requirements.

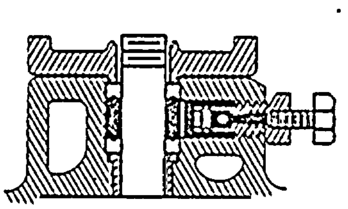


Composition Disc

VALVE PACKINGS

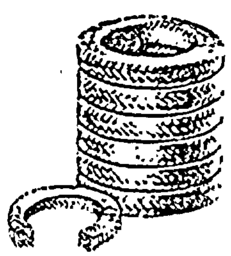


Endless Molded Ring Packing
for Small Size
Bronze and Iron Valves



Injection Type Packing
As used in Crane Class 125
Ferrosteel Wedge Gate Valves
(2-8")

Diagonally Cut
Die-Formed Ring Packing
for Large Size
Bronze and Iron Valves
(also Steel Valves)



Diagonally Cut
Die-Formed Ring Packing
for Corrosion-Resistant
Alloy Steel Valves

Endless TFE Rings
for Ball Valves

Crane valve stem seals vary in material and design depending on fluid, pressure, and temperature conditions . . . as well as the stuffing box construction of the valve.

Endless Molded Ring Packing

Many small size bronze and iron valves (usually 2-inch and smaller) are equipped with endless molded ring packing. The packing is formed of a homogenous mixture of ingredients, especially selected for low friction and non-adherence to stem material as well as longevity when subjected to a broad spectrum of fluids.

Basic ingredients are asbestos impregnated with 30 to 35% TFE (tetrafluoroethylene) for use up to 366 F or an asbestos-graphite mixture for use up to 550 F. A suitable binder is used to provide stability of molded parts. In addition, packings used with ferritic steel stems contain a corrosion inhibitor to avoid pitting of the stem.

Injection Type Packing

Certain Crane iron valves have an injection type stuffing box which permits replenishment of packing while the valve remains in service, greatly simplifying maintenance.

Replenishment packing is in the form of pellets which are suitable for all valve sizes. There is no need for an extensive stock of packing sizes for maintenance purposes. The packing assembly includes two compacted and die-formed endless rings made from an homogenous mixture of asbestos and TFE; one ring is placed in each end of the stuffing box to prevent extrusion of the center core material.

The center core and injection pellets consist of an homogenous mixture of asbestos fibre, TFE, and other ingredients having a consistency capable of being injected, by a screw, through a ball check valve.

A corrosion inhibitor is included to prevent stem pitting. The combination of materials assures low resistance to stem movement and provides a long-life assembly suitable for all fluids and temperatures the valves normally encounter.

Diagonally Cut Die-Formed Ring Packing

This type of packing is used in many valves having conventional stuffing box construction. The rings are square or rectangular in cross section and are used in sets. The number per set depends on the depth of the valve stuffing box. Diagonal cuts on successive rings are staggered about 120 to 180 degrees apart to minimize the probability of a continuous leak path . . . and each ring is individually tamped into position before installing the succeeding ring. This procedure is also recommended when valves using this type of packing are repacked in the field.

Rings for the larger size bronze and iron valves (service temperatures up to 550 F) usually consist of a core of asbestos and graphite with suitable binder, covered by a braided asbestos jacket coated with flake graphite. A suitable agent is included to inhibit stem corrosion.

Rings for steel valves (high temperature service) are similar in construction to those for bronze and iron valves, but have a lower weight loss at elevated temperatures, a minimum content of binder, and an inconel wire insert in each strand of asbestos yarn used in the jacket. A suitable agent is included to inhibit stem corrosion.

Corrosion-resistant alloy steel valves have lattice-braided TFE rings for use up to 500 F . . . and rings of braided asbestos yarn with each strand lubricated with TFE suspensoid for use up to 800 F. The latter type has a low weight loss at elevated temperatures.

Endless TFE (tetrafluoroethylene) Rings

The stuffing box of some ball valves is furnished with endless TFE packing rings. The rings are spring-loaded eliminating need for further adjustment. They are the flat washer type in small size valves, and the V-type with end adaptor in larger size valves.

O-rings *(not ill.)*

In some quarter-turn valves (both ball and butterfly), O-rings serve as the stem seal. The rings are usually Buna N but other rubber compounds may also be used depending upon service conditions.

CRANE TESTS AND WORKING PRESSURES

Air Testing

The fact that many Crane products are recommended for water, oil, gas, and air does not necessarily indicate that all are air tested. It has been found commercially that our regular stock valves have proven quite satisfactory for air or gas service without an air test; therefore, if an air test is required, it must be definitely specified.

In addition, any valve intended for air, gas, or very volatile fluids, where absolute tightness is essential, should be ordered air tested unless the catalog specifically states it is regularly air tested. Air tested valves are provided with end protectors.

When iron or steel gate valves are to be used in pipe lines on natural dry gas service, orders should so specify, so that they can be suitably packed.

Non-Destructive Testing

All Crane steel foundry practice is developed with the aid of radiography, magnetic particle, or fluid penetrant testing. . . . and these inspections provide continuous control of production. X-Ray and Betatron equipment, radio isotopes, and modern magnetic particle machines are used.

Crane steel pressure containing castings may be qualified by non-destructive examinations on a special order basis when specified.

Hydrostatic and Shock Working Pressures

Crane valves are suitable for liquid working pressures specified on catalog pages only when used in hydraulic installations in which shock is absent or negligible. Sudden closure of a valve in a hydraulic system causes the body of liquid, which may be moving at a rate generally in excess of one foot per second, to stop instantaneously. As liquids are relatively incompressible, the sudden cessation of flow effects a rise in pressure considerably greater than the static working pressure; this pressure increase is termed "SHOCK" and may, in some cases, be sufficient to cause valves or piping to fail.

Pressure increase due to shock is not dependent upon the working pressure in the system but upon the velocity at which the liquid is flowing. This pressure surge, or shock, severely limits design velocities . . . a fact readily understandable if it is remembered that pressure rise resulting from arrest of flow may be as high as 60 psi for each foot per second initial velocity. For example, installations of 100 psi and 1000 psi working pressures, with the same initial velocity of 10 feet per second, will be subject to the same increase in pressure (approximately 600 psi) due to instantaneous closure of a valve.

Shock generally prevails in lines equipped with check or quick-closing valves, or in lines supplied by reciprocating pumps. It may also be produced, to a lesser degree, by rapid closure of gate and globe valves. Therefore, care should be exercised when closing valves installed in liquid lines.

Where shock is likely to occur, the maximum shock pressure should be added to the working pressure of the line to determine working pressure of products in the line . . . also, hydraulic installations should be equipped with air chambers or other types of shock absorbers to eliminate, as much as possible, increase in pressure due to shock.

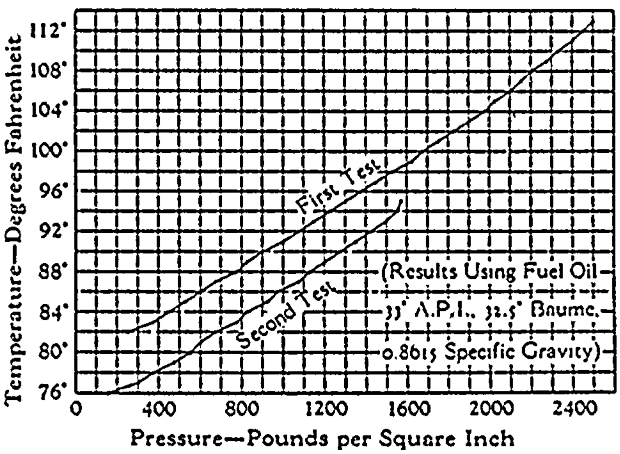
Increase in Pressure Due to Expansion of Liquids

If a vessel is filled with liquid so that no space remains for volumetric expansion, any rise in temperature of the liquid will cause an increase in internal pressure; this is due to the tendency of liquids to change in volume and, as liquids are relatively incompressible, the pressure builds up rapidly with only a slight temperature rise. The increase may be due to the sun's rays or to atmospheric conditions.

Crane tests indicate that when vessels are completely filled with 33° API fuel oil, a rise of 1° F causes an increase in internal pressure of about 75 psi; see chart at right.

In the first test, the 31° increase (from 82° to 113°) caused a total pressure increase of 2250 psi (from 250 to 2500 psi) or about a 73 psi per degree average. In the second test, the 19° increase (from 76° to 95°) caused a total pressure increase of 1425 psi (from 150 to 1575 psi) or about a 75 psi per degree average. While results may vary slightly under actual service conditions, depending upon the kind of oil, its cubical coefficient of expansion, the flexibility, if any, of the vessel, the presence of air in the oil, and other variables, the tests prove conclusively that dangerously high pressures can build up in an oil-containing vessel with only moderate temperature increase.

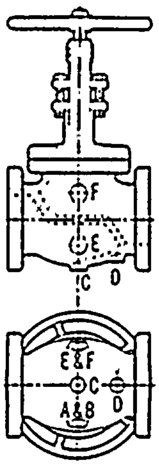
Thermo-Piezo Effects of Oil at Constant Volume



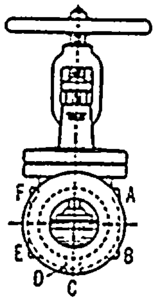
It is recommended, therefore, on valves installed in liquid lines (particularly oil), that some means be taken to prevent entrapment of liquid in the valve bonnet so as to eliminate possible pressure build-up due to rising temperature.

TAPS AND DRAINS FOR FLANGED VALVES

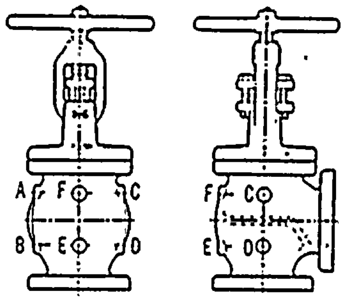
Designating Location of Tapped Holes



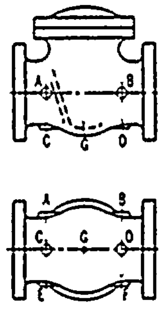
Globe Valve



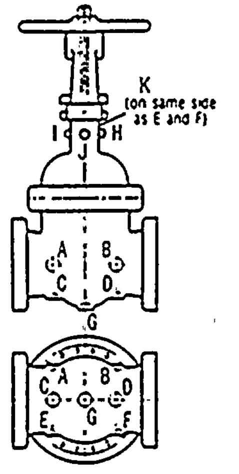
Globe Valve



Angle Valve



Check Valve



Gate Valve

These illustrations indicate a standard method used for designating the location of tapped holes on cast iron and cast steel globe, angle, check, and gate valves in all pressure classes.

Valve bodies can be tapped without a boss for a very small drain hole; the maximum size of the hole, however, depends entirely upon the location of the tapped hole and the pressure class of the valve.

Gate valves are regularly made with bosses (except at location "G"). Globe, angle, and check valves are not regularly made with bosses but can be so furnished when orders specify.

LOCATION OF BY-PASSES

Gate valves: When gate valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the side of the main valve with the stems of both valves parallel, pointing vertically upward.

The more common of the "special" attached-locations is on the center of the flow line, at the bottom of the main valve, with the stem of the by-pass valve at right angles to the main valve stem. This is designated as the "bottom attachment," or defined as "by-pass at bottom." When any other "special" attached-location or other position of the by-pass valve stem is desired, a sketch should be submitted.

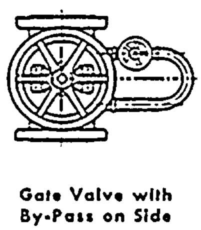
Globe valves: When globe valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the right-hand side of the main valve, with the stems of both valves parallel, pointing vertically upward. When by-pass is "specially" required attached at the left-hand side, the designation shall be "left-hand attachment."

Right-hand side of a globe valve is the side at the right, when facing the flow-port which leads to the under side of the disc.

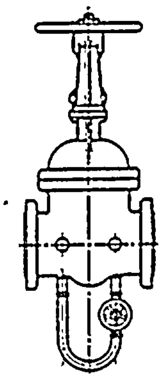
Angle valves: When angle valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the back of the main valve, with the stems of both valves parallel, pointing vertically upward.

When the by-pass is "specially" required attached at the right or left-hand side, the designations shall be "right-hand attachment" or "left-hand attachment." Right-hand side of an angle valve is at the right, when facing the back of the valve.

These illustrations are representative of steel valves.



Gate Valve with By-Pass on Side



Gate Valve with By-Pass at Bottom

ASSEMBLY AND MAINTENANCE OF FLANGED JOINTS

When a flanged joint is assembled, each of the component parts is subjected to tensile or compressive stresses of varying magnitude. In the great majority of cases, it is adequate to tighten the bolts sufficiently to withstand the test pressure without leakage.

The maximum allowable stress values for bolting given in the various codes such as the ASME Boiler and Pressure Vessel Code and the ANSI Code for Pressure Piping are design values to be used in determining the minimum amount of bolting required.

A distinction must be recognized between the design value and the bolt stress that might actually exist or that might be needed for conditions other than the design pressure. The initial tightening of the bolts is a pre-stressing operation, and the amount of bolt stress developed must be within proper limits to insure, on the one hand, that it is adequate to provide against all conditions that tend to produce a leaking joint and, on the other hand, that it is not so excessive that yielding of the bolts and/or flanges can produce relaxation that also can result in leakage.

The first important consideration is the need for a joint to be tight in the hydrostatic test. An initial bolt stress of some magnitude greater than the design value therefore must be provided. If it is not, further bolt strain develops during the test which tends to part the joint and thereby, to decompress the gasket enough to allow leakage. It is evident that an initial bolt stress higher than the design value may, and in some cases must, be developed in the tightening operation. This practice is permissible, as pointed out in Appendix S, Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code, provided it includes necessary and appropriate provision to insure against excessive flange distortion and gross crushing of the gasket.

Investigation of field-erected flanged joints has indicated that the probable bolt stress developed manually, when using standard wrenches on *alloy steel* bolts is:

$$S = \frac{45{,}000}{\sqrt{d}}$$

where S is the bolt stress and d is the nominal diameter of the bolt.

Experience indicates that these stresses are satisfactory for ANSI B16.5 flanges and will comply with the requirements as set forth in the preceding paragraphs. It can be seen that smaller bolts will have excessive stress unless judgment is used in pulling up on them. On the other hand, it will be impossible to develop the desired stress in very large bolts by ordinary hand wrenching. Impact wrenches may prove serviceable, but if not, resort may be had to such methods as preheating the bolt or using hydraulically-powered bolt tensioners. With some of these methods, control of the bolt stress is possible by means inherent in the procedure, especially if effective thread lubricants are employed, but in all cases, the bolt stress can be regulated within reasonable tolerances by measuring the bolt elongation with suitable extensometer equipment. Generally, simple wrenching without verification of the actual bolt stress meets all practical needs, and measured control of stress is employed only when there is some special or important reason for doing so.

It is possible for the bolt stress to decrease after initial tightening, because of slow creep or relaxation of the gasket, particularly in the case of the "softer" gasket materials. This may be the cause of leakage in the hydrostatic test, in which case it may suffice merely to retighten the bolts. A decrease in bolt stress can also occur in service at elevated temperatures as a result of creep in the bolt and/or flange gasket material, with consequent relaxation. When this results in leakage under service conditions, it is common practice to retighten the bolts, and sometimes a single such operation, or perhaps several repeated at long intervals, is sufficient to correct the condition.

(Abstracted in part from Appendix S, ASME Boiler & Pressure Vessel Code, Sec. VIII, Div. 1)

"K" FACTOR TABLE—SHEET 2 of 4

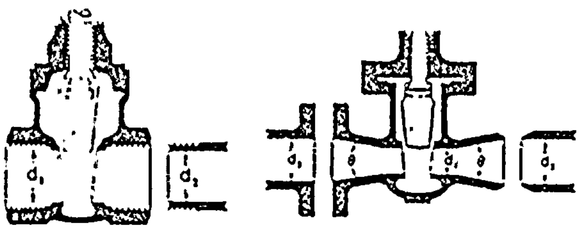
REPRESENTATIVE RESISTANCE COEFFICIENTS (K) FOR VALVES AND FITTINGS

(for formulas and friction data, see page 44)

("K" is based on use of schedule pipe as listed on page 42)

GATE VALVES

Wedge Disc, Double Disc, or Plug Type

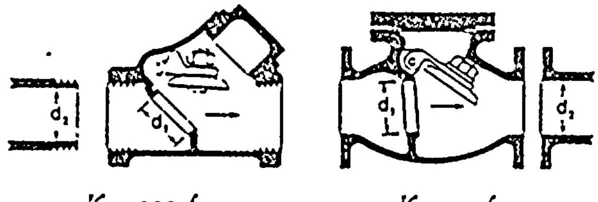


If: $\beta = 1, \theta = 0$ .... $K_1 = 8 f_T$

$\beta < 1$ and $\theta \leq 45°$ .... K_2 = Formula 5

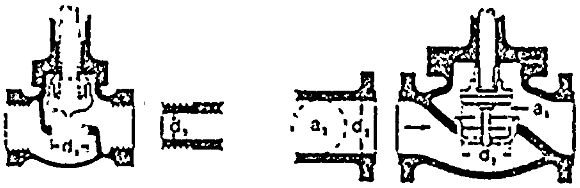
$\beta < 1$ and $45° < \theta \leq 180°$ ... K_2 = Formula 6

SWING CHECK VALVES

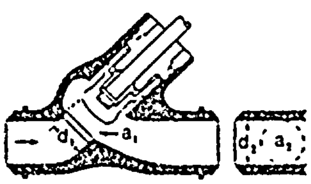


$K = 100 f_T$	$K = 50 f_T$
Minimum pipe velocity (fps) for full disc lift $= 35 \sqrt{\overline{V}}$	Minimum pipe velocity (fps) for full disc lift $= 48 \sqrt{\overline{V}}$

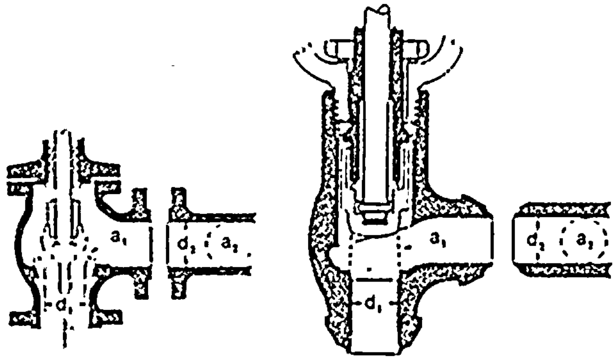
GLOBE AND ANGLE VALVES



If: $\beta = 1 \ldots K_1 = 340 f_T$



If: $\beta = 1 \ldots K_1 = 55 f_T$

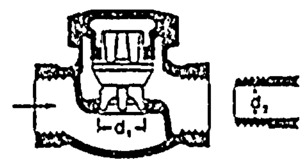


If: $\beta = 1 \ldots K_1 = 150 f_T$ If: $\beta = 1 \ldots K_1 = 55 f_T$

All globe and angle valves, whether reduced seat or throttled,

If: $\beta < 1 \ldots K_2$ = Formula 7

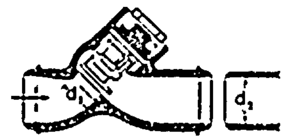
LIFT CHECK VALVES



If: $\beta = 1 \ldots K_1 = 600 f_T$

$\beta < 1 \ldots K_2$ = Formula 7

Minimum pipe velocity (fps) for full disc lift $= 40 \beta^2 \sqrt{\overline{V}}$

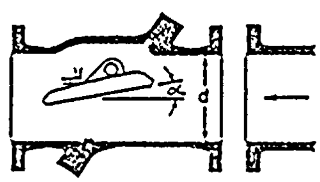


If: $\beta = 1 \ldots K_1 = 55 f_T$

$\beta < 1 \ldots K_2$ = Formula 7

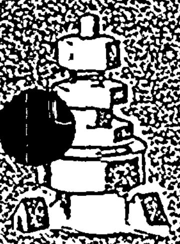
Minimum pipe velocity (fps) for full disc lift $= 140 \beta^2 \sqrt{\overline{V}}$

TILTING DISC CHECK VALVES



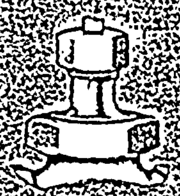
	$\alpha = 5°$	$\alpha = 15°$
Sizes 2 to 8" ... K =	$40 f_T$	$120 f_T$
Sizes 10 to 14" ... K =	$30 f_T$	$90 f_T$
Sizes 16 to 48" ... K =	$20 f_T$	$60 f_T$
Minimum pipe velocity (fps) for full disc lift =	$80 \sqrt{\overline{V}}$	$30 \sqrt{\overline{V}}$

the right valve fo



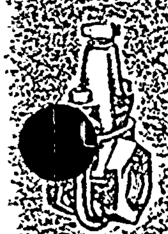
SCREWED-IN BONNET

For small valves where frequent dismantling is not required. Ordinarily used on gate, globe, and angle valves for moderate pressures.



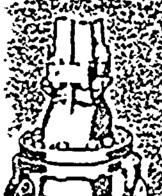
UNION BONNET

Easy to dismantle and reassemble without danger of injury to body-bonnet bearing surfaces. Union ring gives added strength and rigidity to body against internal pressure and distortion. Ideal for services requiring frequent inspection and cleaning of internal valve parts. Use restricted to smaller size valves.



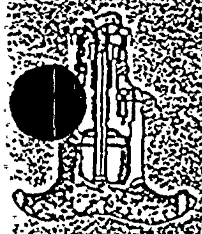
CLAMP-TYPE BONNET

Excellent where frequent inspection and cleaning of lines are necessary. Easy to take apart. Repeated opening does not affect bonnet joint tightness. Used only on certain moderate pressure gate valves.



BOLTED BONNET

Practical, commonly used design adaptable to different types of gasketing. Multiple bolting permits application of equalized sealing pressure. Has practically no limitation for size. Only the highest pressures and temperatures tax its capacity to permanently hold tight.



PRESSURE-SEAL BONNET

Most effective. Used for sealing highest pressures and temperatures especially in steam service. Tighness of seal does not depend on nuts, bolts, and threads as in conventional bonnet joints. Instead, utilizes line fluid pressure to seal the joint. The greater the pressure, the higher the sealing load.

In any fluid handling system, valves are the controlling element . . . starting or stopping flow, regulating or throttling flow, preventing backflow, or relieving and regulating pressure.

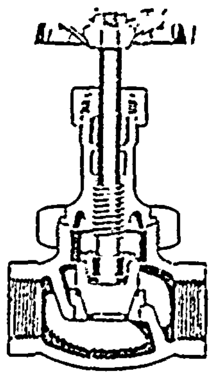
For twelve decades, Crane has provided solutions to flow problems. And for almost the same period, Crane valves have been universally accepted by industry for virtually every application.

For small or large lines, for service conditions ranging from vacuum pressures and cryogenic temperatures to elevated pressures and temperatures, or for tough corrosive applications, there's a Crane valve to do the job . . . dependably.

GATE

Commonly used where minimum pressure drop is important. Serve as efficient stop valves with flow in either direction. Offer practically no resistance to flow when fully open. Not recommended for throttling or flow modulation because they exhibit a flow characteristic curve not conducive to accurate and consistent flow control. Also, high velocity across seats of a slightly open valve may result in damage due to erosion. Therefore, normally used in fully-open or fully-closed position.

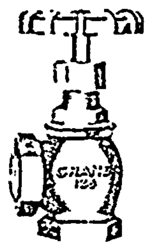
GLOBE



Ideal for throttling service because disc and seat designs provide flow characteristics in which proportionate relationships exist between valve lift and flow rate. Thus permitting accurate and repeatable flow control.

Caution must be exercised to avoid extremely close throttling. Valve or piping damage and vibration, or excessive noise, may be encountered if valves are throttled to provide a pressure drop in excess of about 20% of initial pressure. This is caused by velocities at the restricted sections approaching sonic velocity in the case of compressible fluids and by cavitation in the case of non-compressible fluids. When such conditions are anticipated, consult Crane customer services for recommendations.

ANGLE

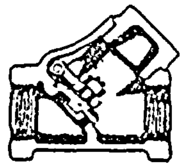


Effectively utilize the globe valve seating principle while providing for a 90° turn in piping. Angle valves require fewer joints . . . save make-up time and labor. Conditions regarding excessive throttling, as noted for globe valves, also apply to angle valves.

every application . . . CRANE

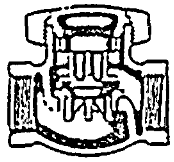
SWING CHECK

Prevent reversal of flow through pipe lines. Offer low resistance to flow and are particularly suited to low velocity service. Most Crane swing checks can be installed in horizontal or vertical upward flow piping.



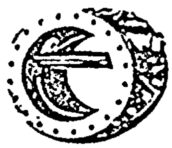
LIFT CHECK

Prevent reversal of flow. Disc is seated by backflow, or by gravity when there is no flow, and is free to rise or fall depending on pressure under it. For use in horizontal lines only.



TILTING DISC CHECK

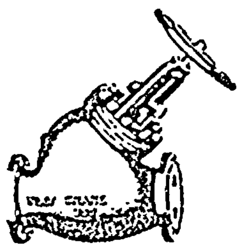
Similar in application to swing check valves. In most installations, slamming with resultant noise and vibration upon reversal of flow is minimized with this construction.

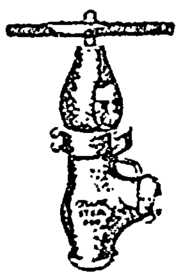


STOP-CHECK

Essentially the same as globe and angle valves, except there is no mechanical connection between stem and disc. Generally installed in steam outlet piping of a boiler when two or more boilers are connected to a common header. Must be installed with pressure under disc. When the stem is raised, only boiler pressure can lift the disc. Valve will not open until boiler pressure reaches header pressure.

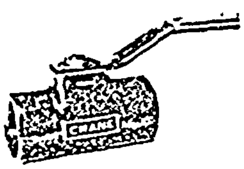
Stop-checks also prevent backflow of steam from header to boiler. Operation is automatic; handwheel or other operating means is provided to permit securing the disc in seated position during boiler shut-down.





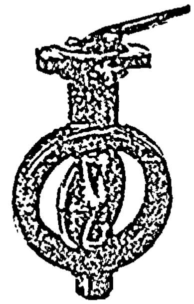
BALL

Feature quarter-turn, on-off operation, straight-through flow, minimum turbulence, low operating torque, tight closure, compact design and light weight. Crane offers three different designs . . . fixed ball, floating ball and double trunnion with top entry, end entry, or bottom entry . . . to "job-match" each application. Available with threaded, solder-joint, or flanged ends.



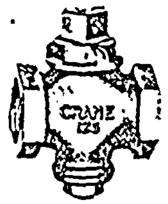
BUTTERFLY

Also, in the "quarter-turn family." Recommended for on-off service and, in some cases, for non-critical throttling applications. Valves have elastomer seats and seals. Are widely used in paper mills, cement mills, chemical and food processing plants, water filtration plants, petroleum product lines, etc. Wafer, lug wafer, and two-flange valves available.



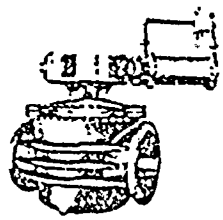
COCKS AND STOPS

Least complicated of the basic valve types. When opening a gate or globe valve, the disc is lifted out of the path of the fluid; in the cock, a plug is turned to provide an opening which coincides with the opening in the body. The alignment of these two openings (with the plug in wide open position) affords a through passage for the fluid. Straightway (two-way), three-way, and four-way patterns with threaded or flanged ends are available.



CONE

Plug-type valves that can be actuated by several types of controls to satisfy special requirements. Used as shutoffs in water systems or as pump discharge check valves. Specially fabricated in iron or carbon steel in sizes from 6 to 48-inch.



SLIDE

For special applications in petroleum refineries and CO boilers. Essentially, enormous throttling valves used to control flows of erosive catalysts, slurries, and flue gases. Special disc slide and ceramic liner make them ideal for control of erosive flows. Custom built, usually of carbon or alloy steel. Sizes up to 85-inch are operating successfully.

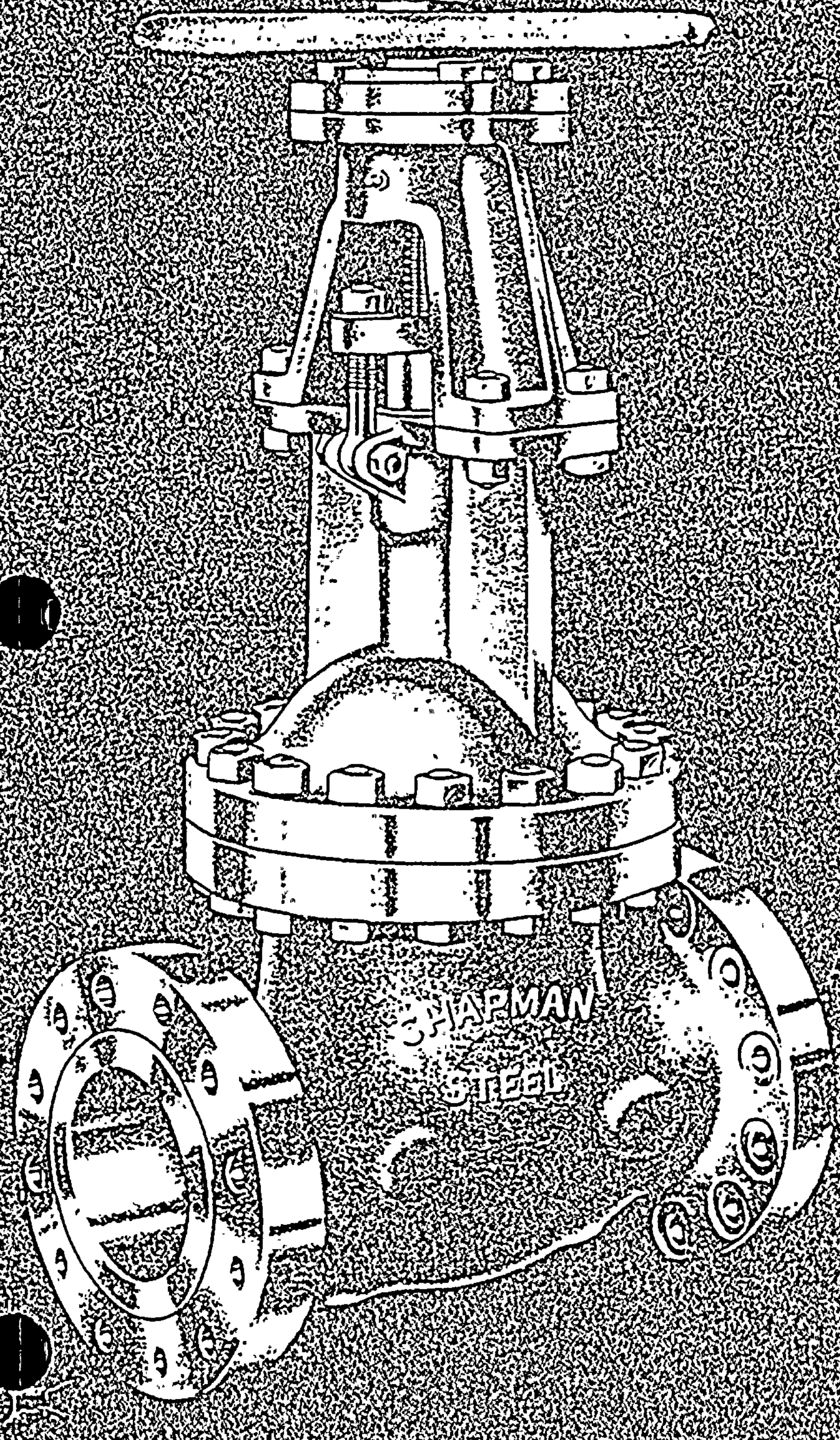
OTHER FLOW PRODUCTS

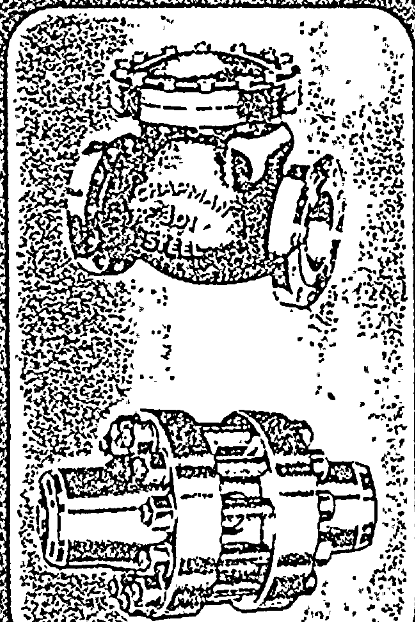
The Crane line also includes foot valves for use in suction lines on shallow well pumps and similar services, as well as a variety of specialties such as sediment separators, exhaust heads, and swing joints. Valve accessories available include cylinder, gear, and motor operators, chain wheels, floor stands, extension stems, etc.

○ corrosion-resistant ○ standard sizes up to 48-inch

CATALOG No. 120-C

CHAPMAN





CHAPMAN DIVISION • CRANE CO.
INDIAN ORCHARD, MASSACHUSETTS

[illegible]
ENGINEERED PRODUCTS SALES DIVISION — CRANE CO.
1720 MILITARY ROAD
BUFFALO, NEW YORK 14212
875-8295

STEEL VALVES—INDEX

The Chapman steel valves in this catalog are obtainable in the steels and their alloys tabulated on pages 2 and 3. *In addition to this complete line of materials and services, Chapman is prepared to design and produce valves of special construction to meet exceptional service conditions.*

inspection and test

Chapman valves are subjected to strict examination and test at each phase of manufacture. Complete and modern inspection equipment is in use and includes a one-million volt x-ray machine, means for radiographic, magnetic particle, and fluid penetrant testing, as well as the use of isotopes iridium 192 and cobalt 60.

The quality of Chapman steel pressure castings is assured by various non-destructive tests as required by service applications or customer requirements. MSS Standards SP-53 and SP-54 are the basis for examination by pressure classes and requirement for acceptance.

The 900-pound and higher pressure classes of castings are inspected by the magnetic particle method and by radiography. In addition, the lower pressure class castings are monitored by these inspection methods and, for some alloy grades, the examination is regularly extended to lower pressure classes.

CHAPMAN cast steel gate valves

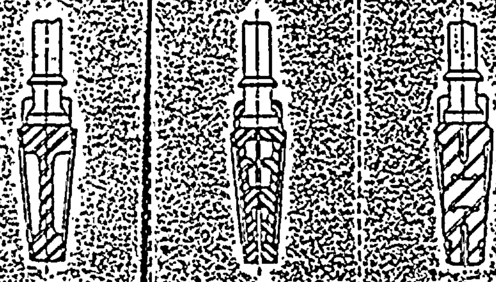
specifications and design

pressure-temperature ratings

All steel valves illustrated in this catalog represent the most modern developments in design, wall thicknesses, flanges, body and bonnet connections, bolting and other features, in strict accordance with the standards of the American Standards Association and the American Petroleum Institute. Thickness of castings is determined with ample factors of safety and corrosion allowance to assure suitability of the valves as pressure vessels for service conditions indicated in the pressure-temperature charts published herein.

The pressure (A.S.A. or A.P.I.) rating printed at the start of each pressure group of valves is the standard rating that can be applied to a carbon steel valve. By the substitution of better heat resistance steels, the allowable rating is considerably increased.

wedge designs

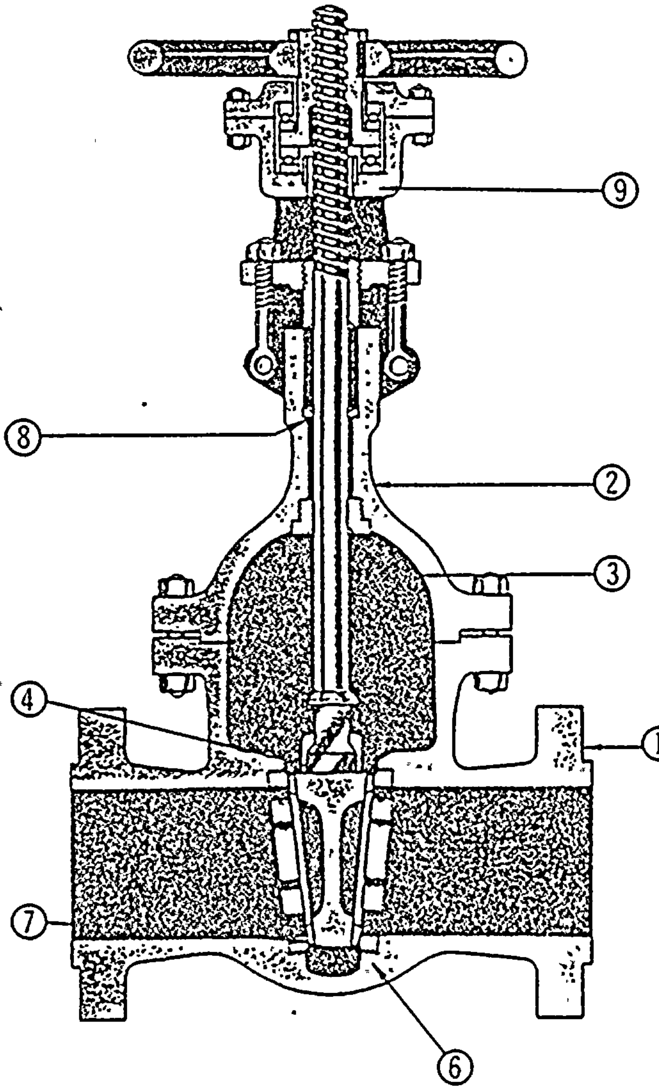


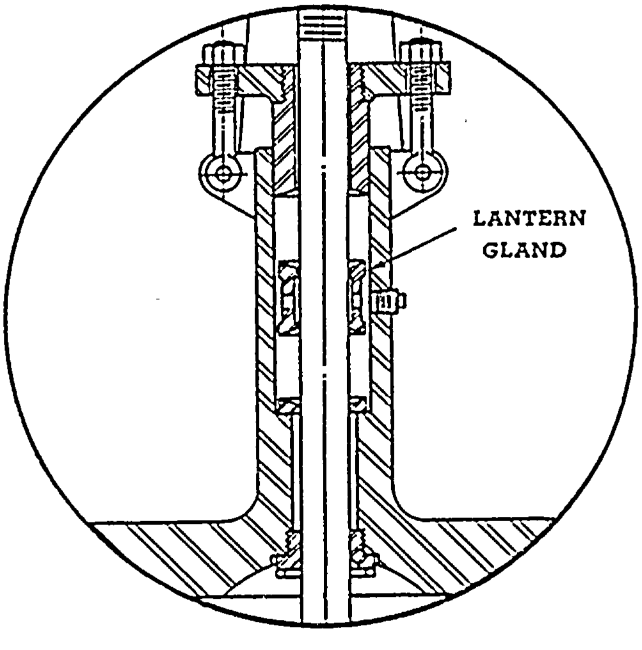
solid — split — flexible

Three types of wedges are available for gate valves in all pressure ratings.

1. The solid wedge design, which is supplied unless otherwise specified, is basically the simplest and has many advantages, including minimum vibration, better fatigue resistance, low stress levels, and inability to trap fluids which tend to build up pressure in the bonnet.
2. The split wedge is recommended for tightness and ease of operation at fluctuating pressures as it will offer less resistance to unwedging in case of body distortion due to temperature changes.
3. The flexible wedge has many of the advantages of both the split and solid wedge types, yet maintains a single assembly.

when ordering steel valves: *(especially for service over 600° F)* it is imperative that specifications give both pressure and temperature of the service intended.





LANTERN GLAND STUFFING BOX
available on special order

1 valve body

Valve bodies for all pressures, except 150 pound, are made utilizing spherical and cylindrical shapes as far as possible, thus approaching contours with all parts in tension under pressure. The port through the body of the gate valves is kept straight, keeping frictional losses at a minimum and preventing damage through erosion due to turbulence. Guides are of ample section and are carefully machined to close clearance on three sides. Valves with flanged body and bonnet connections have alloy steel bolting for maximum relaxation resistance at temperature.

2 valve bonnet

Valve bonnets are attached to the bodies with various types of joint facings, or by welded or pressure sealed joints.

Bonnets, with the exception of the 150 pound pressure group, are of spherical design, and are provided with a condensation chamber below the stuffing box, which is of ample depth and appropriately packed for the service intended. For special service the stuffing box can be furnished with lantern gland. A packing collar of stainless steel or other alloy provides contact with the shoulder on the valve stem, to permit repacking under full pressure with the valve open.

3 valve stem

Valve stems are forged, heat treated, machined and cylindrically ground to a close tolerance, and highly polished to reduce wear on packing. Threads are milled for maximum accuracy.

4 stem connection

All standard steel valves have T-head stem connections which are designed to develop the full strength of the stem and permit accurate, positive seating.

5 by-passes

Complete information on types of standard by-passes, together with chart showing recommended size of by-pass for various pressures and temperatures will be found on pages 22 and 23. These pages also include data relating to size and location of drains and tapped holes.

6 seat rings

Seat rings are of the square bottom seating type with a width of bearing against the disc or wedge gate sufficient to maintain a pressure-tight joint within the allowable loading for the materials used. Unless otherwise specified, valves for high pressures are built with seat rings screwed into the bodies, then seal-welded to remove all possibility of loosening or leakage.

7 seat surfaces

Various alloys or combinations of alloys are recommended as seating surfaces for specific operating conditions. The following tabulation may be used as a guide in specifying materials that will provide maximum service under such conditions. Where unusual service requirements exist, Chapman engineers and metallurgists will gladly make further suggestions and recommendations.

Standard Alloy Combinations for Valve Seating Surfaces — Steel Valves

ALLOY COMBINATION	MAXIMUM RECOMMENDED SERVICE TEMPERATURE	APPLICATION	NOTE
A.I.S.I. T410, Semi-hardened versus Malcomized* A.I.S.I. T410	1025 F.	Steam, oil general.	Excellent wear resistance and high hot hardness.
**CV-21 versus same	1200 F.	1. Boiler feed water, steam, chemical, seats on austenitic stainless steel valves. 2. Certain oil refinery service.	Excellent wear, corrosion and erosion resistance for temperatures to 1200 F.
**CV-21 versus T-304	600 F.	Boiler feed water.	Check valves only.
Haynes Stellite No. 6 versus same	1200 F.	Steam	Excellent wear and corrosion resistance. High hot hardness.
CV-180-CN versus Semi-hardened A.I.S.I. T410	450 F.	L.P.G., gasoline	Excellent wear, corrosion and erosion resistance for temperatures to 450 F.

8 packing

Valves are provided with standard packing of high purity, wire-inserted asbestos, suitably lubricated for high pressure and temperature service, and containing a corrosion inhibitor.

9 ball or roller bearings

The motor units which are supplied for electrical operation of valves are equipped with ball or roller bearings, so that the thrust of operation is taken by anti-friction bearings. For hand operation, gate valves have ball or roller bearings as standard equipment in accordance with the following:

150 pound — No ball bearings
300 pound — No ball bearings
400 pound — 8" size and larger
600 pound — 6" size and larger
900 pound — 4" size and larger
1500 pound — 4" size and larger
2500 pound — 4" size and larger

*Chapman exclusive process for surface hardening stainless steels to 1000 Brinell.

**CV-21—A patented Chapman cobalt base alloy containing chromium, molybdenum and small amounts of other elements. It is capable of being applied as a hard facing without the usual "craze" cracking or checking and shows excellent wear, corrosion and especially erosion resistance; suitable for temperatures to 1200°F.

flanged (with gasket)

For many years, all steel valves were designed and built with flanged body and bonnet connections. These connections were gasketed and bolted tightly to prevent leakage. This design proved entirely satisfactory while temperatures remained below 700° and in fact, it is still quite generally used in the lower pressure-temperature range. Improvements in bolting materials have made practical the use of the flanged design for temperatures of approximately 925°F.

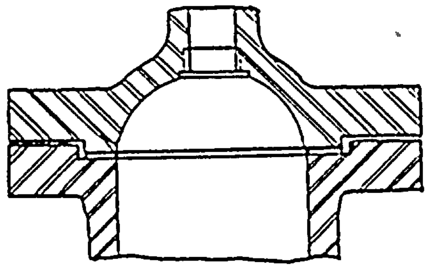
As pressures and temperatures increased, some difficulty was encountered with bolting material, which had a tendency to stretch and allow leakage at the bonnet flange. In an attempt to solve this problem, various designs were developed, such as the Sargol joint which uses a bead of welding for sealing; the ring joint with a special gasket configuration; the Houston joint with calculable gasket area; and the spiral-wound metal, asbestos filled joint with inherent resiliency. All of these have been, in a measure, successfully used.

welded design

In 1936, Chapman introduced the first all-welded body and bonnet joint. Valves assembled by this method are still giving trouble-free service.

The welded body and bonnet joint has the decided advantage of not relying on bolting or other materials which can relax and cause leakage. It is also light in weight and reduces hanger loads. There are no gaskets used — simply a completely tight weld of the body and bonnet. To our knowledge, we have never had leakage in a welded body-bonnet valve.

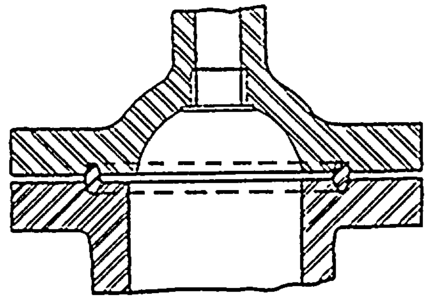
With the improved materials that provide extremely hard facing of valve seats and with the seats welded into the body, there is hardly ever the necessity for opening the bonnet joint of gate valves. When major repairs are required, the valve is simply cut from the line and returned to the factory where a special parting tool opens the bonnet joint.



FLANGED CONNECTION WITH GASKET

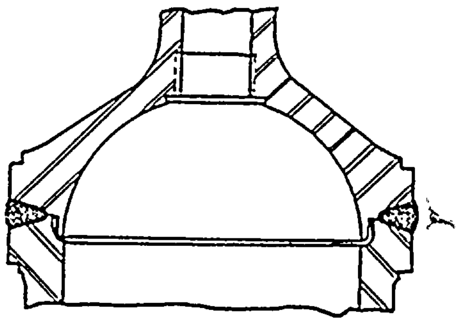
This cross section shows connecting body and bonnet flanges, with gasket inserted. Flanges are bolted tightly together to prevent leakage.

900



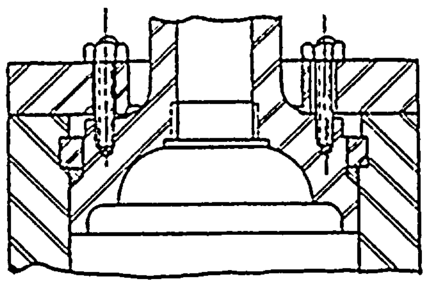
RING JOINT

Flanged connection showing the ring joint with special gasket configuration. See pages 40 and 41 for dimensions and details of this type joint.



WELDED JOINT

No bolts or gaskets are used with this type of connection. Body and bonnet are welded tightly together, making a leak-proof joint.



PRESSURE SEAL

Body and bonnet joint is self-energizing and is assembled with a special seal ring. Provision is made for initial pre-load and take-up on the joint by the use of adjustable alloy bolts.

pressure seal

In the never-ending search for better design, valve manufacturers turned to a type of joint which had found success on feed water heaters in Europe, on gun recoil mechanisms, and similar uses. This design was modified and applied to body-bonnet joint connections under the description "pressure seal".

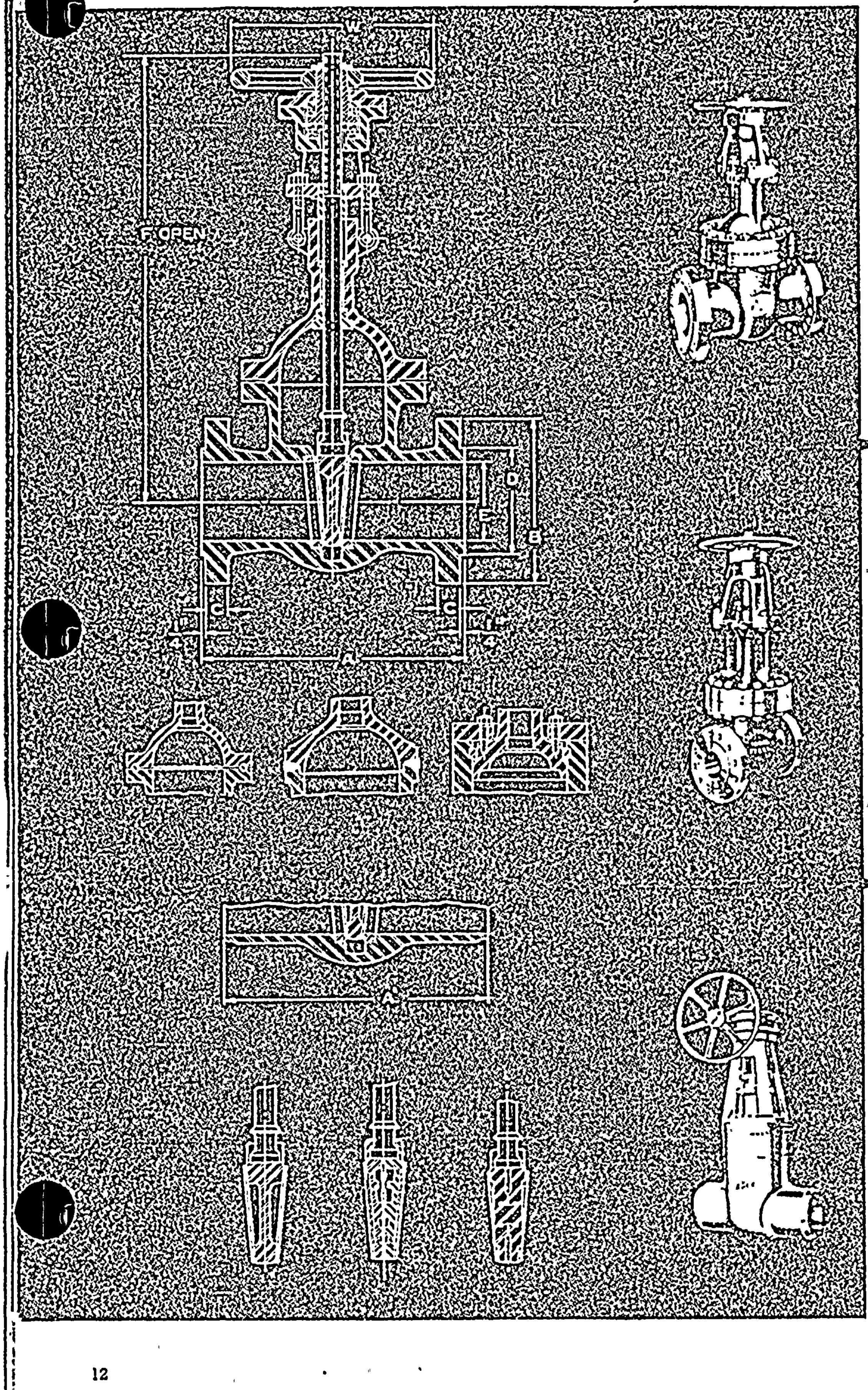
The pressure seal joint consists of a body and bonnet with a triangular-shaped seal ring which "makes up" against the body and bonnet. In Chapman construction we weld in stainless seats where the pressure seal ring seats against both the body and the bonnet. The material utilized in this seat is a material which has found wide acceptance for the main valve seat. Due to the nature of the joint, it is self-energizing; however, because the valve must be tight not only at its designed working pressure but at reduced pressure, a means must be provided to preload the pressure seal ring in order to maintain tightness when operating at reduced pressure.

The pressure seal joint has the advantage of being light in weight, and easy to take apart for cleaning the inside of the valve. It does, however, have the same problem as the bolted joint, in that it is subject to relaxation. This is minimized by the ease with which it may be "taken up".

There is also some problem due to the seal energizing joint and the fact that high pressure valves are tested to 3½ times the rating working pressure, which tends to distort the sealing edge of the pressure seal ring. Moreover, before installation, valves are re-tested at the site at the pipe code rate, 1½ times working pressure, which again tends to overstress the pressure seal joints. This necessitates taking up on the joint, which is usually done by measuring the torque applied to the bolts to bring them back to the original factory seating. Once the valve is in service at line temperature, it should again be checked to be sure the joint has not relaxed. From this point, an annual check is usually sufficient.

Welded or pressure seal type valves are always supplied with welding ends.

CHAPMAN cast steel gate valves



ASA and API ratings* | 900 lb. at 850°F

LIST 900

Sizes 4″ and above supplied wi
ball bearing yokes.

ASA and API ratings* | 1500 lb. a 850°F

LIST 1500

Sizes 4″ and above supplied w
ball bearing yokes.

ASA and API ratings* | 2500 lb. a 850°F

LIST 2500

Sizes 4″ and above supplied wi
ball bearing yokes.

*Ratings are for carbon steel valves.
For other ratings see pages 30-33.

900

nom. size	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
A & A'						15	18	22	24	29	33	38	40½	44½	48		
** A'						12	14	17	20	26	31	36	39	43	48		
B	list 1500 valves are supplied below 3" size					9½	11½	13¾	15	18½	21½	24	25¼	27¾	31		
°C						1½	1¾	2	2 3/16	2½	2¾	3⅛	3⅜	3½	4		
D						5	6 3/16	7 5/16	8½	10⅝	12¾	15	16¼	18½	21		
E						2⅞	3⅞	4¾	5¾	7½	9⅜	11⅛	12¼	14	15¾		
F						32½	39 1/16	42 13/16	48 5/16	55⅜	66	74⅛	80 5/16	89	97 13/16		
G						7½	9¼	11	12½	15½	18½	21	22	24¼	27		
H						8	8	8	12	12	16	20	20	20	20		
I						1	1¼	1⅜	1¼	1½	1½	1½	1⅝	1¾	2		
W						16	18	18	20	24	30	30	36	36	36		

15

nom. size	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
A & A'	10*	11*	12*	14½*	16½*	18½*	21½	26½	27¾	32¾	39	44½	49½	54½			
** A'	5½	6½	7	8½	10	12	16	19	22	28	34	39	42				
B	5⅞	6¼	7	8½	9⅝	10½	12¼	14¾	15½	19	23	26½	29½	32½			
°C	1⅛	1⅛	1¼	1½	1⅝	1⅞	2⅛	2⅞	3¼	3⅝	4¼	4⅞	5¼	5¾			
D	2	2½	2⅞	3⅝	4⅛	5	6 3/16	7 5/16	8½	10⅝	12¾	15	16¼	18½			
E	⅞	1⅛	1⅜	1⅞	2¼	2¾	3⅝	4⅜	5⅜	7	8¾	10⅜	11⅜	13			
F	19 7/16	21 5/32	21 7/32	25 5/16	27 7/16	32 15/32	44 5/16	50⅞	52⅞	66⅞	71¾	80¾	83⅝				
G	4	4¾	4⅞	6½	7½	8	9½	11½	12½	15½	19	22½	25	27¾			
H	4	4	4	8	8	8	8	8	12	12	12	16	16	16			
I	1	1	1⅛	1	1⅛	1¼	1⅜	1⅝	1½	1¾	2	2⅛	2⅜	2⅝			
W	8	10	10	12	14	16	18	20	24	30	36	36	36				

2500

nom. size	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
A'				11	13	14½	18		24	30	36	41	44				
E				1.503	1.771	2.3	2⅞		4⅜	5⅜	7	8¾	10⅜				
F				24 11/16	27 21/32	32 13/32	35 29/32		50 13/16	52 31/32	66 23/32	71⅝	81⅞				
W				12	14	16	16		20	24	30	36	36				

*Sleeve Type
•Does not include ¼" raised face
**Applies to pressure seal and welded bonnet welded end valves

Chapman valves can be furnished with electric motor operators and accessories specified. Where the motor unit manufacturer is not specified, we recommend the Teledyne electric motor operator.

ELECTRICAL CONTROL

The operation of valves and floorstands by electrical control assures the following advantages:

1. Elimination of need for personnel to operate valves at point of installation.
2. Positive control of valves which must be installed in locations remote or difficult of access.
3. Speed of operation is many times as fast as handwheel control.
4. Permits process control of variables, such as flow rate or liquid level.
5. Makes possible accurate sequence or cyclic operation of valve equipment.

construction

Motor units supplied by Chapman are weatherproof, dust and steam tight; units can where necessary be made fully explosion proof. Various sizes and styles are available for different applications, and systems can be varied to fit special requirements.

Motorized controls may be applied to valves of almost any size, for operation in practically any position or location. All units, whether installed directly on a valve, or on a floorstand, can be manually operated in case of power failure. Handwheel cannot rotate during power operation.

motors

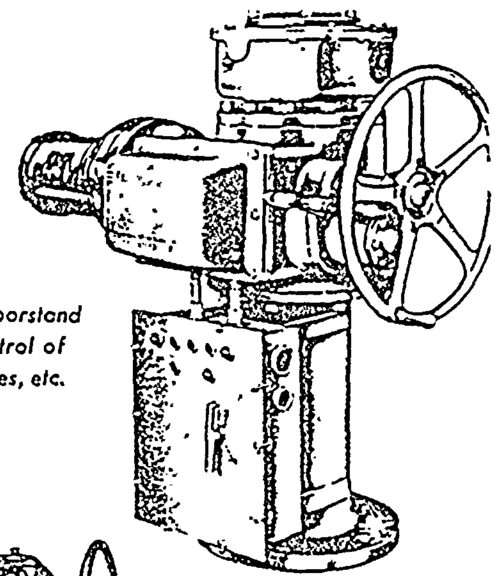
High torque motors are used with windings impregnated to resist both oil and moisture. They are available for either alternating or direct current, and are of size suitable for specified conditions of operation.

limit switches

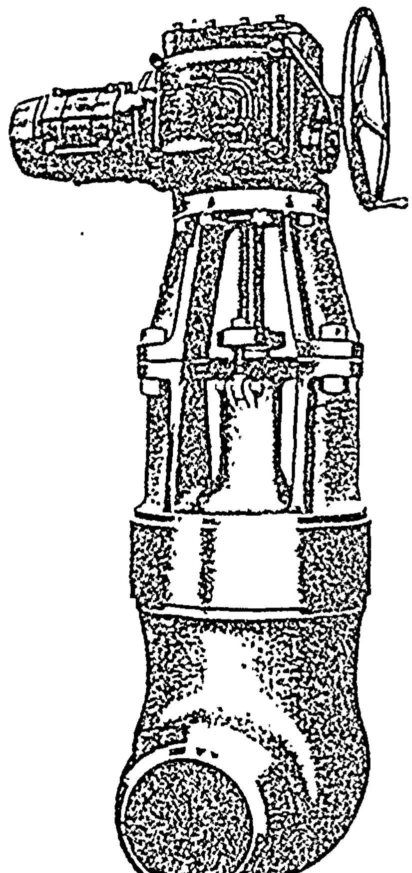
These switches, mounted on the unit in a protecting case, govern valve disc or gate travel in the opening and the closing directions. Valve closing can be controlled to a pre-determined tightness without jamming or scraping of seats. Should an obstruction be met while closing the valve, the limit switch becomes operative and disconnects the source of power, thus avoiding damage to valve seats.

controls

Push button stations may be located for remote control, or near the installation. They are easily mounted at any convenient position. "Open," "stop" and "close" buttons are clearly marked and also lighted, indicating the position of the gate at all times.



Motor-operated Floorstand for electrical control of valves, sluice gates, etc.



High Pressure Steel Valve with Motor Control

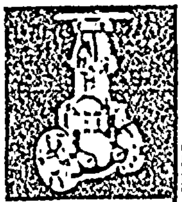
material

temp °F	types 347, 321 150	300	400	600	900	1500	2500	type 316 150	300	400	600	900	1500	2500
100	275	720	960	1440	2160	3600	6000							
150	255	710	945	1420	2130	3550	5915							
200	240	700	930	1400	2100	3500	5830							
250	225	690	920	1380	2070	3450	5750							
300	210	680	910	1365	2050	3415	5690							
350	195	675	900	1350	2025	3375	5625							
400	180	665	890	1330	2000	3330	5550							
450	165	650	870	1305	1955	3255	5430			same as types 347, 321				
500	150	625	835	1250	1875	3125	5210							
550	140	590	790	1180	1775	2955	4925							
600	130	555	740	1110	1660	2770	4620							
650	120	515	690	1030	1550	2580	4300							
700	110	495	660	985	1480	2465	4110							
750	100	470	625	940	1410	2355	3920							
800	92	450	595	895	1345	2240	3730							
850	82	425	565	850	1275	2125	3540							
875	75	415	550	825	1240	2070	3445							
900	70	400	535	805	1205	2010	3350							
925	60	390	520	780	1175	1955	3260							
950	55	380	505	760	1140	1900	3165							
975	50	370	490	735	1105	1840	3070							
1000	40	355	475	715	1070	1785	2975							
1025		345	460	690	1035	1725	2880							
1050		335	445	670	1000	1670	2785							
1075		325	430	645	970	1615	2690							
1100		310	415	625	935	1555	2595							
1125		300	400	600	900	1500	2500							
1150		260	345	520	780	1305	2170		290	390	585	875	1455	2430
1175		215	290	430	650	1080	1800		260	350	525	785	1310	2185
1200		170	230	345	515	855	1430		235	310	465	700	1165	1945
1225		140	190	285	425	710	1185		205	275	415	620	1035	1730
1250		115	150	225	340	565	945		180	240	365	545	910	1515
1275		95	125	190	285	470	785		160	215	320	480	795	1330
1300		75	100	150	225	375	630		135	185	275	410	685	1145
1325		65	85	125	190	315	530		115	155	230	345	575	955
1350		50	70	105	155	255	430		95	125	185	280	465	770
1375		45	60	95	140	230	385		80	105	160	240	405	670
1400		40	55	80	125	205	345		70	90	135	205	345	570
1425		35	50	70	110	180	300		60	80	120	180	300	500
1450		30	40	60	95	155	255		50	70	105	155	255	430
1475		30	40	55	85	140	235		45	55	85	130	215	355
1500		25	35	50	75	130	215		35	45	70	105	170	285

hydrostatic shell test pressure

	150	300	400	600	900	1500	2500	150	300	400	600	900	1500	2500
	425	1100	1450	2175	3250	5400	9000	425	1100	1450	2175	3250	5400	9000

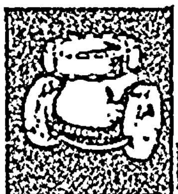
of standard steel valves
(accurate within ± 10%)



cast steel gate valves pages 4 to 13

rising stem type

	SIZE	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	30	36
LIST 150	Flg. End	26	31	35	50	70	87	120	120	179	220	371	515	756	1070	1385	1732	2125	3120		
	Welded End				42	60	70	90	100	150	192	304	455	635	905	1190	1510	1855	2500		
LIST 155	Flg. End															1370	1564	1780	2610	4250	6300
	Welded End															1175	1342	1510	1988	4245	5275
LIST 158	Flg. End				55	75	88	118	125	175	220	367	528	780	1095	1410	1600	1790	3115	4540	5830
LIST 300	Flg. End	35	60	65	89	122	157	192	215	315	436	600	905	1255	1710	2440	3000	3890	5955		
	Welded End	20	40	55	65	98	125	155	173	266	360	505	750	1015	1525	2015	2505	3370	4675		
LIST 400	Flg. End								248	370	534	850	1200	1685	2020	2660	4080	5900	7657		
	Welded End								193	308	433	728	1035	1420	1920	2300	3765	5700	6997		
LIST 600	Flg. End	35	70	85	98	130	185	217	335	515	768	1135	1790	2570	3455	3370	6020	7015	9360		
	Welded End	25	60	70	80	106	155	180	255	455	619	962	1575	2155	2960	3675	4460	5755	8020		
	W.E. Press. Seal					'90	113	138	213	351	582	925	1450	1975	2620	3230					
LIST 900	Flg. End						332	447	562	768	975	1470	2470	3575	4925	5850	8425				
	Welded End						262	357	453	616	835	1180	2140	2770	4170	4950	6675				
	W.E. Welded Bonnet						235	325	365	540	743	1085	2040	2600	3550	4375	5550				
	W.E. Press. Seal						208	294	381	519	750	1185	1860	2560	3475						
LIST 1500	Flg. End	94	120	147	235	320	460	580	785	1500	1755	3220	4910	7150	8575	9505					
	Welded End	80	97	123	192	275	412	510	735	1340	1595	2740	3690	4650	6425	7875					
	W.E. Welded Bonnet				110	163	227	392	557	885	1000	2225	3185	4640	5950	6625					
	W.E. Press. Seal				150	215	235	377	520	867	610	980	1975	3150	3250	5350					
LIST 2500	W.E. Welded Bonnet				155	210	276	315	355	800	850	1887	3060	3560	3990						
	W.E. Press. Seal				138	185	290	350	390	780	1035	2017	3000	3425	3860						



cast steel check valves pages 14 to 19

swing check type

	SIZE	1½	2	2½	3	4	5	6	8	10	12	14	16
LIST 151A	Flg. End	36	51	55	80	115	140	175	300	474	695	1200	
	Welded End	30	35	42	58	80	109	150	235	370	560	1010	
LIST 301A	Flg. End	42	50	70	98	152	215	270	422	636	955	1340	1650
	Welded End	32	40	50	70	107	166	200	312	487	720	1155	1225
LIST 401A	Flg. End					210	247	435	595	780			
	Welded End					160	185	358	476	607			
LIST 601A	Flg. End	54	75	130	154	259	409	567	900	1245	1828		
	Welded End	39	57	105	117	193	349	443	727	1030	1410		
LIST 901A	Flg. End				220	430	713	997	1430	1680			
	Welded End				150	321	561	800	1140	1350			
LIST 1501A	Flg. End		336	367	488	830	1310	1790	2555				
	Welded End		300	322	440	780	1150	1630	2075				

SFP QC

00425 2120

CRANE

CHAPMAN DIVISION, CRANE CO. • 203 HAMPSHIRE STREET, INDIAN ORCHARD, MASS. 01051

413-543-5551 • TWX 413-781-0541 • TELEX 95-0456

August 20, 1968

NIAGARA MOHAWK POWER CORP.
MAR 1 1969
APP. S.F. Padkowski
AS TO AGREEMENT WITH PURCHASE ORDER SPECIFICATIONS

Niagara Mohawk Power Corp.,
535 Washington St.,
Buffalo, New York

Gentlemen:- Attention Mr. S. F. Padkowski

Subject: Order N1-239
Chapman CV-07001-7
Item 01
Valves 38-01 & 38-13 SHUTDOWN COOLING
2 - 14" 900 PSIG

CERTIFICATE OF TEST

This will certify that the valves furnished on this order successfully withstood a shell test 3250 PSIG seat test of 2200 PSIG. Also an air test of 10-15-30-40 and 60 PSIG without any leakage.

Valves also passed X-ray and dye penetrant test in foundry.

All valves hydro and air test witnessed by H. Crabtree of Stone & Webster.

John C. Moore
J. C. Moore
Quality Assurance Supervisor

/J

b) per item 2.6, all valves shall be examined by chloride free liquid penetrant in accordance with applicable procedures specified in ASTM E-165.

c) per item 2.10, all valves shall function smoothly without sticking, rubbing, vibrating, or scouring during steady state as well as when opening and closing.

d) per item 2.13, leakage across the seat when the valve is fully closed and under pressure hydrostatic test of 1875 psig shall not exceed a rate of 2 cc per hour per inch of valve seat diameter.

e) per item 2.14, valve stem leakage of contained vapors or fluids shall be zero as determined by visual examination.

f) per item 2.15, the joint between body and bonnet shall be leakage free when under hydrostatic test of 1875 psig.

g) per item 4.9, pressure drop at full fluid flow.

h) per item 4.10, leakage guarantee at full differential pressure and temperature.

i) per Change No. 1 of Purchase Requisition No. EH-79A-873, dated April 10, 1967, the following applies to valve B.P. Nos. 38-01, 38-02, and 38-13 only:

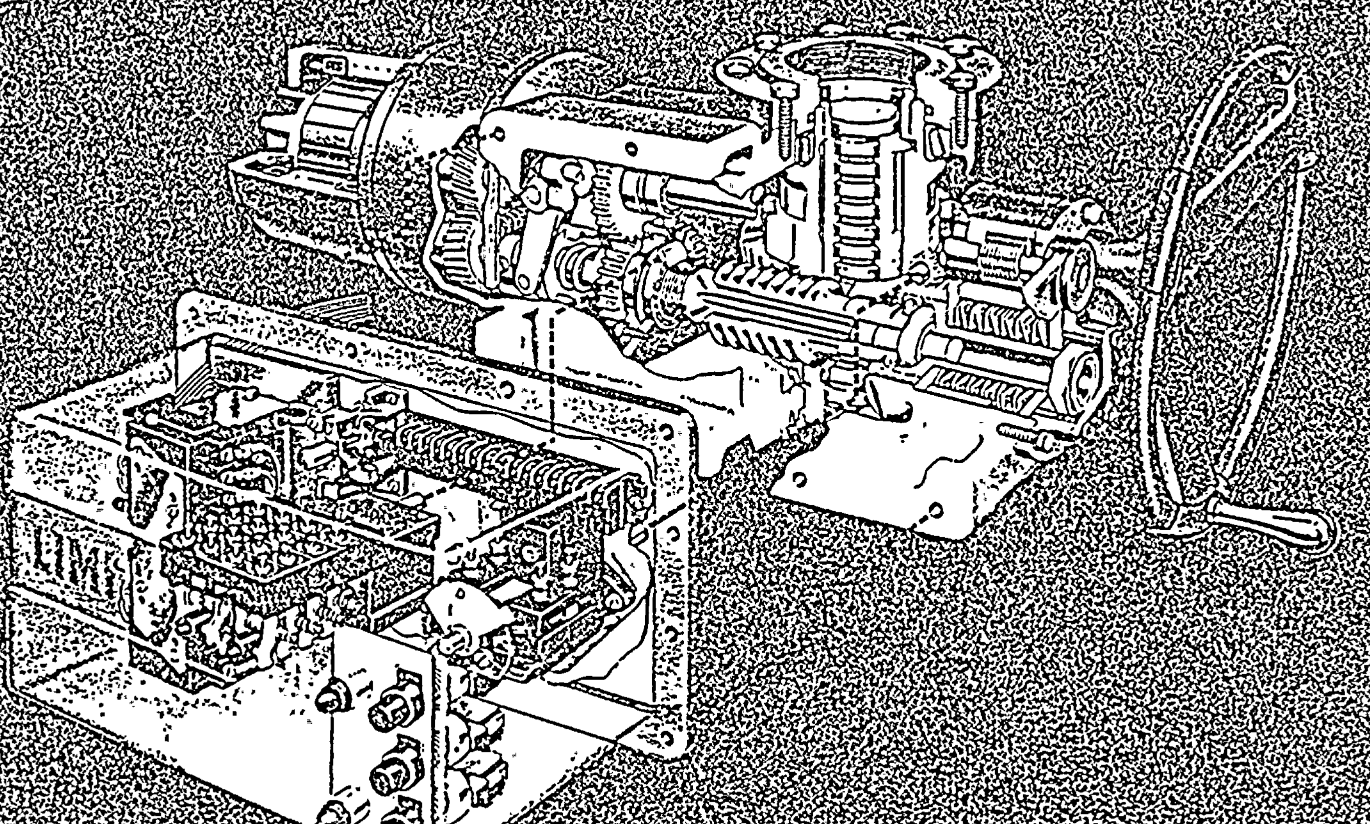
A seat leakage test is to be performed on the valves with air or nitrogen gas. The leakage is not to exceed 300 cc/hr/in of valve seat diameter. The test is to be made at three (3) pressure points - 15 psig, 25 psig, and 35 psig with leakage reported at each of these pressure levels. The test is to be made with the valve completely dry and without shock loading. All tests are to start from 0 psig.

2. Seismic Design

Verify with calculations, or whatever approach was used, that each motor operated gate valve of item 1 (E.P. Nos. 38-01 and 38-13) can withstand seismic forces of 0.30g horizontal and 0.111g vertical and that each motor operated gate valve of items 2 and 3 (E.P. Nos. 38-02, 38-03, 38-04 and 38-05) can withstand seismic forces of 0.20g horizontal and 0.10g vertical.

LIMITORQUE®
TYPE SMB
INSTRUCTION AND MAINTENANCE MANUAL

Bulletin SMB 82D



A PRODUCT OF LIMITORQUE® CORPORATION

TYPICAL OPERATION
SMB UNITS

Description of Motor Operation:

The motors used on the Limitorque valve controls are high starting torque, totally enclosed motors. They are furnished in weatherproof, explosion proof or submersible enclosures. All motors are furnished with ball bearings and provided with grease seals. No lubrication of these motors is necessary since they are lubricated at the factory for lifetime operation. All 3 phase AC motors are of the squirrel cage design and DC motors are compound wound.

Since the operation of the Limitorque valve control is basically the same for all SMB operators the following general description of the motor operation is applicable. Any of the parts drawings may be referred to in following this description. Although the various part numbers will differ for each size operator, for the purpose of explanation we will refer to the parts list drawing.*

The electric motor has a helical pinion mounted on its shaft extension. This pinion, pc. #40, drives the worm shaft clutch gear, pc. #41, which is engaged with pc. #50, the worm shaft clutch.This piece is splined to the worm shaft, pc. #43. Piece #53, the worm, is splined to the worm shaft, pc. #43. Piece #53, the worm, is splined to the worm shaft and when it is rotated it turns pc. #16, the worm gear. The worm gear has two lugs cast onto the top portion which engages the two lugs on the drive sleeve, pc. #11. These lugs are spaced so that when the worm gear begins to turn during motor operation there is a certain amount of lost motion before the lugs engage and cause the hammer blow effect within the operator.

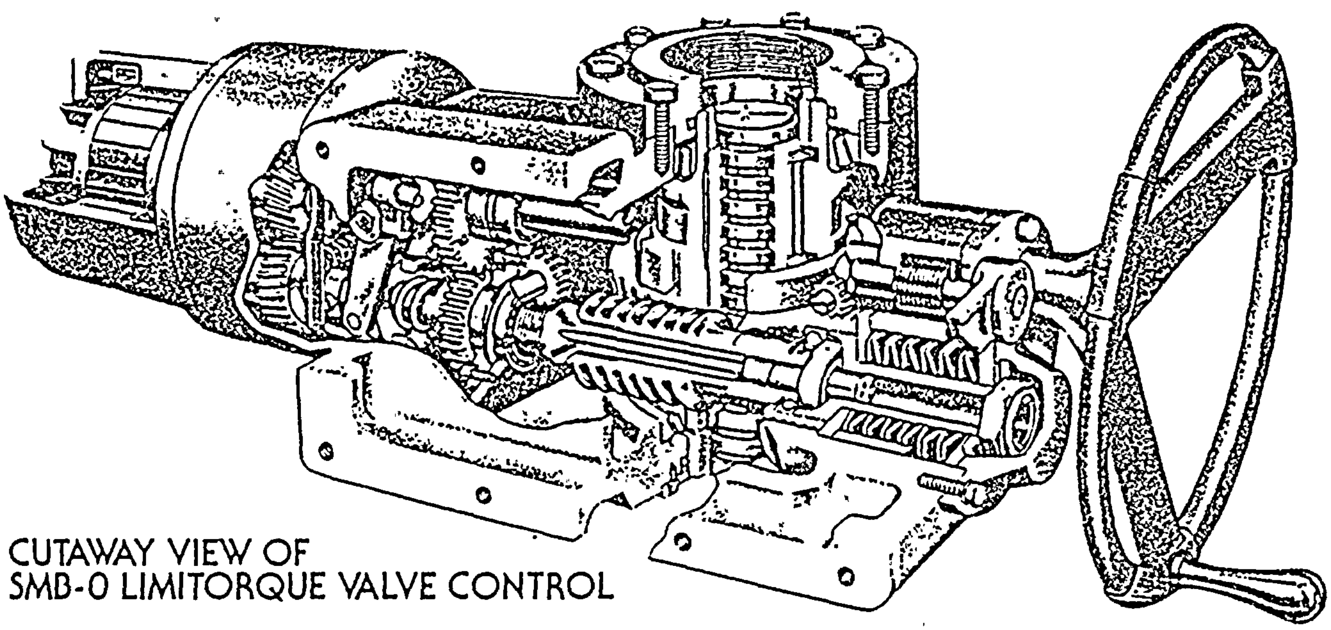
As soon as the worm gear lugs engage, the drive sleeve being splined internally with pc. #20, the stem nut, causes the stem nut to rotate and open or close the threaded stem of the valve. The stem nut is threaded to fit the thread of any rising stem valve. In the case of non-rising stem valves or where the electric operator is mounted in tandem with an additional gear drive, the stem nut, pc. #20, is merely bored and keyed to fit the shaft.

The thrust developed by a Limitorque valve control is absorbed by the heavy duty thrust bearings on the top and bottom of the main drive sleeve. As the Limitorque valve control develops greater torque, when seating the valve, the worm slides axially along the splines of the worm shaft and compresses the belleville springs, pc. #56, which is the torque spring. These are calibrated springs and for every increment of compression for a given size unit a certain predetermined amount of torque is developed. The torque switch is mechanically actuated by the worm. When the worm moves back a preset distance and develops the determined amount of torque output required, the torque switch opens and a pair of electrical contacts, which are wired into the motor control circuit, interrupts the circuit and stops the motor at this point.

The geared limit switch, pc. #105, is directly geared to the worm shaft and is in step at all times with the movement of the Limitorque valve control. It cannot slip since there are no belts or other friction devices used in its operation. Once the geared limit switch is set to trip at its proper position of valve travel it will trip at the same point every time. See instructions on how to set the geared limit switch.

Generally, the torque switch is wired into the motor control circuit to stop the operator in a full closed position of any rising stem type of operation and the geared limit switch is wired into the motor control circuit to stop the operator at the full open position. In the case of most 90° turn valves and sluice gates the geared limit switch is wired into the motor control circuit to stop the operation at both the full open and full close position of the valve. The torque switch is wired in series with the geared limit switch in both directions so that in the event a mechanical overload occurs the torque switch will open and cause the motor to stop. Check the wiring diagram of the actual installation to determine the correct wiring connections to be made for the torque switch and geared limit switch.

*Shown on page 22 (SMB-0 through SMB-4)



CUTAWAY VIEW OF
SMB-0 LIMITORQUE VALVE CONTROL

Description of Hand Operation:

In the event of power failure, a handwheel is provided for emergency hand operation of the Limitorque valve control. The SMB type of operator has an automatic handwheel declutching arrangement. In order to hand operate the type SMB operator the declutch lever is pulled downward. This mechanically disconnects the electric motor from the handwheel through the clutch assembly. In the case of the SMB-000 and SMB-00 (refer to page 18), the clutch ring, pc. #28, and clutch keys, pc. #14, are moved upward until the clutch keys engage with the lugs on the bottom of the handwheel. Where the handwheel is side mounted on the SMB-00 (refer to page 19), the clutch keys engage the lugs on the bottom of the bevel gear pc. #100.

This assembly is held in this position by trippers which are illustrated on the parts drawing. The operator will remain in hand operation indefinitely until the electric motor is energized and the tripper cams mounted on the worm shaft cause the trippers to release the clutch ring and clutch keys from their hand position. This is an automatic feature of the Limitorque valve control.

This declutching action is similar in all the larger size SMB operators. Referring to the parts drawing for the SMB-0, it should be noted that when the declutch lever is depressed, the declutch lever shaft causes the declutch fork to push the worm shaft clutch out of engagement with the motor helical gearing and into engagement with the handwheel clutch pinion. The worm shaft clutch is locked in this position by the trippers. Therefore, when the handwheel is rotated, the handwheel gear turns the handwheel clutch pinion and in turn the worm shaft, putting the Limitorque operator into motion.

As soon as the electric motor is energized, the tripper pins, which are part of the worm shaft clutch gear, cause the trippers to be released allowing the worm shaft clutch to be released from hand operation and engage in motor operation.

In all cases with the SMB operator, when the handwheel is turned it does not rotate the motor. Similarly, when the motor is in operation the handwheel does not turn.

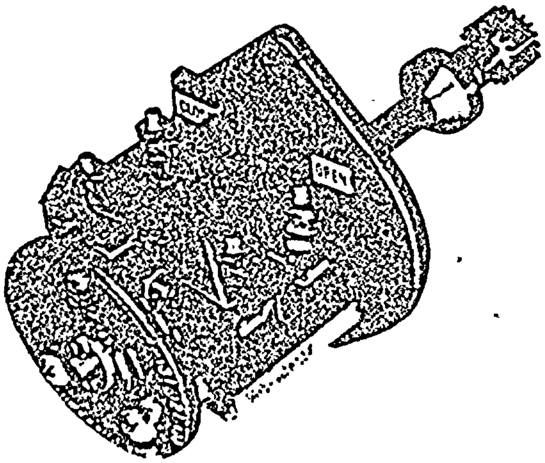
SMB-00 THRU SMB-5 DOUBLE TORQUE SWITCH*

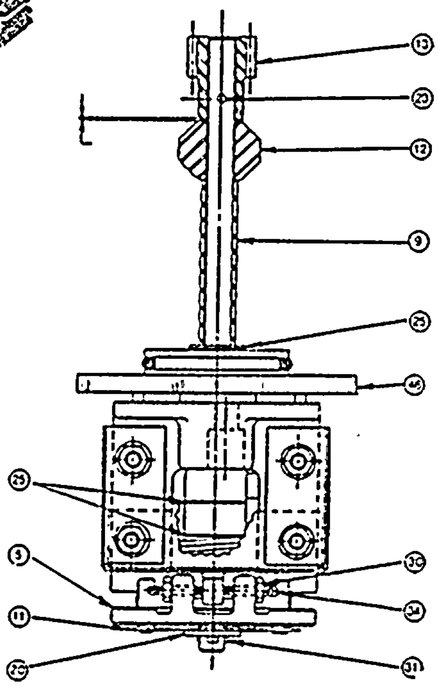
Procedure for Setting:

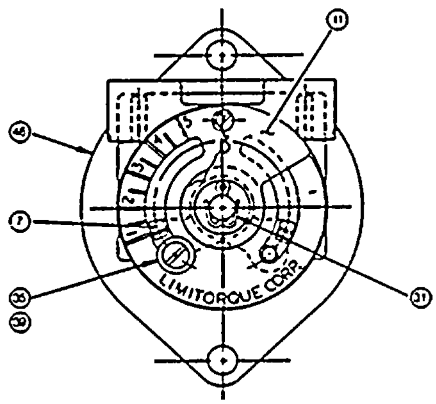
1. Torque settings must be made with switch mounted in Limitorque.
2. Make sure all electric power is off.
3. For the open direction torque switch or close direction torque switch loosen screw, pc. #35 and set pointer, pc. #7, at desired torque setting. The higher the number, the higher the torque output of the unit.
4. Tighten pc. #35
5. Operate valve electrically to seat valve, insuring tight shut-off.
6. A maximum stop setting plate is furnished on all units. Do not exceed this setting without consulting factory.

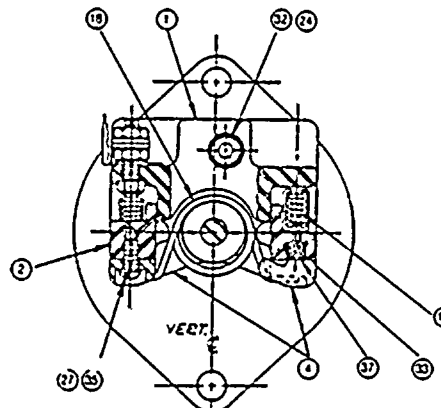
*Available in assembled form only.

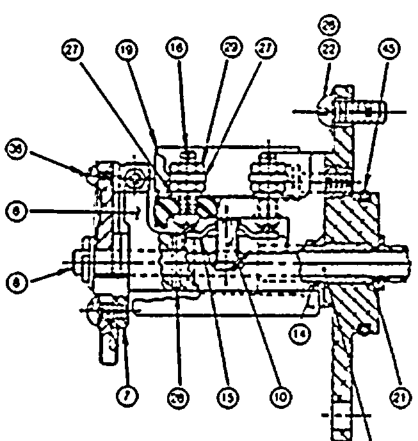
PC. NO.	NO. REQ.	DESCRIPTION
1	1	TERMINAL BLOCK
2	2	CONTACT BLOCK
4	2	ARM
5	1	DIAL
6	1	ACTUATING LINK
7	2	POINTER
8	1	SHAFT
9	1	SPACER
10	2	CONTACT SUPPORT
11	1	TORQUE LIMITER
12	1	BUSHING
13	1	T.SW. PINION
14	1	BEARING
15	2	CONTACT FINGER
16	[illegible]	TERMINAL STUD
17	[illegible]	COMPR. SPRING
18	[illegible]	TORSION SPRING
19	1	INSULATOR
20	1	FLAT WASHER
21	1	"O"-RING
22	2	SCREW-ROUND HD. SLOTTED ¼-18 x ⅜ LG.
23	1	ROLL-PIN 3/32 DIA. x 5/8 LG.
24	1	LOCKWASHER-¼
25	3	THRUST WASHER
26	2	5/16 LOCKWASHER
27	12	LOCKWASHER #10
28	1	ROLL PIN 3/32 DIA. x 3/4 LG.
29	8	HEX. NUT #10-32
30	2	HEX. NUT #6-32
31	1	COTTER PIN ⅓₂ DIA. x ¾ LG.
32	1	SCREW-SOC. HD. CAP ¼-20 x ¾ LG.
33	2	SCREW-PAN HD. SELF-TAPPING #4-40 x ¼ LG.
34	2	SCREW-HEX. SOC. SET #6-32 x 5/8 LG.
35	6	SCREW-MACH. RD. HD. #10-32 x 3/8 LG.
36	1	SCREW-MACH. RD. HD. #5-40 x 3/16 LG.
37		WAX AS REQUIRED
39	2	LOCKWASHER
45	1	"O"-RING
46	1	MOUNTING BRACKET

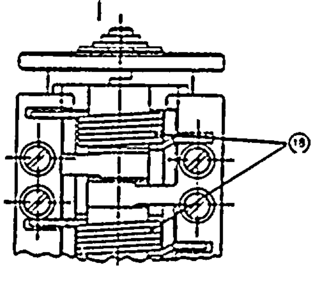










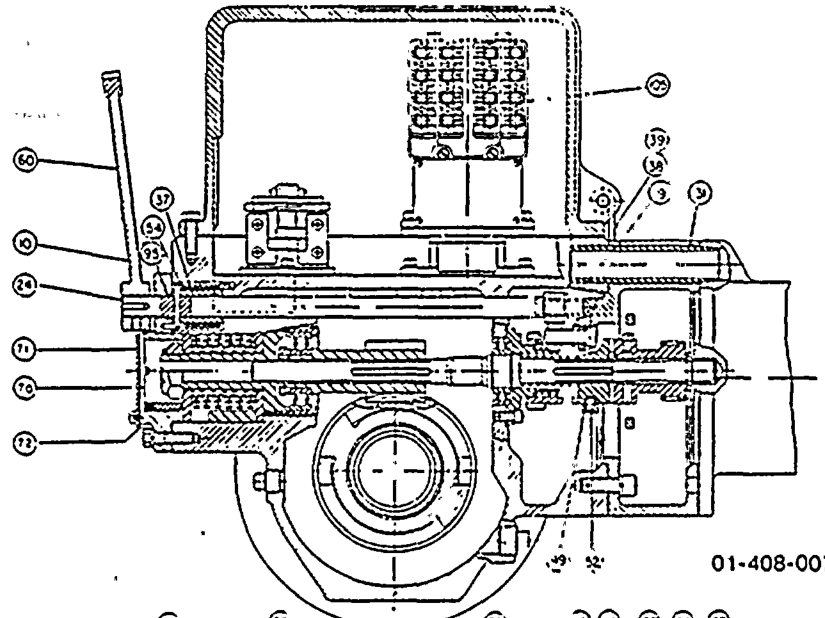


NOTE: APPLY GREASE AT ASSEMBLY

SMB-0 TO SMB-4 & SMB-4T

Footnotes
(1) Two required on SMB 3 & 4
(2) Only on SMB 0 & 1

PC. NO.	DESCRIPTION
1	CLUTCH HOUSING
2	HOUSING
3	HOUSING COVER
4	SPRING CARTRIDGE CAP
5	HANDWHEEL 12"
6	LIMIT SW COMP COVER
7	HANDWHEEL GEAR
8	WORM SHAFT BEARING CAP
9	DECLUTCH LINK
10	DECLUTCH LEVER
11	DRIVE SLEEVE
12	DECLUTCH FORK
16	WORM GEAR
17	SPRING RING
18	BUSHING
19	BUSHING
20	STEM NUT
24	MANUAL DECLUTCH SHAFT
25	HANDWHEEL SHAFT
26	SEAL RETAINER PLATE
27	SPLIT RING RETAINER
28	WORM GEAR SPACER
29	TORQUE LIMIT SLEEVE
30	LOCKING NUT
31	MOTOR CONDUIT NIPPLE
32	CLUTCH TRIPPER #1
33	CLUTCH TRIPPER #2
34	FORK PIVOT PIN
35	HANDLE
36	HANDLE ROD
37	DRUM
38	UPPER HINGE
39	LOWER HINGE
[illegible]	MOTOR PINION
[illegible]	W. S. CLUTCH GEAR
[illegible]	H. W. CLUTCH PINION
[illegible]	WORM SHAFT
44	BEARING CARTRIDGE CAP
45	BEARING CARTRIDGE STEM
46	SPACER (See Footnote 2)
47	SPLIT RING
48	THRUST WASHER
49	CLUTCH ROLLER
50	W. S. CLUTCH
51	TRIPPER PIN
52	CLUTCH ROLLER PIN
53	WORM
54	TORSION SPRING
55	"O" RING SPACER
56	BELLEVILLE SPRING
57	H. W. PINION SPRING
58	FORK RETURN SPRING
59	TRIPPER SPRING
60	NAMEPLATE
66	HOUSING COVER GASKET
67	CLUTCH HSG. & MOTOR GASKET
68	SPRING CART. CAP GASKET
69	L. S. COMP COVER GASKET
70	LOCKNUT
71	SPRING CART. CAP PLATE
72	SPRING CART. CAP PLATE GASKET
74	BEARING SHIMS
75	ROLLER BEARING CONE
76	ROLLER BEARING CUP
77	ROLLER BEARING CONE
78	ROLLER BEARING CUP
79	BALL BEARING
80	BALL BEARING
81	BALL BEARING (See Footnote 1)
82	BALL BEARING
83	BEARING LOCKNUT
84	ELASTIC STOP NUT
85	ELASTIC STOP NUT
86	RETAINING RING
[illegible]	RETAINING RING
[illegible]	RETAINING RING
[illegible]	RETAINING RING
[illegible]	RETAINING RING
91	RETAINING RING
92	RETAINING RING
93	QUAD RING
94	QUAD RING
95	"O" RING
96	"O" RING
97	BUSHING
98	GREASE FITTING
103	MOTOR
104	TORQUE SWITCH
105	GEARED LIMIT SWITCH



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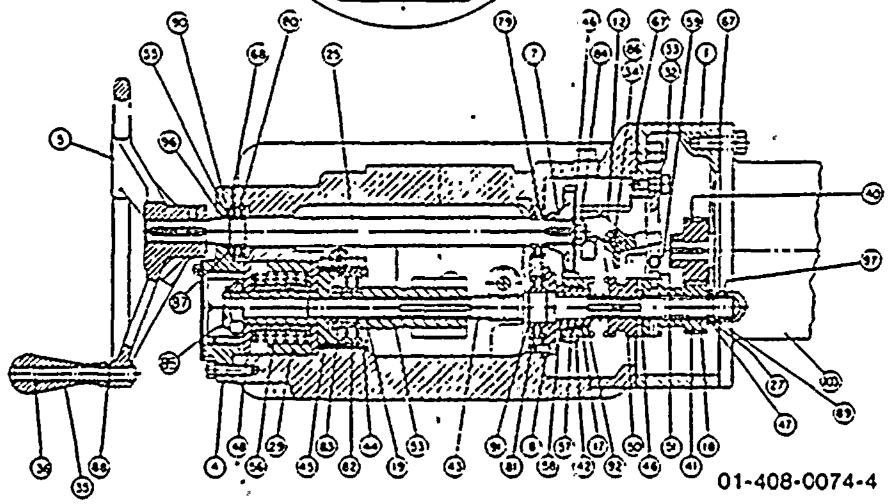

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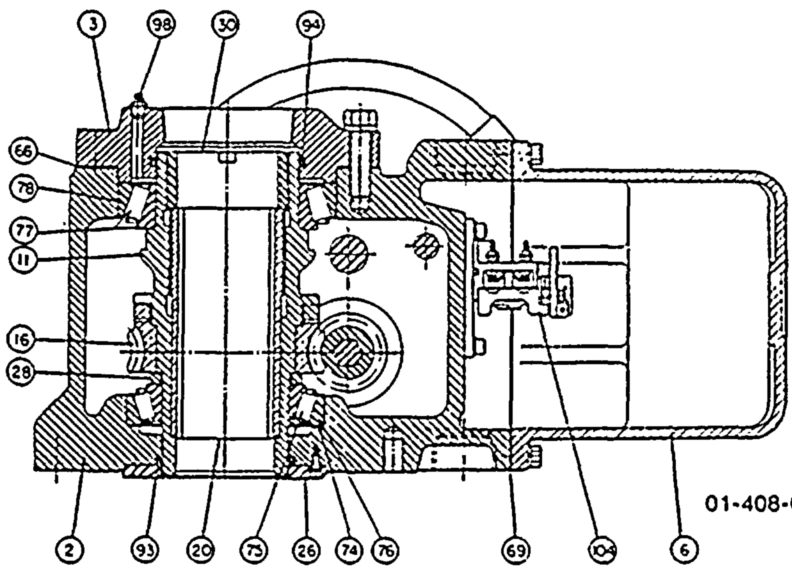

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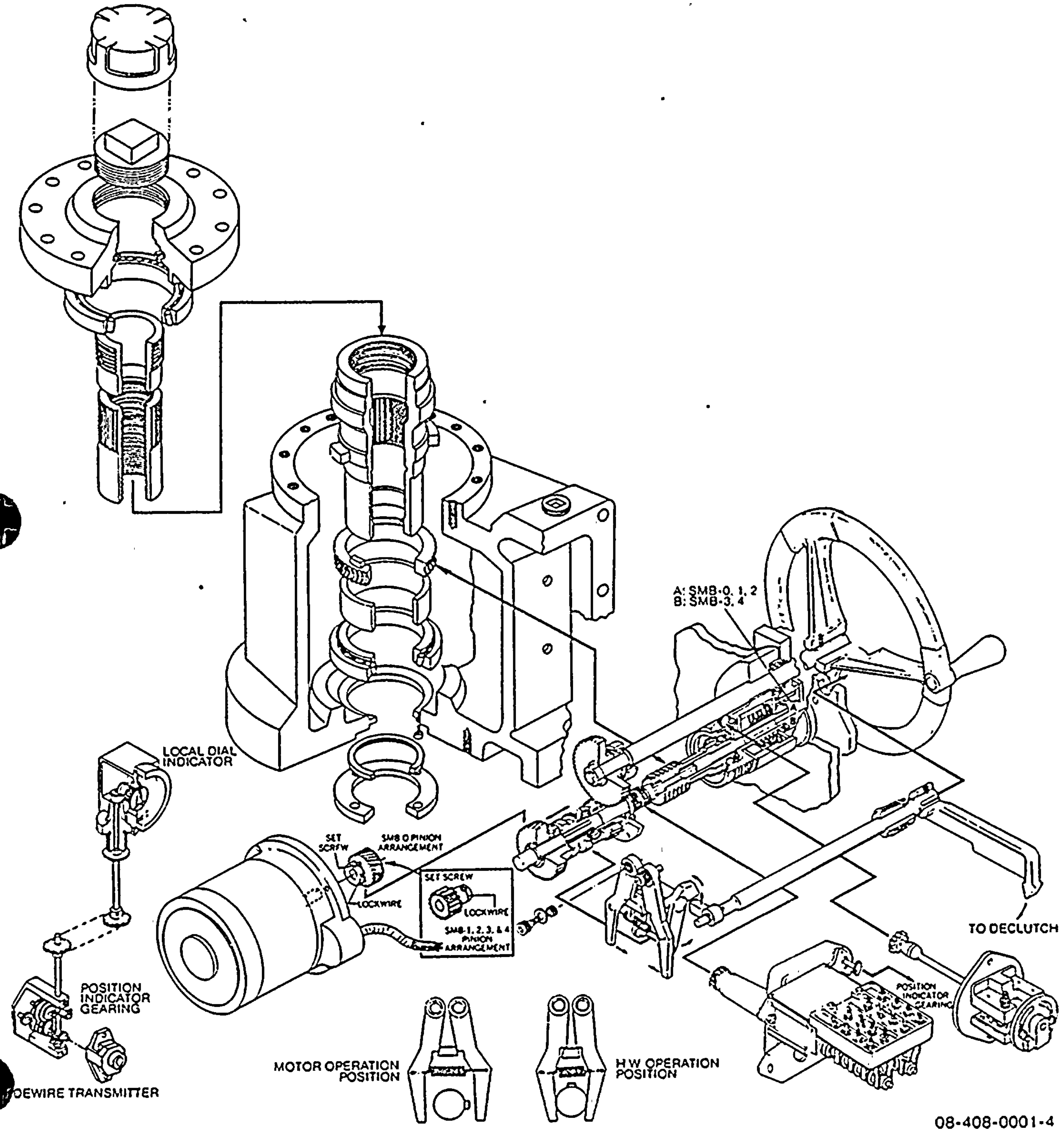
SMB-0 TO SMB-4 & SMB-4T



08-408-0001-4

LIMITORQUE MOTORS

BULLETIN LM-77

Prepared by
LIMITORQUE CORPORATION

The application of motor actuators to valves requires unique performance characteristics from both the actuator and the motor. There are numerous approaches to actuator design; however, all motor designs for valve actuator service must have a number of common characteristics.

The force (thrust or torque) required to operate a valve is not totally predictable. There are many philosophies regarding the equations used to determine the force (thrust or torque) required to seat/unseat or stroke a valve. Each valve design can have a distinct set of load characteristics entirely different from other valves in the same general family, or similar types or designs even within the same valve manufacturer.

The following data represents typical operating criteria for a valve actuator and how this data should be used in the motor design.

GATE AND GLOBE VALVE REQUIREMENTS

Seating/Unseating

All formulae currently used by gate and globe valve manufacturers in determining the forces required to operate their valves are centered around seating or unseating the gate or plug against a differential pressure. This seating/unseating force usually occurs in the last few turns of the actuator (or first few turns in unseating) and reaches its maximum in 50 to 2000 milliseconds depending on the speed of operation and the rigidity of the valve.

The seating/unseating force requires the most torque out of the valve actuator motor (see Figure 1). Because of the very short time this force is experienced as compared to the total stroke time, Limitorque uses the "stall torque" or "starting torque" potential of the motor (less a safety factor) to produce it. This means that motor amperage may approach its locked rotor value while seating or unseating a valve.

RUNNING

While stroking a valve, the only two forces present are the stuffing box load and the stem piston differential effect (stem area x line pressure) with the latter being the only predictable force.

The stem piston differential effect is an additive force to the stuffing box load in the closing direction and a negative force in the opening direction. The motor running torque capability must adequately handle the combination of the stuffing box load and the stem piston effect.

Experience and valve manufacturers data show that the stroking force, (average of opening and closing a gate or globe valve), is approximately 20% to 40% of the seating force in the overwhelming number of applications (see Figure 1). When this load (20% to 40% of seating) is reflected back to the motor, it represents 10% to 25% of the seating load due to the increase of the actuator dynamic efficiency as opposed to starting or static efficiency. The motor should therefore, be adequate to accommodate a running torque of 10% to 25% of the seating force (torque).

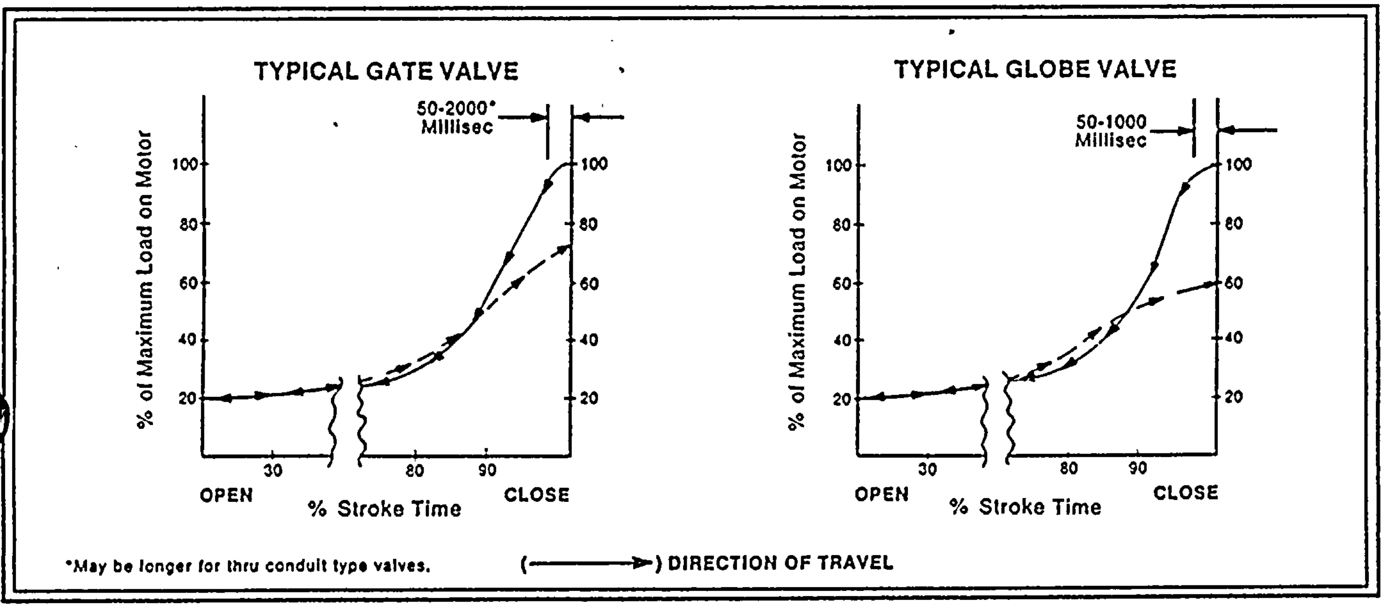


Figure 1

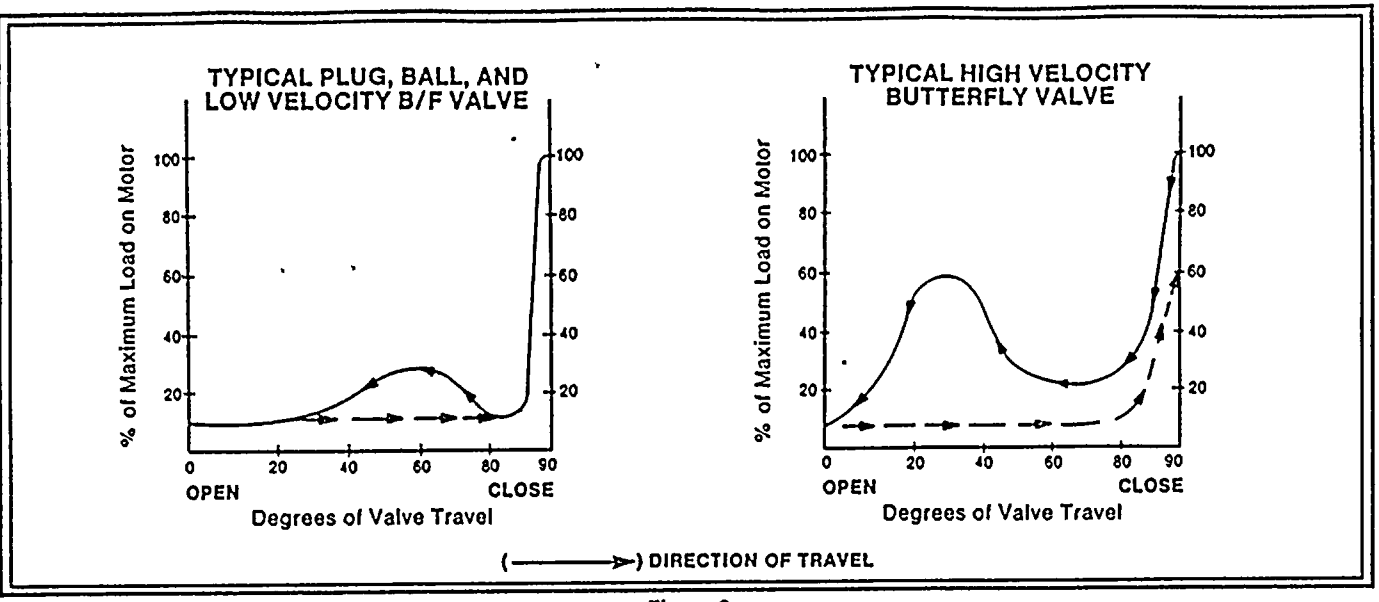


Figure 2

BUTTERFLY, BALL, AND PLUG VALVE REQUIREMENTS

The tailoring of motor designs to butterfly, ball, and plug valves is a bit easier as the running torques for these valve designs are more predictable than in gate and globe valve applications.

The seating or unseating forces in a butterfly, ball, or plug valve are composed of a bearing friction and a force proportional to the shutoff pressure and leakage rate allowed, whereas the running load is proportional to the flow rate and disc design. The majority of butterfly valve applications fall into the same class as the gate and globe valves where the average running torque is approximately 20% to 40% of the normal seating/unseating torque (see Figure 2). This actuator running load, when reflected at the motor, again represents 10% to 25% of the seating load due to the increase in unit efficiency while running.

Because of the unique flow characteristics of "high velocity" butterfly valves, e.g., circulating water applications or those located in turbulent flow areas, the running torque requirements may be as great or even greater than the seating torque. In applications such as these, it is not uncommon to witness motor current draws approaching 200% to 250% of nameplate for a short period of time while stroking a butterfly valve through its peak torque requirement (between 20% and 75% open) when a standard running torque rated motor is used. This momentary load is of no consequence on applications with stroking times of five minutes or less as the "average" load the motor experiences is well within its capabilities. For "high velocity" applications with stroke times longer than five minutes, motor capacity should be verified.

MOTOR DESIGN EVALUATION

The preceding data indicates that a theoretical motor torque is required to seat or unseat a valve and that an average of approximately 10% to 25% of the seating/unseating torque is needed throughout the stroke. With this as a basis for performance, we can determine the physical (frame) requirements best suited for valve actuator service.

Inertia/Frame Size

All motor-operated valves rely on finitely set limit or torque switches to de-energize the motor at a given position or torque level. Any additional overtravel or load developed due to inertia must be kept to a minimum. Additional forces due to inertia, which are over and above the normal required seating forces, can cause premature valve wear and, possibly, valve damage. By keeping the motor frame size as small as possible, consistent with good design, inertia is kept as low as possible.

Duty Rating/Frame Size

Recognizing the usual short stroke times (less than two minutes) on most motor actuator applications, a short time rating of the motor is selected to minimize frame size and inertia and yet maximize useability which would enable motors of the same torque and duty rating to be used interchangeably—regardless of application and service. This gives both Limitorque and its customer the advantage of one family of torque and duty rated motors for the vast majority of applications.

Heavy duty valve actuators of the Limitorque type are generally used in areas where three-phase A.C. power is readily available. The optimum combination of motor frame sizes for three-phase motors occurs with a 15-minute duty rating. When using single phase and D.C., the best combination of motor frame sizes occurs with a 5-minute duty rating.

Frame Design

Most customers prefer to have their motors serviced by local repair shops: therefore, standard Nema frame sizes are used. This frame should be TOTALLY ENCLOSED for both indoor and outdoor applications, and NON-VENTILATED (for the usual short stroke time applications) to minimize inertia. (A fan would be useless for short time ratings and it would increase the motor inertia.) Motor frames are designed in accordance with Nema MG1-1.26A & E (Nema IV) for indoor and outdoor applications (weatherproof) and Nema MG1-1.26A & C (Nema VII) for explosion-proof service.

Insulation System

The current industry standard for motor insulation is Nema Class "B" with a maximum continuous temper-... rating of 120°C (rise + ambient). The rated service ...r for special purpose motors such as those used on valve actuators should be 1.0 as there is no uniform condition which could be used as a base for any other service factor.

There is an inherent service factor built into the motor design rating by virtue of its required duty compared to its duty rating. This inherent service factor is described by the following equation:

$$\frac{\text{DUTY RATING}}{\text{OPERATING TIME}} = \text{inherent service factor}$$

The use of special insulation systems such as Nema Class "F" or "H" is not recommended unless the service conditions are beyond the range of the standard Class "B" system. Special insulation systems add to the initial cost and lead time without adding appreciable safety factor to the motor design.

Any insulation system used by Limitorque has an inherent safety factor computed in the same manner as the motor service factor.

Motor Design

The ideal motor which meets all of the above criteria is:

...rting torque rated
...ated Running Torque = approximately 20% of starting torque
Rated Service Factor = 1.0
Standard Insulation = Class "B"
*Rated Running Time @ Rated Running Torque is 15 minutes for 3-phase; 5 minutes for D.C. and single phase.
**Standard Nema TENV Frame Size

*Without exceeding Nema allowable temperature rises for the insulation system used.
**Limitorque motors are supplied in standard Nema frame sizes but are equipped with modified flange and shaft for mounting purposes.

Proper Motor Selection

In applying the above motor, Limitorque ensures that

(1) The application never requires more starting torque than the motor has available.

(2) The motor will stroke the valve at least open and close without exceeding its safe thermal rating.

(3) The motor will stroke the valve when the motor terminal voltage is ±10% of the required rating (unless otherwise specified; e.g., most nuclear safety-related specs call for +10%, −20%).

When reviewing the running torque requirements, Limitorque cannot ensure that the actual running loads on the motor are always less than the 20% rated running torque listed on the nameplate (which represents an average running condition), but rather that the motor will absolutely stroke the valve for the specified number of times. It must ALWAYS be kept in mind that the 20% rated running torque is available for at least rated running time of 15 minutes for A.C., and 5 minutes for D.C. and single phase. This same motor can be used for much higher running loads (over 20%) for equal or shorter running time ratings provided the Nema insulation rating is not exceeded. The motor performance curve is used by Limitorque to ensure that the Nema temperature requirements are maintained at running loads over the standard 20% rated.

Limitorque motors are specifically designed for valve operator service. The speed/torque curves are prepared by the Limitorque engineering staff who then approves the frame size and duty rating. Most Limitorque motors have ample thermal capacity to operate at twice the standard 20% rated running torque listed on the nameplate for periods of five to fifteen minutes (see Figure 3). These motors are applied per the Limitorque standard Selection Procedure which includes the appropriate safety factor requirements.

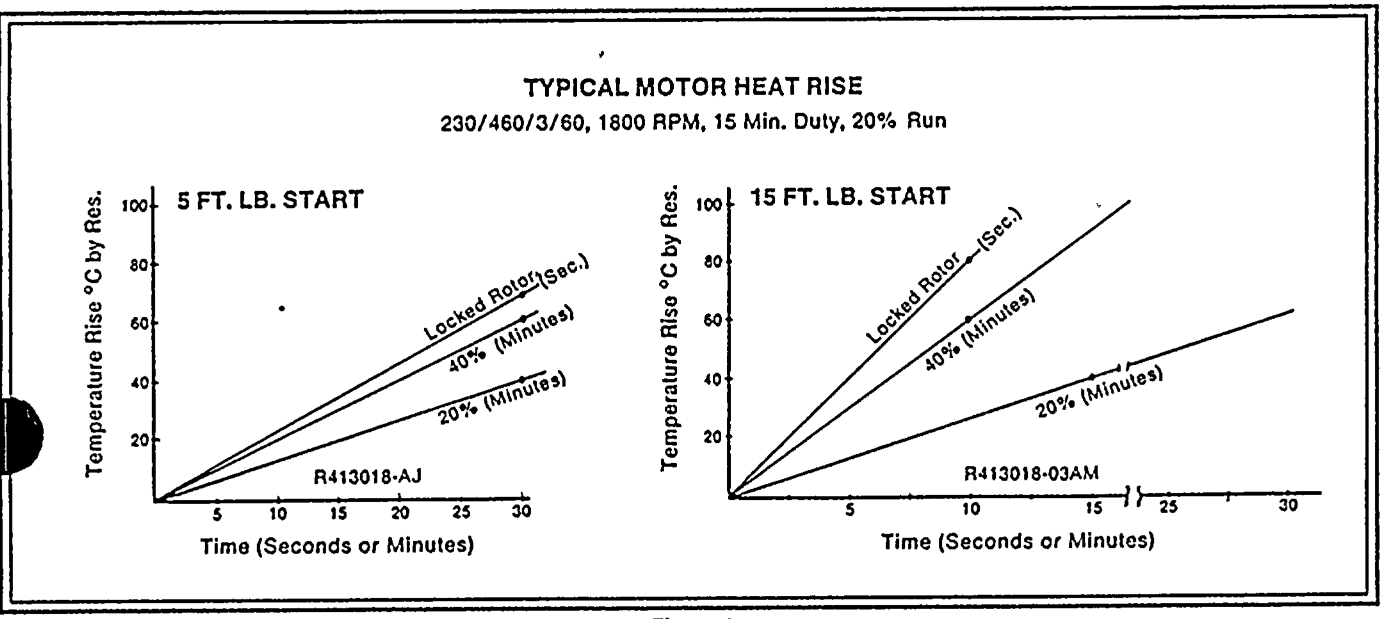


Figure 3

SELECTING OVERLOAD PROTECTION

The standard thermal overload relay, if selected by routine commercial methods, will not adequately protect a short time duty rated motor primarily because it was designed for motors used in continuous duty applications and not applications which have run times of five seconds to two minutes such as commonly found on valve actuators.

To select a thermal overload relay, one must look at the stroke time for the application and protect the motor accordingly. Usually, the best method for selecting a thermal overload is to ensure that the motor will trip the overload device while at locked rotor current, within ten seconds for A.C. (3-phase) and eight seconds for D.C. and single phase.

There are "quick trip" overload relays commercially available which are ideal for valve actuator motors. These overloads allow the motor to run at nameplate (rated full load) current indefinitely, however, they will trip within five seconds at locked rotor current (usually 600% to 800% of nameplate full load current).

Built-in motor thermal contacts are not a dependable means of protecting medium and large valve actuator motors. Most actuator motors fail because the motor has been stalled too long or too often. Motor winding hot spots develop under a stalled condition and these hot spots cannot be handled adequately by motor thermal contacts, especially if less than three (for 3-phase) are used. Motor rotors (which are the center of the heat build-up under stalled conditions) receive maximum protection from a current sensitive overload device, such as a "quick trip" or correctly selected "bi-metallic" overload relay.

Thermal contacts are designed to be very small to allow them to fit into the motor windings. This miniaturizing detracts from the ruggedness and dependability of the thermal contact. The fact that they are imbedded in the motor windings makes them impossible to maintain or service without rewinding the motor which also detracts from their acceptability.

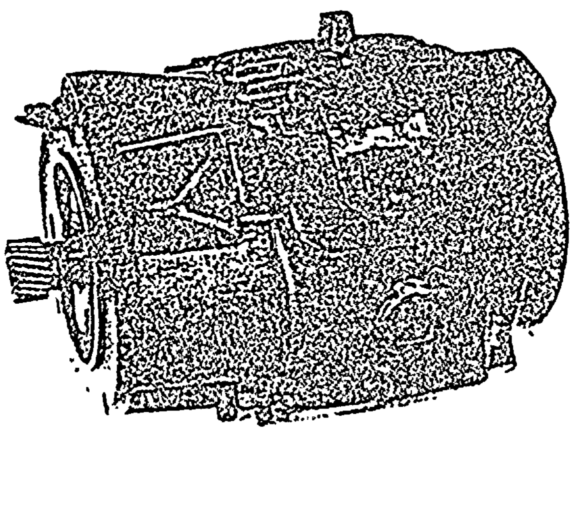
Limitorque motors are designed to operate at higher than nameplate voltage. A high voltage will cause the full load nameplate current to rise due to the saturation of the stator winding.

It is NOT UNCOMMON to experience motor current draws in excess of the motor nameplate full load current in any valve actuator application. Determination of running loads for a valve is an inexact science and the actual values can vary depending on finishes, fits, etc.

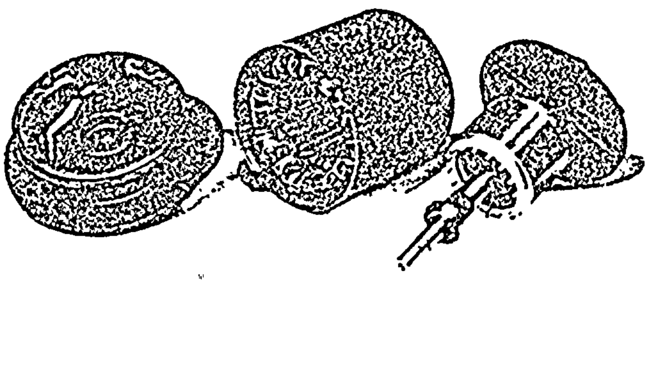
Apparent overcurrent may be further magnified by such conditions as an overly tight valve stuffing box, dirty or unlubricated valve stem. Although this condition is adequately covered by the motor thermal rating, it could cause nuisance tripping on thermal overload devices which are sized on motor full load current only.

Before increasing the size of the motor overload devices, check all of the operating conditions to ensure a problem does not exist in the valve itself.

Further information may be obtained from any of the local Limitorque sales offices or by writing to Limitorque Corporation, Lynchburg, Va. 24506.



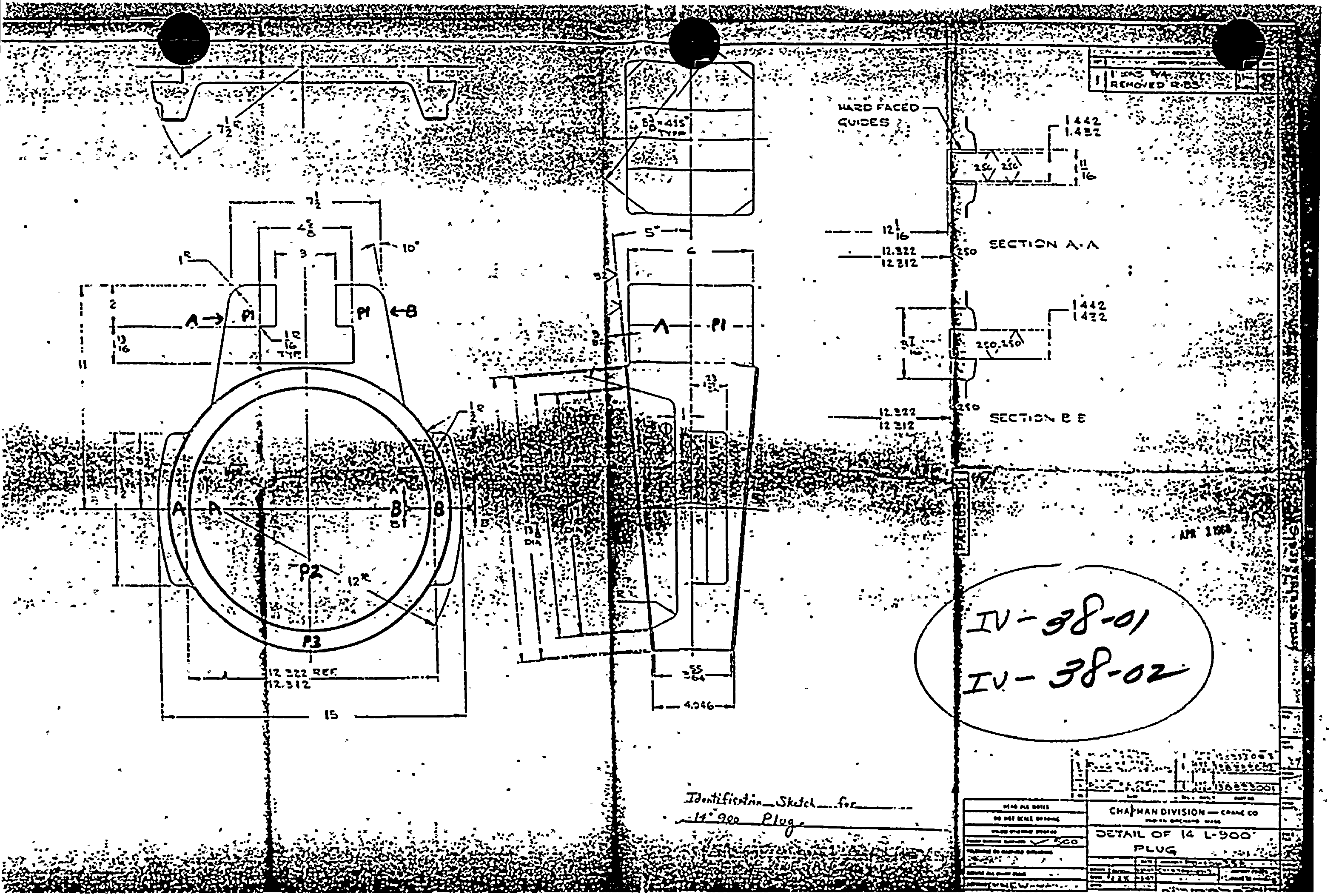
Typical nuclear containment motor—NEMA 184 frame.

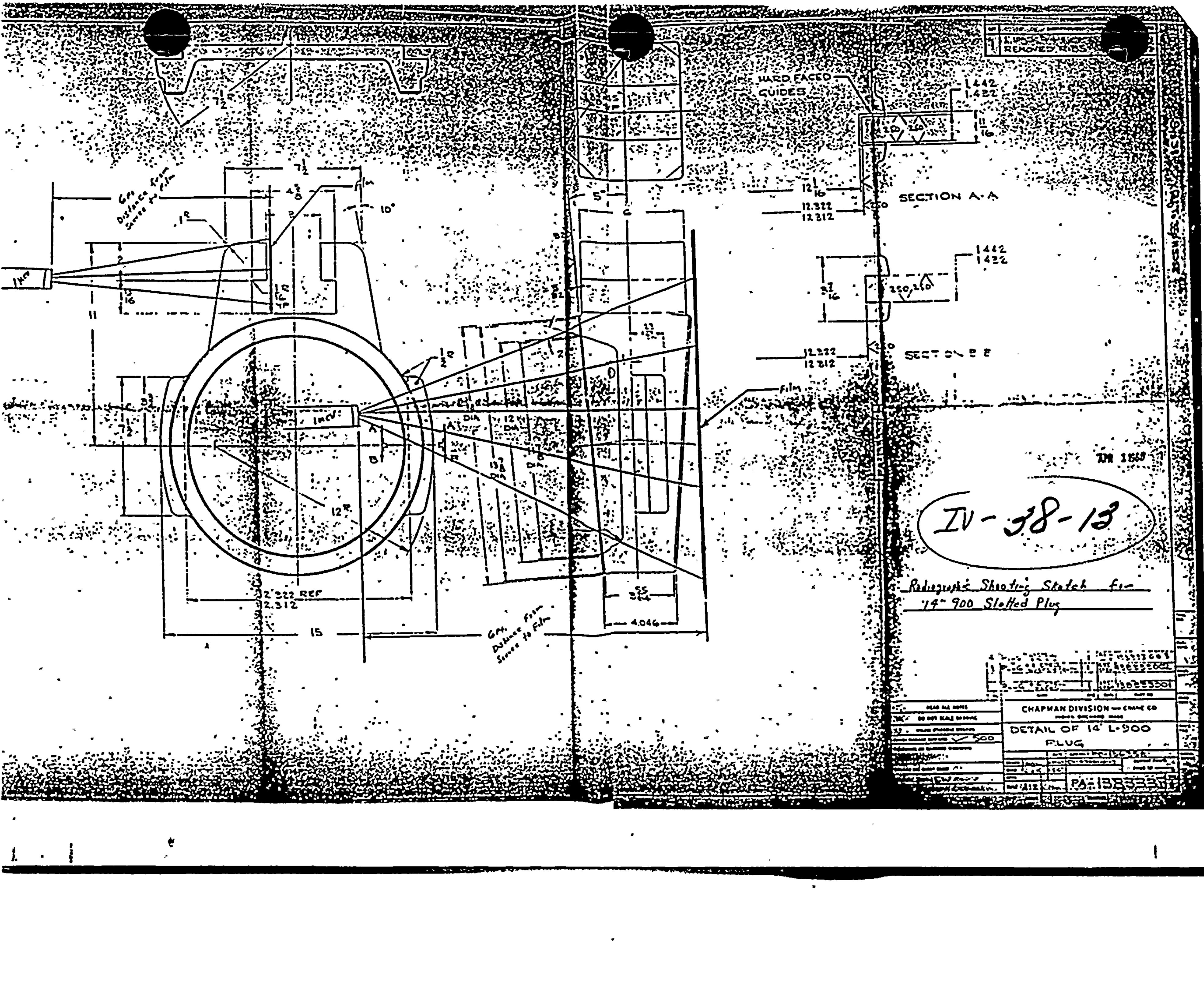


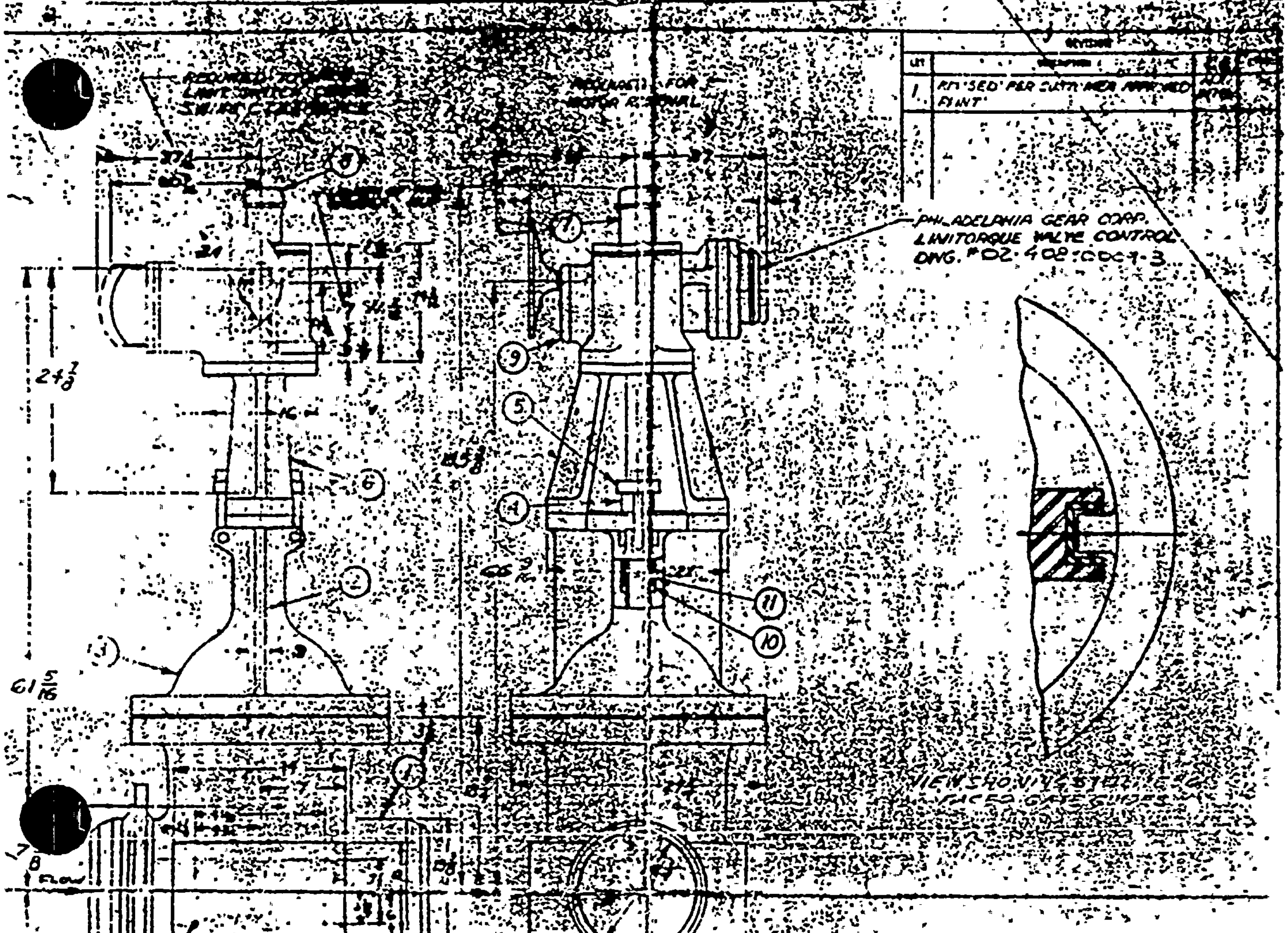
Typical weatherproof motor—NEMA 56 frame.

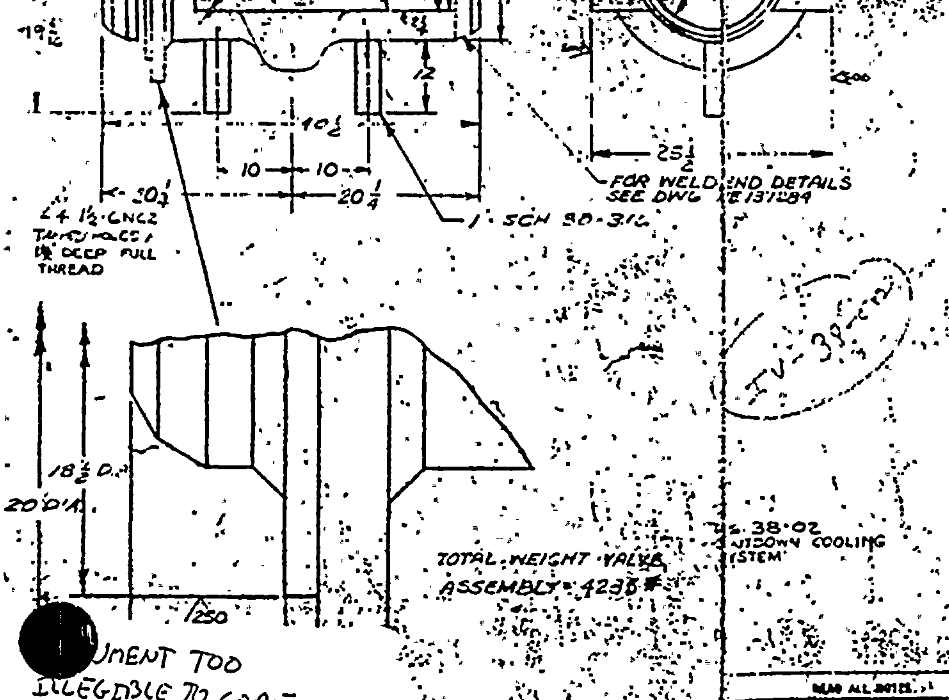
LIMITORQUE CORPORATION
OFFICES IN PRINCIPAL CITIES
5114 Woodall Road, Lynchburg, Virginia 24506

Printed In U.S.A.


HARD FACED GUIDES
SECTION A-A
SECTION B-B
12.322 REF
12.312
15
4.046
P1
P2
P3
IV-38-01
IV-38-02
Identification Sketch for 14" 900 Plug
CHAPMAN DIVISION — CRANE CO
DETAIL OF 14 L-900 PLUG


HARD FACED GUIDES
SECTION A-A
SECTION B-B
Film
Gft. Distance from Source to Film
12.322 REF
12.312
15
4.046
IV-38-13
Radiographic Shooting Sketch for
14" 900 Slotted Plug
CHAPMAN DIVISION — CRANE CO
DETAIL OF 14" L-900
PLUG





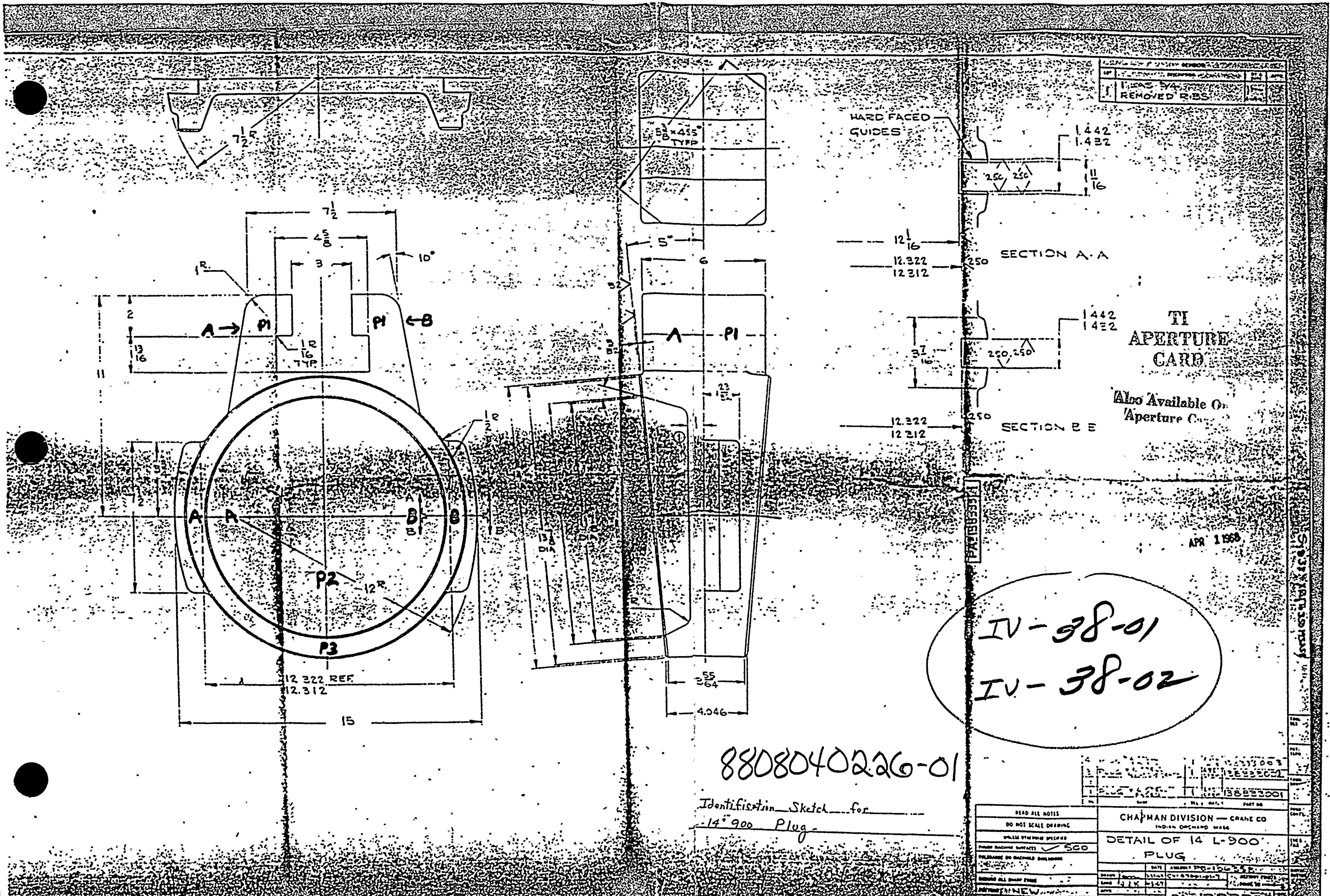
11	PACKING	3	JM-338
10	STUFF. BOX WSHR	1	A276 316
3	LIMIT[illegible] UNIT	1	SMB-5-100
5	PIPE [illegible]	1	M I
[illegible]	[illegible]WER	1	ASTM A53 [illegible]
6	[illegible]KE	1	FAB. STEEL
5	[illegible] FLANGE	1	ASTM A105-GR2
4	FOLLOWER NOSE / STELLITE FACED PACKING COLLAR	1	ASTM A276-316
[illegible]	STUD NUTS		ASTM A194-8
[illegible]	BODY STUDS		ASTM A193-B8
3	BONNET [illegible]	1	ASTM A351 CF8M
2	STEM	1	ASTM A276-316
[illegible]	GATE STELLITE FACED SEAT & GUIDE SLOT	1	ASTM A351 CF8M
[illegible]	SEAT RINGS STELLITE FACED	2	ASTM A276 316
1	BODY [illegible]	1	ASTM A351 CF8M

CHAPMAN DIVISION

[illegible] 900 BOLTED BONNET [illegible] GATE VALVE WITH FLEXIBLE [illegible] BONNET JOINT & SMB-3 LIMITORQUE

PB-134371

DOCUMENT TOO ILLEGIBLE TO CODE

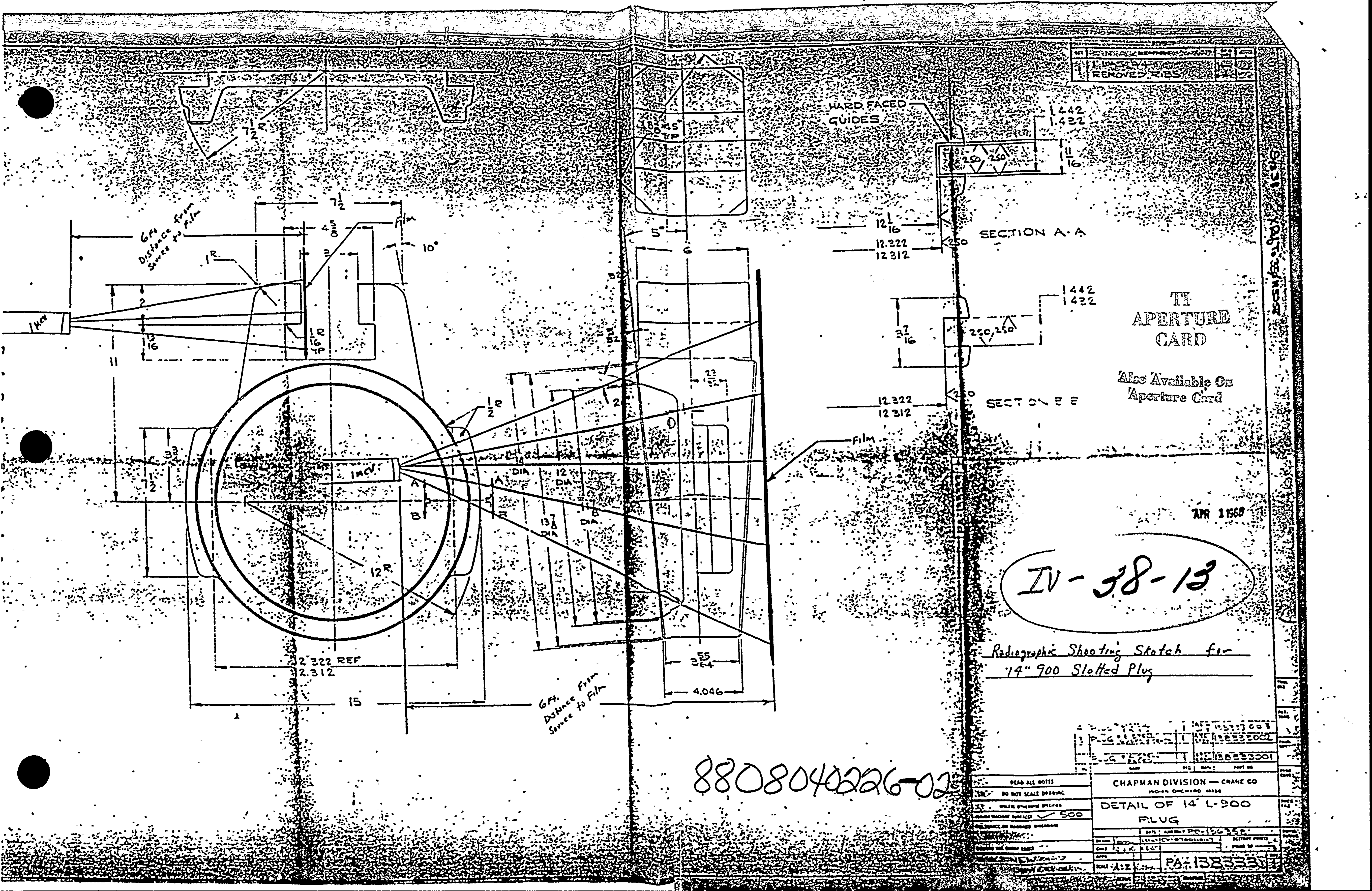


IV-38-01

IV-38-02

8808040226-01

Identification Sketch for 14" 900 Plug


REMOVED RIBS
HARD FACED GUIDES
SECTION A-A
SECTION B-B
TI APERTURE CARD
Also Available On Aperture Card
APR 1980
IV-38-13
Radiographic Shooting Sketch for "14" 900 Slotted Plug
6 Ft. Distance from Source to Film
Film
1 MeV
12 DIA
15
2.322 REF
2.312
4.046
8808040226-02
CHAPMAN DIVISION — CRANE CO
DETAIL OF 14 L-900 PLUG
PA-138333

REACTOR SHUTDOWN COOLING SYSTEM

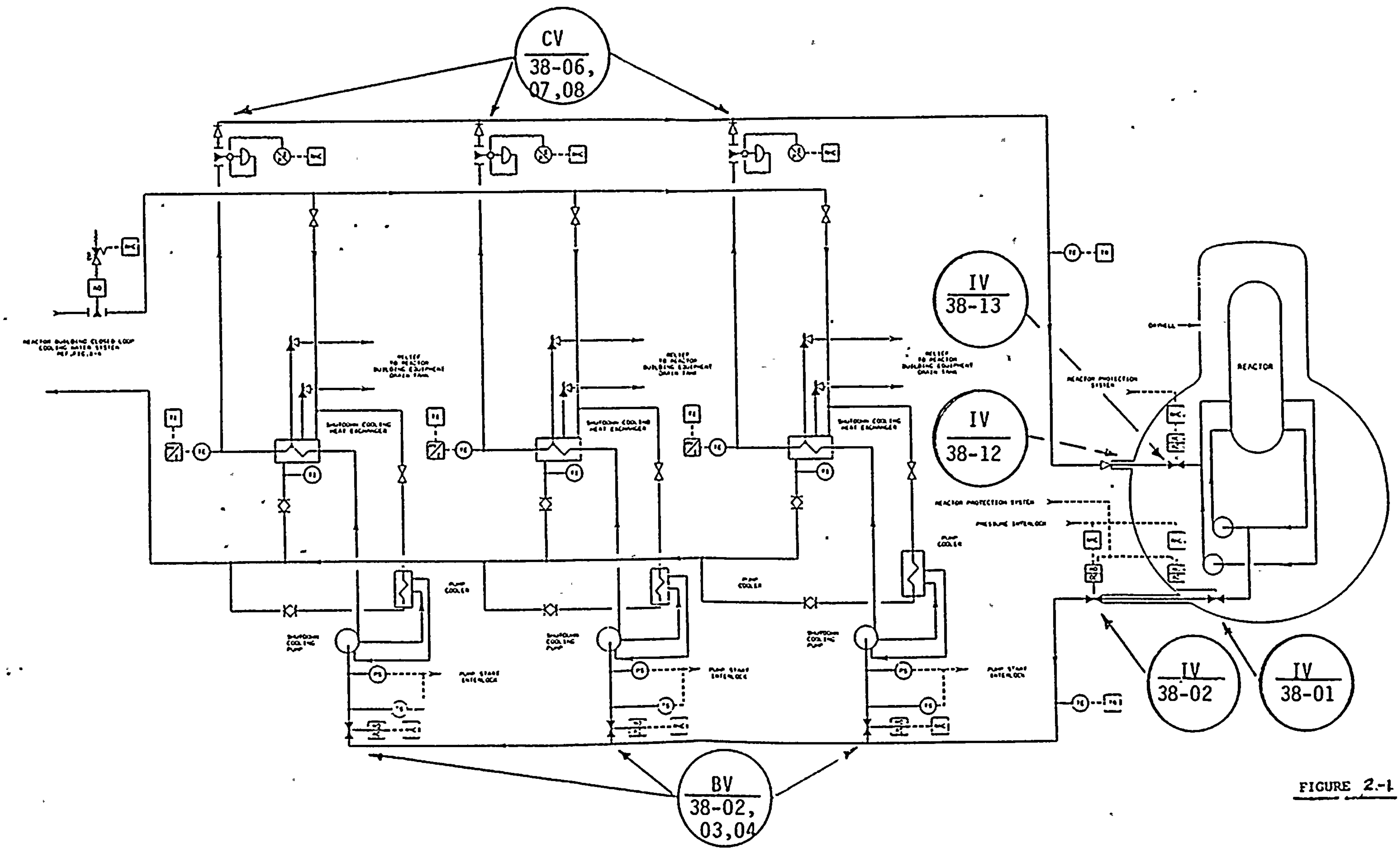


FIGURE 2-1

ENCLOSURE 3 ATTACHMENTS

- Table 1 of NMPC/NMP1 August 1978 Submittal
  - NMP1 Drywell and Suppression Chamber Penetration List
  - System/Penetration/Type B Testing Classification
- Collection of Typical NMP1 Primary Containment-Penetrations Drawings:

C-18415-C

C-18301-C

C-18198-C

C-18697-C

C-18474-C (Sheets 1, 3, 6)

C-18578-C

C-18347-C

C-18470-C

C-18158-C

C-18697-C

C-18178-C

C-18359-C

<u>ATTACHMENT TO ENCLOSURE 3</u>

TABLE 1

NINE MILE POINT UNIT

DRYWELL AND SUPPRESSION CHAMBER

PENETRATION LIST

May 28, 1978

5200G

Table 1 (Cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Electrical	X-E225	0	
Electrical	X-E226	0	
Electrical	X-E227	0	
Electrical	X-E228	0	
Electrical	X-E229	0	
Electrical	X-E230	0	
Electrical	X-E231	0	
Electrical	X-E232	0	
Electrical	X-E233	0	
Electrical	X-E235	0	
Electrical	X-E236	0	
Electrical (Spare)	X-E192		0
Electrical (Spare)	X-193		0
Electrical (Spare)	X-E194		0
Electrical (Spare)	X-E195		0
Electrical (Spare)	X-E196		0
Electrical (Spare)	X-E197		0
Electrical (Spare)	X-E198		0
Electrical (Spare)	X-E199		0
	X-E213		0
	X-E234		0
Electrical (Spare)	XS-E350		0
Electrical (Spare)	XS-E351		0

Note:
X - Drywell Mechanical Penetrations XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations XS-E - Suppression Chamber Electrical Penetrations.

Table [illegible]nt'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Electrical	X-E188	0	
Electrical	X-E189	0	
Electrical	X-E190	0	
Electrical	X-E191	0	
Electrical	X-E200	0	
Electrical	X-E201	0	
Electrical	X-E202	0	
Electrical	X-E203	0	
Electrical	X-E204	0	
Electrical	X-E205	0	
Electrical	X-E206	0	
Electrical	X-E207	0	
Electrical	X-E208	0	
Electrical	X-E209	0	
Electrical	X-E210	0	
Electrical	X-E211	0	
Electrical	X-E212	0	
Electrical	X-E214	0	
Electrical	X-E215	0	
Electrical	X-E216	0	
Electrical	X-E217	0	
Electrical	X-E218	0	
Electrical	X-E219	0	
Electrical	X-E220	0	
Electrical	X-E221	0	
Electrical	X-E222	0	
Electrical	X-E223	0	
Electrical	X-E224	0	

Note:
X - Drywell Mechanical Penetrations　XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations　XS-E - Suppression Chamber Electrical Penetrations.

Table 1 (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Spare	XS-328		0
Spare	XS-329		0
Spare	XS-331		0
Spare	XS-339		0
Spare	XS-343		0
Spare	XS-344		0
Spare	XS-345		0
Spare	XS-346		0
Spare	XS-349		0
Spare	XS-353		0
Spare	XS-356		0
Spare	XS-357		0
Spare	XS-362		0
Spare	XS-363		0
Spare	XS-364		0
Electrical	X-E176	0	
Electrical	X-E177	0	
Electrical	X-E178	0	
Electrical	X-E179	0	
Electrical	X-E180	0	
Electrical	X-E181	0	
Electrical	X-E182	0	
Electrical	X-E183	0	
Electrical	X-E184	0	
Electrical	X-E185	0	
Electrical	X-E186	0	
Electrical	X-E187	0	

Note:
X - Drywell Mechanical Penetrations XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations XS-E - Suppression Chamber Electrical Penetrations.

Table [illegible]cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Spare	X-130		0
Spare	X-132		0
Spare	X-136		0
Spare	X-143		0
Spare	X-144		0
Spare	X-145		0
Spare	X-148		0
Spare	X-152		0
Spare	X-153		0
Spare	X-155		0
Spare	X-158		0
Spare	X-159		0
Spare	X-160		0
Spare	X-161		0
Spare	X-162		0
Spare	X-163		0
Spare	X-164		0
Spare	X-165		0
Spare	X-166		0
Spare	X-167		0
Spare	X-168		0
Spare	X-170		0
Spare	X-171		0
Spare	X-172		0
Spare	X-173		0
Spare	X-175		0
Spare	X-238		0
Spare	XS-323		0

Note:
X - Drywell Mechanical Penetrations XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations XS-E - Suppression Chamber Electrical Penetrations.

Table [illegible] (Cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Spare (Instrument Conn)	X-65		0
Spare (Instrument Conn)	X-66		0
Spare (Instrument Conn)	X-77		0
Spare (Instrument Conn)	X-78		0
Spare (Instrument Conn)	X-83		0
Spare (Instrument Conn)	X-84		0
Spare	X-89		0
Spare	X-90		0
Spare	X-91		0
Spare	X-92		0
Spare	X-93		0
Spare	X-94		0
Spare	X-97		0
Spare	X-101		0
Spare	X-102		0
Spare	X-105		0
Spare	X-106		0
Spare	X-109		0
Spare	X-110		0
Spare	X-113		0
Spare	X-114		0
Spare	X-117		0
Spare	X-118		0
Spare	X-123		0
Spare	X-124		0
Spare	X-125		0
Spare	X-126		0
Spare	X-128		0

Note:
X - Drywell Mechanical Penetrations
XE - Drywell Electrical Penetrations
XS - Suppression Chamber Mechanical Penetrations
XS-E - Suppression Chamber Electrical Penetrations.

Table [illegible] (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Control Rod Drive Hyd. Piping	X-239A		0
Control Rod Drive Hyd. Piping	X-239B		0
Control Rod Drive Hyd. Piping	X-239C		0
Spare	X-6		0
Spare	X-10		0
Spare	X-11		0
Spare	X-12A		0
Spare	X-15		0
Spare	X-16		0
Spare	X-17		0
Spare	X-27		0
Spare	X-59		0
Spare	X-60		0
Spare	X-61		0
Spare	X-62		0
Spare	X-67		0
Spare	X-68		0
Spare	X-69		0
Spare	X-70		0
Spare	X-76		0
Spare	X-85		0
Spare	X-86		0
Spare	X-87		0
Spare	X-88		0
Spare (Instrument Conn)	X-46		0
Spare (Instrument Conn)	X-63		0

Note:
X - Drywell Mechanical Penetrations   XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations   XS-E - Suppression Chamber Electrical Penetrations.

Table 1 (Cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Reactor Head Spray	X-129		0
Liquid Poison	X-131		0
Reactor Level Protection System (Static)	X-53		0
Reactor Level Protection System (Static)	X-71a		0
Reactor Level Protection System (Static)	X-72f		0
Reactor Level Protection System (Static)	X-71b		0
Reactor Level Control Range (Static)	X-71D		0
Reactor Level Control Range (Static)	X-72D		0
Reactor Level Control Range (Variable)	X-71E		0
Reactor Level Control Range (Variable)	X-72E		0
Reactor Level Triple Low	X-71F		0
Reactor Level Triple Low	X-133		0
Reactor Level Wide Range (Static)	X-72A		0
Reactor Level Wide Range (Variable)	X-72B		0
Core Diff. Press. Impulse Line	X-82		0
Reactor Level-Triple Low	X-133		0
Reactor Water Sample	X-139		0
Cont. Rod Drive Exhaust to Reactor	X-174		0

Note:
X - Drywell Mechanical Penetrations XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations XS-E - Suppression Chamber Electrical Penetrations.

Table 1 (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Vent Pipe From Drywell	XS-300		0
Vent Pipe From Drywell	XS-301		0
Vent Pipe From Drywell	XS-302		0
Vent Pipe From Drywell	XS-303		0
Vent Pipe From Drywell	XS-304		0
Vent Pipe From Drywell	XS-305		0
Vent Pipe From Drywell	XS-306		0
Vent Pipe From Drywell	XS-307		0
Vent Pipe From Drywell	XS-308		0
Vent Pipe From Drywell	XS-309		0
Vacuum Breaker	XS-313		0
Vacuum Breaker	XS-314		0
Vacuum Breaker	XS-315		0
Vacuum Breaker	XS-316		0
Vacuum Breaker	XS-317		0
Vacuum Breaker	XS-318		0
Vacuum Breaker	XS-319		0
Vacuum Breaker	XS-320		0
Suppression Water Temp. Indicator	XS-322		0
Torus Cooling	XS-326		0
	XS-354		0
Suppression Vessel N_2 Vent & Fill	XS-327		0
Suppression Pool Make-Up Water	XS-330		0
Breathing Air	X-121		0
Service Water	X-122		0

Note:
X - Drywell Mechanical Penetrations
XE - Drywell Electrical Penetrations
XS - Suppression Chamber Mechanical Penetrations
XS-E - Suppression Chamber Electrical Penetrations.

Table .1 (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Vent Pipe to Suppression Vessel	X-24A		0
Vent Pipe to Suppression Vessel	X-24B		0
Vent Pipe to Suppression Vessel	X-24C		0
Vent Pipe to Suppression Vessel	X-24D		0
Vent Pipe to Suppression Vessel	X-24E		0
Vent Pipe to Suppression Vessel	X-24F		0
Vent Pipe to Suppression Vessel	X-24G		0
Vent Pipe to Suppression Vessel	X-24G		0
Vent Pipe to Suppression Vessel	X-24H		0
Vent Pipe to Suppression Vessel	X-24J		0
Vent Pipe to Suppression Vessel	X-24K		0
Drywell Floor Drain Sump	X-25		0
Drywell Equipment Drain Sump	X-26		0
Leak Rate Mon Ref. Ves. in Drywell	X-74		0
Leak Rate Mon Drywell Pressure	X-80		0
Suppression Vessel Water Level Transmitter	XS-347		0
	XS-348		0
Suppression Vessel Pressure Indicator	X-355		0
Drywell Level Impulse Line	X-168		0
Containment Spray Pump-Test	X-352		0
Suppression Vessel Air Vent & Fill	X-340		0

Note:
X - Drywell Mechanical Penetrations
XE - Drywell Electrical Penetrations
XS - Suppression Chamber Mechanical Penetrations
XS-E - Suppression Chamber Electrical Penetrations.

Table 1 (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Recirc. Flow Transmitter Impulse Line	X-37		0
Recirc. Flow Transmitter Impulse Line	X-43		0
Recirc. Pump Seal Press Impulse Line	X-38		0
Recirc. Pump Seal Press Impulse Line	X-41		0
Recirc. Pump Seal Press Impulse Line	X-42		0
Recirc. Pump Seal Press Impulse Line	X-44		0
Recirc. Pump Seal Press Impulse Line	X-47		0
Drywell Air Vent & Fill	X-18		0
Drywell N_2 Vent & Fill	X-19		0
O_2 Analyzer Return to Drywell	X-40		0
O_2 Analyzer Sample & Return	XS-321		0
Drywell O_2 Analyzer Sample	XS-48		0
Drywell O_2 Analyzer Sample	XS-49		0
Drywell O_2 Analyzer Sample	XS-50		0
Containment Sampling	X-20		0
Containment Sampling	X-21		0
Containment Sampling	X-64		0
Containment Sampling	X-98		0
Containment Sampling	X-134		0
Drywell Pressure	X-52		0
Drywell Pressure	X-135		0

Note:
X - Drywell Mechanical Penetrations
XE - Drywell Electrical Penetrations
XS - Suppression Chamber Mechanical Penetrations
XS-E - Suppression Chamber Electrical Penetrations.

Table [illegible] (Cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
T.I.P. System	X-23B	0	
T.I.P. System	X-23C	0	
T.I.P. System	X-23D	0	
T.I.P. System	X-23E	0	
T.I.P. System (Spare)	X-23F	0	
T.I.P. System (Spare)	X-23G	0	
Shutdown Cooling Return	X-7	0	
Shutdown Cooling Supply	X-8	0	
Clean Up Supply	X-9	0	
Clean Up Return	X-154	0	
Clean Up System Relief Valve Disch.	X-365	0	
Closed Loop Cooling Supply	X-12B		0
Closed Loop Cooling Return	X-13B		0
Closed Loop Cooling Return	X-156		0
Closed Loop Cooling Supply	X-157		0
Recirc. Pump Diff. Press Impulse Line	X-28		0
Recirc. Pump Diff. Press Impulse Line	X-29		0
Recirc. Pump Diff Press Impulse Line	X-30		0
Recirc. Pump Diff. Press Impulse Line	X-31		0
Recirc. Pump Diff. Press Impulse Line	X-32		0
Recirc. Flow Transmitter Impulse Line	X-34		0
Recirc. Flow Transmitter Impulse Line	X-35		0
Recirc. Flow Transmitter Impulse Line	X-36		0

Note:
X - Drywell Mechanical Penetrations
XE - Drywell Electrical Penetrations
XS - Suppression Chamber Mechanical Penetrations
XS-E - Suppression Chamber Electrical Penetrations.

Table 1 (cont'd)
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Emergency Condenser Return	X-5A	0	
Emergency Condenser Return	X-5B	0	
Emergency Cooling Elbow Flow Meter	X-51		0
Emergency Cooling Elbow Flow Meter	X-54		0
Emergency Cooling Elbow Flow Meter	X-71C		0
Emergency Cooling Elbow Flow Meter	X-72C		0
Core Spray	X-13A	0	
Core Spray	X-14	0	
Core Spray Suction	XS-332		0
Core Spray Suction	XS-333		0
Core Spray Suction	XS-336		0
Core Spray Suction	XS-337		0
Core Spray Pump Test	XS-334		0
Core Spray Pump Test	XS-335		0
Containment Spray Suction	XS-324		0
Containment Spray Suction	XS-325		0
Containment Spray Suction	XS-341		0
Containment Spray Suction	XS-342		0
Containment Spray	X-137	0	
Containment Spray	X-140	0	
Containment Spray	X-149	0	
Containment Spray	X-150	0	
T.I.P. System (Spare)	X-23A	0	

Note:
X - Drywell Mechanical Penetrations   XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations   XS-E - Suppression Chamber Electrical Penetrations.

Table 1
Nine Mile Point Unit 1
Drywell and Suppression Chamber Penetration List

System	Penetration Number(s)	Type B Testing Required	Type B Testing Not Required
Equipment Lock	X-1	0	
Equipment & Personnel Lock	X-1A	0	
Emergency Escape Lock	X-1B	0	
Concrete Grouting Access Hole	X-237		0
Access Manhole	XS-310	0	
Access Manhole	XS-311	0	
Access Manhole	XS-312	0	
Main Steam	X-2A	0	
Main Steam	X-2B	0	
Main Steam Relief Valve Disch.	XS-358		0
Main Steam Relief Valve Disch.	XS-359		0
Main Steam Relief Valve Disch.	XS-360		0
Main Steam Relief Valve Disch.	XS-361		0
Main Steam Relief Valve Disch.	XS-366		0
Main Steam Relief Valve Disch.	XS-367		0
Main Steam Flow Impulse Line	X-75		0
	X-81		0
Primary Feedwater	X-4A	0	
Primary Feedwater	X-4B	0	
Emergency Condenser Steam Supply	X-3A	0	
Emergency Condenser Steam Supply	X-3B	0	

Note:
X - Drywell Mechanical Penetrations   XS - Suppression Chamber Mechanical Penetrations
XE - Drywell Electrical Penetrations   XS-E - Suppression Chamber Electrical Penetrations.

ENCLOSURE 4 ATTACHMENTS

- Additional Information To Be Incorporated In Containment Spray System Operating Procedure #N1-OP-14

ATTACHMENT TO ENCLOSURE 4

ADDITIONAL REQUIREMENTS BEING ADDED TO N1-OP-14

Add the following to the Off-Normal Procedures Section:

H. Off-Normal Procedures (Cont.)

Establishing A Water Seal On The Containment Spray Discharge Isolation Valves.

NOTE: This procedure is to be performed if a Loss-of-Coolant Accident (LOCA) occurs. A water seal must be established on the Containment Spray Inlet Discharge Isolation Valves for the Containment Spray loop(s) that are not in operation. Per Appendix J of 10 CFR 50, this water seal must be maintained for a minimum of thirty days to prevent any radioactive release through these lines.

1. If no Containment Spray pump is in operation, THEN start the Containment Spray System in the Torus Cooling Mode of operation, using one pump, per the Off-Normal section of this procedure (paragraph H.5.0, page [later]).

2. Shut the following valves for the loop(s) that are not in operation in the Containment Spray Mode:

Loop	Containment Isolation Valve
111	CTN-SP Inlet IV-111
112	CTN-SP Inlet IV-112
113	CTN-SP Inlet IV-113
114	CTN-SP Inlet IV-114

3. Cross-connect the idle loops of Containment Spray with the operating loop by opening, or verifying open the following Bypass to Torus valves (one of the valves will already be open if in the Torus Cooling Mode):

BV-AOV-80-40, Bypass to Torus for Loop #111

BV-AOV-80-41, Bypass to Torus for Loop #121

BV-AOV-80-44, Bypass to Torus for Loop #112

BV-AOV-80-45, Bypass to Torus for Loop #122

NINE MILE POINT UNIT 1

SSFI

QUICK LOOK MEETING

November 17, 1988

,8811290448

ENCLOSURE 2

AGENDA

- INTRODUCTION	C. D. Terry
- RESPONSES TO SSFI ISSUES	L. A. Klosowski R. G. Randall P. E. Francisco W. A. Hansen M. J. Falise
o ISSUE	
o RESPONSE	
o RESOLUTION STATUS	
o GENERIC IMPLICATIONS	
- COMMITMENTS	S. W. Wilczek, Jr.
- SUMMARY	C. D. Terry

INTRODUCTION

- PROVIDE OVERVIEW OF ACTIONS
- FOCUS - "QUICK LOOK"/STARTUP ISSUES
- RESOLUTION OF SPECIFIC ISSUES
- ADDRESS PROGRAMMATIC CONCERNS
- INTEGRATION WITH RESTART ACTION PLAN AND NMP IMPROVEMENT PLAN
  - NEAR TERM AND LONGER RANGE IMPROVEMENTS
- OBJECTIVES
  - DESCRIBE ACTIONS
  - ADDRESS QUESTIONS
  - SUMMARIZE COMMITMENTS
  - IDENTIFY ADDITIONAL FOLLOWUP ACTIONS, IF REQUIRED

RESPONSE TO SSFI ISSUES

ISSUE 1.a:	TECHNICAL SPECIFICATION FOR CORE SPRAY
NMPC RESPONSE:	- REVISE TECH SPEC TO REQUIRE 2 SPARGER OPERATION - TEN HOUR SHUT DOWN REQUIREMENT - SINGLE SPARGER TECH SPEC BEING CONSIDERED FOR SUBMITTAL POST RESTART
RESOLUTION:	RESOLVED: TECH SPEC SUBMITTED BY DECEMBER 15, 1988
GENERIC IMPLICATIONS FOR STARTUP:	- GENERIC REVIEW OF LICENSING CHANGES TO BE COMPLETED BEFORE RESTART

ISSUE 1.b(1): CORE SPRAY PUMP NET POSITIVE SUCTION HEAD (NPSH)

NMPC RESPONSE:
- CALCULATIONS PERFORMED
- ASSUMES 0 PSIG TORUS PRESSURE
- ASSUMES 140°F TORUS WATER TEMPERATURE
- NPSH AVAILABLE MEETS PUMP REQUIREMENTS

RESOLUTION:
- RESOLVED
- CALCULATIONS AVAILABLE FOR REVIEW

GENERIC IMPLICATIONS FOR STARTUP:
- OTHER PUMPS WHICH TAKE SUCTION FROM TORUS
- WILL VERIFY SUFFICIENT NPSH AVAILABLE FOR CONTAINMENT SPRAY PUMPS BEFORE SYSTEM DECLARED OPERABLE

ISSUE 1.b(2): INTERACTION EFFECT OF PUMP SUCTION SPACING ON VORTEXING

NMPC RESPONSE:

- CALCULATIONS PERFORMED
- INTERACTION INSIGNIFICANT
- MINOR VORTEXING FOR SINGLE PUMP OPERATION
- WILL NOT AFFECT PUMP OR SYSTEM OPERATION

RESOLUTION:

- RESOLVED
- CALCULATIONS AVAILABLE FOR REVIEW

GENERIC IMPLICATIONS FOR STARTUP :

- OTHER PUMPS WHICH TAKE SUCTION FROM TORUS
- WILL REVIEW CONTAINMENT SPRAY PUMPS FOR VORTEX EFFECTS BEFORE SYSTEM DECLARED OPERABLE

ISSUE 1.b(3):		CORE SPRAY SYSTEM RESISTANCE CURVES DID NOT ACCOUNT FOR ALL COMPONENTS
NMPC RESPONSE:	-	CALCULATIONS PERFORMED
	-	ALL COMPONENTS INCLUDED
	-	DEMONSTRATE SUFFICIENT CORE SPRAY FLOW TO MEET APPENDIX K REQUIREMENT
RESOLUTION:	-	RESOLVED
		CALCULATIONS AVAILABLE FOR REVIEW
GENERIC IMPLICATIONS FOR STARTUP :	-	NONE
	-	SYSTEM ADEQUATE AS DESIGNED

<u>ISSUE 1.b(4)</u>	CORE SPRAY PUMP CURVES NOT CONTROLLED OR VALIDATED BY FULL RANGE TESTING
<u>NMPC RESPONSE:</u>	- CORE SPRAY PUMP CURVES TO BE ISSUED IN CONTROLLED MANNER - ADD CURVES TO CONFIGURATION MANAGEMENT SYSTEM - VALIDATE PUMPS MEET CURVES AT SEVERAL FLOW RATES - REVISE POST MAINTENANCE TESTING REQUIREMENTS
<u>RESOLUTION:</u>	- RESOLVED - VALIDATE CURVES BY TESTING - CONTROL CURVES - VALIDATE AFTER MAJOR MAINTENANCE
<u>GENERIC IMPLICATIONS FOR STARTUP :</u>	- CONTROL PUMP CURVES FOR ALL SAFETY SYSTEMS - CHANGE PROCEDURES TO REQUIRE VALIDATION OF PUMP PERFORMANCE AFTER MAJOR MAINTENANCE - TEST EFFECTED PUMPS

ISSUE 1.b(5):		PARTIAL CORE SPRAY FLOW DIVERSION THROUGH PUMP DISCHARGE RELIEF VALVE BEFORE RECLOSING
NMPC RESPONSE:	-	CALCULATIONS PERFORMED
	-	DEMONSTRATE SUFFICIENT CORE SPRAY FLOW TO MEET APPENDIX K REQUIREMENTS
RESOLUTION:	-	RESOLVED
	-	CALCULATIONS AVAILABLE FOR REVIEW
GENERIC IMPLICATIONS FOR STARTUP :	-	NONE
	-	SYSTEM ADEQUATE AS DESIGNED

ISSUE 1.c(1): CORE SPRAY LOW SUCTION AND LOW DISCHARGE PRESSURE ALARMS

- SETPOINTS - ALARMS OCCUR DURING SYSTEM OPERATION
- ALARM RESPONSE - SECURE PUMPS REQUIRED FOR CORE COOLING

NMPC RESPONSE:

- OPERATING PROCEDURES HAD CAUTIONS
- LOW SUCTION PRESSURE ALARM
  - LOWER SETPOINT
  - REVISE ALARM RESPONSE - SURVEILLANCE/LOCA
- LOW DISCHARGE PRESSURE ALARM
  - LOWER SETPOINT

RESOLUTION:

- RESOLVED
- ALARM SETPOINTS REVISED BEFORE SYSTEM DECLARED OPERABLE
- OPERATOR RESPONSE PROCEDURE REVISED BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP : - NONE

ISSUE 1.c(2) — CORE SPRAY STRAINER HIGH DELTA P ALARM

- SETPOINTS - ALARMS OCCUR DURING SYSTEM OPERATION
- ALARM RESPONSE - SECURE PUMPS REQUIRED FOR CORE COOLING

NMPC RESPONSE

- CALCULATIONS PERFORMED
- ALARM WILL NOT OCCUR AT ANTICIPATED FLOWS UNLESS STRAINER CLOGGED
- OPERATING PROCEDURE HAD CAUTIONS
- REVISE ALARM RESPONSE - SURVEILLANCE/LOCA

RESOLUTION:

- RESOLVED
- CALCULATIONS AVAILABLE FOR REVIEW
- OPERATOR RESPONSE PROCEDURE REVISED BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP :

- NONE

ISSUE 1.c(3) CORE SPRAY HIGH PRESSURE ALARM

- SETPOINT - ALARM WOULD OCCUR ON RELIEF VALVE FAILURE
- ALARM RESPONSE - SECURE PUMPS REQUIRED FOR CORE COOLING

NMPC RESPONSE:

- ALARM SETPOINT ABOVE SHUT OFF HEAD OF PUMPS
- ALARM SETPOINT TO BE REVISED
- ALARM DETECTS RELIEF VALVE FAILURE
- PROTECTS PUMP FROM OVERHEATING
- REVISE ALARM RESPONSE TO ADD PROVISION TO RESTART PUMPS

RESOLUTION:

- RESOLVED
- ALARM RESPONSE WILL BE REVISED BEFORE SYSTEM DECLARED OPERABLE
- ALARM SETPOINT REVISED BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP :

- REVIEW OTHER SAFETY SYSTEMS TO ENSURE APPROPRIATE ALARM RESPONSE AND ALARM SETPOINTS BEFORE SYSTEM DECLARED OPERABLE

ISSUE 1.D(1):		TORUS FILLING PROCEDURE NOT APPROPRIATE WHEN CORE SPRAY SYSTEM INITIATED
NMPC RESPONSE:	-	PROCEDURES TO BE REVISED
	-	NO PREVIOUS VALIDATION AND VERIFICATION OF OPs ASSOCIATED WITH EOPs
	-	VALIDATION AND VERIFICATION OF THESE OPs HAS NOW BEEN PERFORMED
RESOLUTION:	-	RESOLVED
	-	REVISE PROCEDURES
GENERIC IMPLICATIONS FOR STARTUP:	-	NONE

ISSUE 1.d(2): NPSH AND VORTEX GRAPHS NOT ADEQUATELY LABELLED

NMPC RESPONSE: - RELABEL GRAPHS

RESOLUTION: - RESOLVED

- GRAPHS RELABELLED

GENERIC IMPLICATIONS FOR STARTUP : - NONE

ISSUE 1.D(3):		LIMITATIONS OF RPV LEVEL INDICATION DID NOT INCLUDE INSTRUMENT WHICH SHARED CORE SPRAY TAP
NMPC RESPONSE:	-	OPERATORS HAD BEEN CORRECTLY TRAINED
	-	PROCEDURE WILL BE REVISED
RESOLUTION:	-	RESOLVED
	-	PROCEDURE WILL BE REVISED BEFORE STARTUP
GENERIC IMPLICATIONS FOR STARTUP:	-	NONE

ISSUE 1.e(1): CONDENSATE AND BOOSTER PUMP SET WOULD NOT PROVIDE SPECIFIED FLOW AT 450 PSIG REACTOR PRESSURE

NMPC RESPONSE:

- HPCI OPERABLE ABOVE 110 PSIG
- CALCULATIONS PERFORMED
- SPECIFIED FLOW CAN BE PROVIDED AT 337 PSIG
- REVISE TECH SPEC BASES TO 337 PSIG

RESOLUTION:

- RESOLVED
- TECH SPEC BASES REVISION WILL BE SUBMITTED TO NRC BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE 1.e(2): NO ANALYSES TO DEMONSTRATE AVAILABILITY OF ELECTRIC POWER FROM BENNETTS BRIDGE HYDRO

- ADS COULD INITIATE BEFORE HPCI/FEEDWATER SYSTEM WOULD BE AVAILABLE

NMPC RESPONSE:

- LICENSING BASES INDICATE HPCI IS NOT AVAILABLE DURING LOSS OF OFF-SITE POWER
- HPCI NOT USED IN ACCIDENT ANALYSIS
- REVISE FSAR FOR CLARITY

RESOLUTION:

- RESOLVED
- PERFORM EVALUATION TO CHANGE FSAR
- FSAR TO BE CLARIFIED AT NEXT UPDATE

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE 1.e(3): NO ANALYSES TO DEMONSTRATE ADEQUATE TRANSFER OF WATER FROM CONDENSATE STORAGE TO HOTWELL WITHOUT VACUUM

NMPC RESPONSE:
- CALCULATIONS PERFORMED
- ADEQUATE TRANSFER IS DEMONSTRATED

RESOLUTION:
- RESOLVED
- CALCULATIONS AVAILABLE FOR REVIEW

GENERIC IMPLICATIONS FOR STARTUP :
- NONE
- SYSTEM ADEQUATE AS DESIGNED

ISSUE 1.e(4):

- HPCI/FEEDWATER PUMP CURVES NOT CONTROLLED
- SURVEILLANCE LIMITED TO MOTOR DRIVEN FEEDWATER PUMPS
- FAILED TO REFLECT CHANGED IMPELLERS

NMPC RESPONSE:

- HPCI/FEEDWATER PUMP CURVES WILL BE ISSUED IN CONTROLLED MANNER (INCLUDING CONDENSATE AND BOOSTER)
- ADD CURVES TO CONFIGURATION MANAGEMENT SYSTEM
- VALIDATE CURVES AT SEVERAL FLOW RATES
- REVISE POST MAINTENANCE TESTING REQUIREMENTS TO INCLUDE VALIDATION AFTER MAJOR MAINTENANCE
- ADD SURVEILLANCE REQUIREMENTS FOR CONDENSATE AND BOOSTER PUMPS
- PERFORM SURVEILLANCE OF MOTOR DRIVEN FEEDWATER PUMPS AS DONE PRESENTLY

ISSUE 1.E(4): (CONTINUED)

RESOLUTION: - RESOLVED

- VALIDATE CURVES BY TESTING
- CONTROL CURVES
- VALIDATE AFTER MAJOR MAINTENANCE
- ADD SURVEILLANCE REQUIREMENTS FOR CONDENSATE AND BOOSTER PUMPS

GENERIC IMPLICATIONS FOR STARTUP: - SEE ISSUE 1.B(4)

ISSUE 1.f: CORE SPRAY "KEEP FULL" SYSTEM MAY NOT PREVENT WATER HAMMER DURING LOCA CONDITIONS DUE TO SECTIONS OF EMPTY PIPE

NMPC RESPONSE:

- OPERATING/TESTING HISTORY DOES NOT INDICATE SIGNIFICANT WATER HAMMER CONCERN
- WILL PERFORM SPECIAL TEST TO STARTUP SYSTEM WITH SURVEILLANCE LINE CLOSED
- SIMILAR TO STARTUP DURING LOCA
- VERIFY NO SIGNIFICANT WATER HAMMER

RESOLUTION:

- RESOLVED
- TESTING TO BE PERFORMED BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE 1.g: VALVE 30-10 MAY NOT BE SUITABLE FOR OPERATION DUE TO FURMANITE REPAIR

NMPC RESPONSE:

- ENGINEERING EVALUATION OF VALVE CONDITION
- REPAIR OR REPLACE IF NECESSARY
- PREPARE ENGINEERING SPECIFICATION FOR FURMANITE REPAIRS

RESOLUTION:

- RESOLVED
- VALVE WILL BE EVALUATED
- VALVE WILL BE REPAIRED OR REPLACED IF NECESSARY
- BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP:

- ENGINEERING SPECIFICATION BEFORE NEXT USE OF FURMANITE
- WILL REVIEW USE OF FURMANITE ON OTHER S.R. VALVES BEFORE SYSTEM DECLARED OPERABLE

ISSUE 1.h: RANGE OF CORE SPRAY FLOW INDICATION NOT ADEQUATE FOR RANGE OF EXPECTED FLOWS

NMPC RESPONSE:

- INSTRUMENT RANGE SUFFICIENT FOR REQUIRED FLOWS
- INSTRUMENT RANGE WILL BE INCREASED TO COVER EXPECTED FLOWS

RESOLUTION:

- RESOLVED
- INSTRUMENT RANGE WILL BE INCREASED BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE 1.i: MOTOR DRIVEN FEEDWATER PUMPS NOT DESIGNED FOR FREQUENT STARTING AS MAY BE REQUIRED BY REACTOR LEVEL CONTROL MOD AND OPERATING PROCEDURES

NMPC RESPONSE:

- REQUIRES HPCI SIGNAL
- FAILURE OF BOTH FLOW CONTROL VALVES
- PROCEDURE CHANGES MADE FOR OPERATOR TO TAKE MANUAL CONTROL OF FLOW CONTROL VALVE
- MANUAL CONTROL CAN BE ASSUMED BEFORE PUMP CYCLING OCCURS

RESOLUTION:

- RESOLVED
- PROCEDURE CHANGES MADE BEFORE SYSTEM DECLARED OPERABLE

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE 2.A:	INADEQUATE COLLECTION, REVIEW AND ACCEPTANCE OF SURVEILLANCE DATA		
NMPC RESPONSE:	-	EXAMPLES CITED BELIEVED TO BE ISOLATED	
	-	SAMPLE OTHER SURVEILLANCE RECORDS	
RESOLUTION:	-	PERFORM SAMPLING OF SURVEILLANCE RECORDS BY STARTUP	
	-	TAKE ADDITIONAL ACTION BASED ON SAMPLE RESULTS	
GENERIC IMPLICATIONS FOR STARTUP:	-	NONE	

ISSUE 2.B: INTERNAL RESPONSE TO INDUSTRY ACTION APPEARS UNTIMELY AND INSUFFICIENTLY RESEARCHED

NMPC RESPONSE:

- INFORMAL PROGRAM BEFORE 1980
- INSPECTION EXAMPLES PRE-1980
- PROGRAM HAS BEEN STRENGTHENED
- ITEMS ARE PRIORITIZED UPON RECEIPT BY SRO
- ACCELERATED PROGRAM IN PLACE TO REDUCE BACKLOG

RESOLUTION:

- REDUCE BACKLOG
- ADDRESS START-UP RELATED ITEMS

GENERIC IMPLICATIONS FOR STARTUP:

- ADDRESS START-UP RELATED ITEMS

ISSUE 2.c:	INVESTIGATION INTO PROBLEMS AND ASSESSMENTS OF REPORTABILITY IN ACCORDANCE WITH 10CFR50.72 AND 10CFR50.73 DID NOT ALWAYS APPEAR TO BE ADEQUATE
NMPC RESPONSE:	- NOT INDICATIVE OF GENERIC PROBLEM - SALP INDICATES CONSERVATIVE REPORTING
RESOLUTION:	- RESOLVED
GENERIC IMPLICATIONS FOR STARTUP:	- NONE

ISSUE 2.D: WRITTEN PERIODIC MAINTENANCE PROGRAM DID NOT INCLUDE

- ALL VENDOR RECOMMENDED MAINTENANCE
- ACTUAL PERIODIC MAINTENANCE BEING PERFORMED

NMPC RESPONSE:

- PLANT IS WELL MAINTAINED (OPERATING RECORD)
- PERIODIC MAINTENANCE NOT ALL DOCUMENTED
- PERIODIC MAINTENANCE PROGRAM BEING UPGRADED
  - ° IMPROVED DOCUMENTATION
  - ° VENDOR MANUAL REVIEW PERFORMED

RESOLUTION:

- ONGOING

GENERIC IMPLICATIONS FOR STARTUP:

- REVIEW DISPOSITIONS FOR VENDOR RECOMMENDATIONS NOT INCORPORATED IN PROCEDURES

ISSUE 2.e: NON-LICENSED OPERATOR TRAINING LACKED TOPIC ON LOCAL VALVE POSITION DETERMINATION

NMPC RESPONSE: - TRAINING WILL BE ADDED

RESOLUTION: - RESOLVED

- TRAINING WILL BE ADDED

GENERIC IMPLICATIONS FOR STARTUP: - LESSONS LEARNED PROGRAM AT UNIT 1 BEING STRENGTHENED AS PART OF NMP IMPROVEMENT PROGRAM

ISSUE 2.F: QUALITY ASSURANCE AUDIT PROGRAM CONCENTRATED ON PROGRAMMATIC RATHER THAN IDENTIFYING SIGNIFICANT TECHNICAL ISSUES

NMPC RESPONSE:

- NMPC ACTIONS SINCE EARLY 1988

  - ° QUALITY ASSURANCE AUDIT PROGRAM RECENTLY REVISED TO BE PERFORMANCE BASED RATHER THAN COMPLIANCE BASED

  - ° INITIAL TRAINING IN PERFORMANCE BASED AUDITS COMPLETED

  - ° INCREASED ASSIGNMENT OF TECHNICAL SPECIALISTS TO PERFORM AUDITS

  - ° FILL OPEN AUDITOR POSITIONS WITH SPECIALISTS

RESOLUTION: - ONGOING

GENERIC IMPLICATIONS FOR STARTUP: - NONE

ISSUE 2.G: MATERIAL DEFICIENCIES IDENTIFED BY TEAM NOT PREVIOUSLY IDENTIFIED BY NMPC

NMPC RESPONSE:

- SPECIFIC ITEMS BEING ADDRESSED
- NMPC MANAGEMENT INCREASING EMPHASIS FOR PERSONNEL TO IDENTIFY DEFICIENCIES
- ADDITIONAL TRAINING WILL BE PROVIDED AS NECESSARY TO "HIGHLIGHT" DEFICIENT ITEMS
- STAFFING SYSTEM ENGINEERS - ADD OWNERSHIP

RESOLUTION:

- RESOLVED
- NMPC WILL BE WALKING DOWN ALL SAFETY RELATED SYSTEMS BEFORE SYSTEMS ARE DECLARED OPERABLE
- NMPC HAS UNDERTAKEN WALK-DOWN OF ALL SAFETY RELATED LARGE BORE PIPE SUPPORTS

GENERIC IMPLICATIONS FOR STARTUP:

- NONE

ISSUE: REVIEW OF OTHER SYSTEMS

- CALCULATIONS TO SUPPORT SSFI SHOW ADEQUATE ORIGINAL DESIGN

NMPC RESPONSE:

- REVIEW/CATEGORIZE WEAK AREAS IDENTIFIED BY SSFI (E.G. PUMP CURVES, NPSH, VORTEX)

- IDENTIFIED BROADER CONCERNS AND APPLICABILITY TO OTHER SYSTEMS (E.G. CONTAINMENT SPRAY)

- NMPC STRENGTHENING CONTROL OF SURVEILLANCE REQUIREMENTS

- CONTINUE PLANS FOR DESIGN BASIS RECONSTITUTION PROGRAM

    - PRIORITIZE SYSTEMS

    - DEVELOP SYSTEM DESIGN BASIS DOCUMENTS (SDBDs)

    - USE NMPC PERSONNEL AS LEADS SUPPLEMENTED BY CONSULTANTS

    - PERFORM SSFI TYPE REVIEW AFTER INDIVIDUAL SYSTEM DESIGN BASIS IS RECONSTITUTED

    - PART OF NMP1 IMPROVEMENT PROGRAM

QUICK LOOK SSFI

SUMMARY OF FUTURE COMMITMENTS

1.	SUBMIT REVISED TECH SPEC TO REQUIRE TWO SPARGER OPERATION (1.A)	12/15/88
2.	GENERIC REVIEW OF TECH SPEC CHANGES (1.A)	BEFORE STARTUP
3.	VERIFY SUFFICIENT NPSH FOR CONTAINMENT SPRAY (1.B(1))	BEFORE SYSTEM IS OPERABLE
4.	VERIFY VORTEX EFFECTS FOR CONTAINMENT SPRAY (1.B(2))	BEFORE SYSTEM IS OPERABLE
5.	VALIDATE CORE SPRAY PUMP CURVES VIA TESTING (1.B(4))	BEFORE SYSTEM IS OPERABLE
6.	CONTROL CORE SPRAY PUMP HEAD CURVES (1.B(4))	BEFORE SYSTEM IS OPERABLE
7.	REVISE POST MAINTENANCE TEST REQUIREMENTS TO VALIDATE PUMP HEAD CURVES AFTER MAJOR MAINTENANCE (1.B(4))	BEFORE STARTUP
8.	REVISE CORE SPRAY SUCTION ALARM SETPOINTS (1.C(1))	BEFORE SYSTEM IS OPERABLE
9.	REVISE CORE SPRAY OPERATOR RESPONSE PROCEDURE (1.C(1))	BEFORE SYSTEM IS OPERABLE

SUMMARY OF COMMITMENTS (CONTINUED)

10.	REVISE CORE SPRAY OPERATOR RESPONSE PROCEDURE (1.c(2))	BEFORE SYSTEM IS OPERABLE
11.	REVISE CORE SPRAY HIGH PRESSURE ALARM SETPOINTS (1.c(3))	BEFORE SYSTEM IS OPERABLE
12.	REVISE CORE SPRAY OPERATOR RESPONSE PROCEDURE (1.c(3))	BEFORE SYSTEM IS OPERABLE
13.	REVIEW ALARM RESPONSES/SETPOINTS FOR OTHER SAFETY SYSTEMS (1.c(3))	BEFORE SYSTEM IS OPERABLE
14.	REVISE PROCEDURES (1.D(1))	BEFORE SYSTEM IS OPERABLE
15.	REVISE PROCEDURE TO ADDRESS RPV LEVEL INDICATION (1.D(3))	BEFORE STARTUP
16.	REVISE TECH SPEC BASES FOR HPCI (1.E(1))	BEFORE SYSTEM IS OPERABLE
17.	PERFORM EVALUATION TO REVISE FSAR TO CLARIFY BENNETTS BRIDGE/HPCI AVAILABILITY (1.E(2))	BEFORE STARTUP
18.	VALIDATE HPCI PUMP CURVES VIA TESTING (1.E(4))	DURING STARTUP
19.	CONTROL HPCI PUMP HEAD CURVES (1.E(4))	BEFORE SYSTEM IS OPERABLE

SUMMARY OF COMMITMENTS (CONTINUED)

20.	REVISE POST MAINTENANCE TEST REQUIREMENTS TO VALIDATE PUMP HEAD CURVE AFTER MAJOR MAINTENANCE (1.E(4))	BEFORE STARTUP
21.	ADD SURVEILLANCE REQUIREMENTS FOR CONDENSATE AND BOOSTER PUMPS (1.E(4))	BEFORE SYSTEM IS OPERABLE
22.	PERFORM A SPECIAL TEST TO VERIFY NO WATER HAMMER IN CORE SPRAY SYSTEM (1.F)	BEFORE SYSTEM IS OPERABLE
23.	EVALUATE FEEDWATER VALVE REPAIR WITH FURMANITE/RESOLVE IF UNACCEPTABLE (1.G)	BEFORE SYSTEM IS OPERABLE
24.	DEVELOP AN ENGINEERING SPECIFICATION FOR FURMANITE USE (1.G)	BEFORE NEXT USE OF FURMANITE
25.	REVIEW USE OF FURMANITE ON OTHER SR VALVES (1.G)	BEFORE SYSTEM IS OPERABLE
26.	REVISE CORE SPRAY FLOW INDICATION INSTRUMENT RANGE (1.H)	BEFORE SYSTEM IS OPERABLE
27.	REVISE FEEDWATER PUMP PROCEDURE TO ADDRESS FREQUENT STARTING (1.I)	BEFORE SYSTEM IS OPERABLE

SUMMARY OF COMMITMENTS (CONTINUED)

28.	PERFORM SAMPLING OF SURVEILLANCE RECORDS/TAKE ADDITIONAL ACTION AS REQUIRED	BEFORE STARTUP
29.	REDUCE BACKLOG OF OEA ITEMS (2.B)	ONGOING
30.	ADDRESS STARTUP RELATED ISSUES (2.B)	BEFORE STARTUP
31.	REVIEW ADDITIONAL VENDOR MAINTENANCE RECOMMENDATIONS (2.D)	BEFORE STARTUP
32.	TRAINING ON LOCAL VALVE POSITION DETERMINATION (2.E)	BEFORE STARTUP
33.	STRENGTHEN UNIT 1 LESSONS LEARNED PROGRAM (2.E)	NMP IMPROVEMENT PROGRAM
34.	WALK-DOWN ALL SAFETY RELATED SYSTEMS (2.G)	BEFORE SYSTEM IS OPERABLE
35.	WALK-DOWN ALL SAFETY RELATED LARGE BORE PIPE SUPPORTS (2.G)	ISI PROGRAM
36.	RESPONSE TO QUICK LOOK LETTER	12/15/88

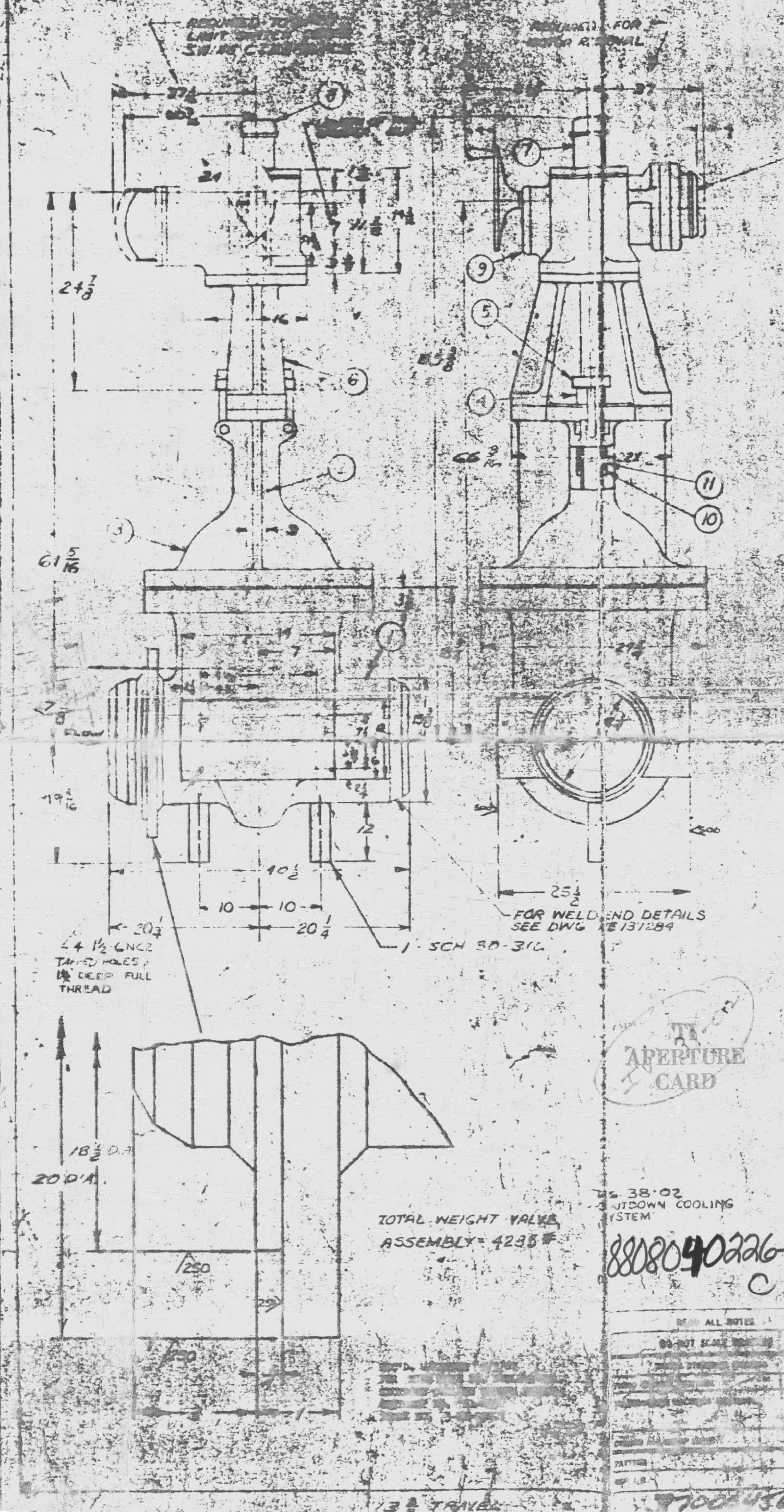
SUMMARY

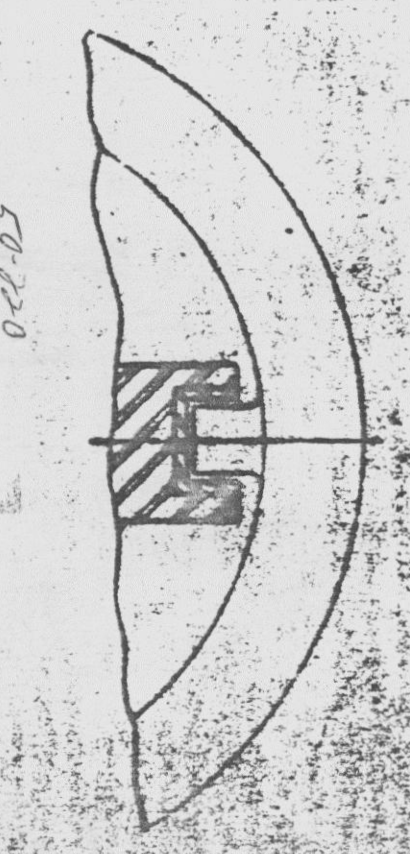
- THOROUGH REVIEW OF SSFI ISSUES
  - "QUICK LOOK" LETTER
  - NMPC SCREENING
  - DETERMINATION OF STARTUP AND LONGER TERM ACTIONS
- BROADER CONCERNS ADDRESSED, E.G.
  - CONTROL OF SURVEILLANCE REQUIREMENTS
  - SAFETY RELATED PUMPING SYSTEMS
  - REVIEW OF LICENSING BASIS
  - BEFORE RESTART
- INTEGRATION INTO NMP1 RESTART ACTION PLAN
  - PART OF PLAN
  - INTEGRATED SCHEDULE
  - ASSESSMENT OF TOTAL WORKLOAD
- LONGER RANGE PROGRAM
  - DESIGN BASE UPGRADE - ADDITIONAL SYSTEM REVIEWS
  - IMPROVED PERSONNEL CAPABILITY - EXPERIENCED PERSONNEL AND TRAINING

MEETING ATTENDEES

NAME	ORGANIZATION
Mary F. Haughey	NRC
Robert A. Capra	NRC
Wayne Hodges	NRC
S. W. Wilczek, Jr.	Niagara Mohawk
C. D. Terry	Niagara Mohawk
P. E. Francisco	Niagara Mohawk
Lee Klosowski	Niagara Mohawk
Jim Dyer	NRC
Charles J. Haughney	NRC
J. R. Johnson	NRC
R. A. Benedict	NRC
Bruce A. Boger	NRC
W. A. Hansen	Niagara Mohawk
G. D. Wilson	Niagara Mohawk
Hank George	TENERA
Robert B. Burtch, Jr.	Niagara Mohawk
Mark Wetterhahn	Conner & Wetterhahn
J. Phillip Jordan	Swidler & Berlin
John G. Roberts	NYS - PSC
Robert Randall	Niagara Mohawk
Michael J. Falise	Niagara Mohawk
Frank Orr	NRC
John Johnson	MPR Assoc. Inc.
Ashok Thadani	NRC
Steven Varga	NRC

ENCLOSURE 3





Docket # 50-220
Control # 8808040226
Date 7/26/88 of Document
REGULATORY DOCKET FILE

LET	DESCRIPTION			
1	REVISED PER CUSTOMER APPROVED PRINT			

11	PACKING	3	JM-338
10	STUFF. BOX WSHR.	1	A276 316.
3	LIMIT[illegible] UNIT	1	SMB 3-100
[illegible]	PIPE CAP	1	M.I.
[illegible]	STEM [illegible]WER	1	ASTM A53-GR.A
6	YOKE	1	FAB. STEEL
5	[illegible] FLANGE	1	ASTM. A105-GR 2
4	FOLLOWER NOSE STELLITE #6 FACED	1	ASTM. A276-316
	PACKING COLLAR	1.	ASTM. A276-316
	STUD NUTS		ASTM A194-8
	BODY STUDS		ASTM A193-B8
3	BONNET FLEX[illegible] B & B JOINT	1	ASTM A351 CF8M
2	STEM	1.	ASTM A276-316
	GATE STELLITE 6 FACED SEAT & GUIDE SLOT	1	ASTM A351 CF8M
	SEAT RINGS STELLITE #6 FACED	2	ASTM A276 316
1	BODY FLEXITALLIC B & B JOINT	1	ASTM. A351 CF8M
NO.	NAME	REQ.	MATL. SPECIFICATION

8808040226-03
C

APERTURE CARD

READ ALL NOTES
DO NOT SCALE DRAWING

CHAPMAN DIVISION — CRANE CO.
INDIAN ORCHARD, MASS.

[illegible] 900 BOLTED BONNET [illegible]
GATE VALVE WITH FLEXITALLIC [illegible]
BONNET JOINT & SMB-3 LIMIT[illegible]

PB-132371

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