

ANDERSON GREENWOOD CROSBY
WRENTHAM, MASS.

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ENGINEERING PROCEDURE
TITLE: DESIGN SPECIFICATION

DS-6113, Revision 3

Yarway 5600 Series Welbond® Valves
Manually Operated Globe Type Stop Valves
1/2" through 2"
Intermediate Standard Class 1700



| | NAME | TITLE | SIGNATURE | DATE |
|-------------------|------------|--------------------------|--------------------|-----------|
| PREPARED BY: | D.W. Allen | Sr. Engr. | <i>D. W. Allen</i> | 06 Feb 02 |
| APPROVED BY: | C.R. Dowd | Nuclear Prod. Engr. Mgr. | <i>C. R. Dowd</i> | 06 Feb 02 |
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Flow Control

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CERTIFICATION

I, the undersigned, being a registered Professional Engineer competent in the applicable field of design and related nuclear power plant requirements relative to this Design Specification, certify to that to the best of my knowledge and belief it is correct and complete with respect to the Design and Service Conditions given and provides a complete basis for construction in accordance with NCA-3250 and other applicable requirements to the ASME Boiler and Pressure Vessel Code, Section III, Division I, 1986 Edition (No Addenda) subject to reconciliation of this Design Specification with the Owner's Design Specification as required by NCA-3256(b).

Revision 3



Certified by:

David O. Thomas

Registered Professional Engineer
Commonwealth of Massachusetts
Registration No. 33747

Date: 14 Aug 2009

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| REVISION NUMBER | REVISION DATE | REASON FOR REVISION |
|-----------------|--------------------------------|---------------------|
| -0 | 06 Feb 02 | |
| -1 | DWA 10 Apr 02 CRD 11 Apr 02 | 10 Apr 02 |
| -2 | MGT 30 OCT 07 CRD 10 Oct 07 | 03 Oct 07 |
| -3 | Jas 3 Aug 09 CRD 17 Sep 09 | 03 Aug 09 |

Revised drawing revision level in Paragraph 11.

Revised drawing revision level in Paragraph 11.

Revised drawing revision level in Paragraph 11, deleted "E" from AMS material specification in Paragraphs 3.5.2 and 4.1.1 b).

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1. Scope

1.1 This design specification is prepared as permitted by NCA-3256(b) and defines the requirements for nuclear service globe valves, Class 1700 ANSI Rating, 2" nominal pipe size and smaller, Class 1 as defined in the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components, 1986 Edition with no Addenda. Valves supplied in accordance with this Design Specification shall have the ASME "N" symbol stamp.

1.2 Buyer's or Owner's Responsibility

1.2.1 The Owner or his Designee shall be responsible for reconciling Anderson Greenwood Crosby's Design Specification with the Design Specification for the facility using the product.

1.2.2 The Owner or his Designee shall be responsible for the installation of the valves.

1.2.3 The Buyer shall notify the Owner of 10CFR21 notification as identified under Paragraph 1.3.3

1.3 Anderson Greenwood Crosby Responsibility

1.3.1 Anderson Greenwood Crosby shall be responsible for designing, fabricating, testing and shipping the valves in full compliance with this specification including all codes, standards and documents referenced in Section 2.0.

1.3.2 Anderson Greenwood Crosby shall ensure that the materials of construction and the actual operability of the valves shall be compatible with the design operating conditions contained in this specification.

1.3.3 The requirements of 10CFR21 apply. In the event notification to the NRC is required, coincident notification shall be sent to the Buyer.

1.3.4 Anderson Greenwood Crosby shall be responsible for establishing, maintaining and documenting a Quality Assurance program in accordance with Section 13.0.

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2. Applicable Codes, Standards and Documents

All work to be performed under this Specification shall conform to the applicable portions of the following codes, standards and documents. Other editions or addenda of ASME Section II are allowed providing Anderson Greenwood Crosby certifies that the material meets or exceeds the requirement of the designated edition or addenda for design as required by NCA 1140, ASME Section III.

2.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1986 Edition with No Addenda

- a) Section II - Material Specifications
- b) Section III - Nuclear Power Plant Components (herein referred to as the Code)
- c) Section V - Non-destructive Examination
- d) Section IX - Welding and Brazing Qualifications

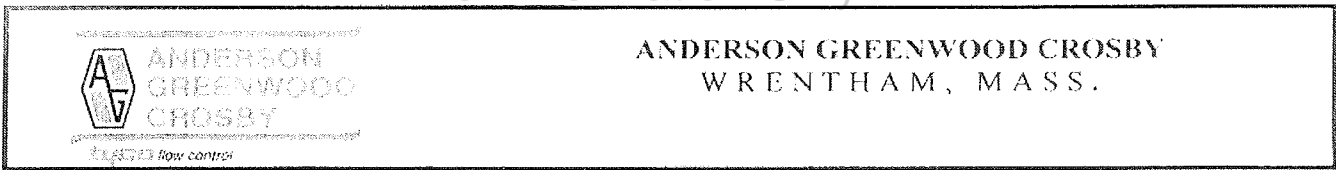
2.2 American National Standards Institute (ANSI)

- a) B16.11-1973 - Forged Steel Fittings, Socket-Welding and Threaded
- b) N45.2.2-1978 - Level C - Packaging, Shipping, Receiving, Storage and handling of Items for Nuclear Power Plants
- c) B16.34-1981 - Valves - flanged and buttwelding end
- d) ASME NQA-2-1989, Part 2.1 - Quality Assurance Requirements for Cleaning of Fluid System and Associated Components for Nuclear Power Plants
- e) ASME NQA-2, Part 2.2 - Quality Assurance Requirements for Packaging, Shipping, Receiving and Handling of Items for Nuclear Power Plants

2.3 Code of Federal Regulations

- a) 10CFR21 - Reporting of Defects and Noncompliance
- b) 10CFR50 Appendix B - Quality Assurance Criteria for Nuclear Power Plants

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3. Design Requirements

3.1 Definitions

3.1.1 Pressure Retaining Items

Pressure retaining items are defined as body, disc and backseat bushing.

3.1.2 Function of Valves

Globe valves shall be designed to prevent flow in either direction when in a closed position. However, the normal flow direction is under the seat.

3.1.3 Component Boundaries

Socket-welding valves are designed to be welded into the line with socket bore line diameters as specified in B16.11. The weld ends of the valves shall act as the component boundary.

3.2 Environmental Conditions

3.2.1 Determination of the suitability of the valves for environmental conditions including corrosion, erosion and radiation shall be the responsibility of the owner.

3.2.2 Plant and System Service Conditions

Determination of the suitability of the valves for plant and system operating conditions (commonly referred to as normal, upset, emergency and faulted) shall be the responsibility of the owner.

3.2.3 Design Service Limits and Load Combinations

The owner shall reconcile his design and service loads with the ratings established by Anderson Greenwood Crosby's design and seismic reports.

3.2.4 Overpressure Protection

Overpressure protection is the responsibility of the owner and rapid closing of a valve which may cause pressure increases for extremely short duration should be considered in service loading evaluation.

3.2.5 Test Loads

This specification does not consider test loads. The reconciliation under Paragraph 1.2.1 shall confirm that test loads are not a consideration.

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3. Design Requirements (Continued)

3.3 Design Operating Conditions

- 3.3.1 The specified globe valves provide on/off flow control. The contained fluid will be the water associated with a water-cooled, commercial nuclear power plant.
- 3.3.2 The design operating conditions shall not exceed the intermediate class pressure/temperature ratings derived from the tables in B16.34. The complete tabulation shall be listed in the design report. These non-listed pressure/temperature ratings shall be interpolated as provided for in NB-3543 of Section III and shall be limited to the metal design temperature for which stress intensity values are listed in Tables 1-1.0 of Section III as given below with the corresponding design pressure.

| Valve Body Material | Design Pressure, psig | Maximum Temperature |
|---------------------|-----------------------|---------------------|
| SA-105 | 3020 | 700°F |
| SA-182-F316 | 2350 | 800°F |

As provided in NB-3513 valve designs 4 inches and smaller are acceptable when they satisfy the design rules of NB-3513.1.

- 3.3.3 The valves shall be capable of operating during and after faulted loadings due to seismic forces acting simultaneously with the service loadings specified in this section without exceeding the primary stress limits of NB-3224.1 as allowed for Level C Service Limits. The valve assemblies shall have a natural frequency of 33 Hz or greater. Valve acceptability for these requirements shall be demonstrated by calculations converting seismic accelerations into equivalent loading plus dead weight using static analysis. A 1.0g dead weight loading shall be added to all seismic acceleration directions to provide for valve installation in any orientation.

3.3.3.1 Service Loadings

- a) Seismic - 6.5g simultaneously in three orthogonal axes
- b) Dead Weight 1.0g in all axes
- c) Temperature - 650°F
- d) Internal Pressure - rated valve pressure at the temperature specified in c) above
- e) Bending moment calculated using the conditions in NB-3655.2 based on Schedule 160 connecting pipe with material strength equal to the valve body at the temperature specified in c) above

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PRECISION flow control

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3. Design Requirements (Continued)

3.4 Design Life

Valves are suitable for a minimum design life of 40 years at the specified operating conditions, excluding items such as packings and gaskets.

3.5 Overall Valve Design

3.5.1 General

Globe stop valves are outside screw and yoke design, rising rotating stem and of the backseating type. Valves are of the bonnetless design with a one piece body.

3.5.2 Discs

Discs are solid AMS 5385 (Stellite 21) as permitted by NB-2121(C). -3

3.5.3 Seats

3.5.3.1 Seats are solid AMS 5387 (Stellite 6).

3.5.3.2 Seats are vacuum brazed to body in accordance with ASME Section III NB-4500.

3.5.4 Backseats

Valves are furnished with threaded in backseats.

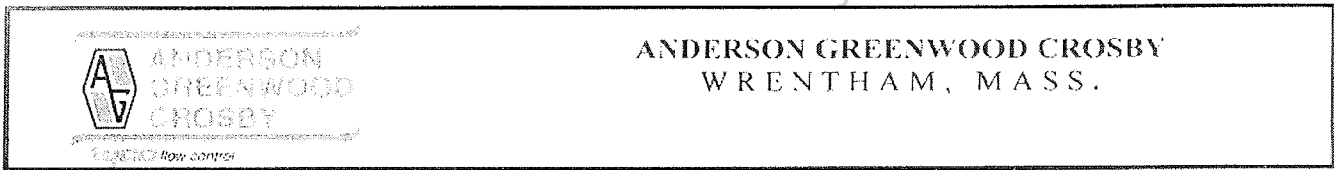
3.5.5 Stems

Stems are precipitation hardened stainless steel per ASME SA-564 Grade 630, Condition H1075 (17-4 PH)

3.6 Design Report

Design reports, in accordance with NB-3560 of the Code, shall be submitted to the owner or his Designee for review. Documentation of review shall be forwarded to Anderson Greenwood Crosby prior to shipment of the valves per Paragraph NCA-3260 of the Code.

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4. Materials

4.1 General

4.1.1 Materials for pressure retaining items shall be as follows:

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- a) Bodies: Carbon Steel Forged SA-105
Austenitic Stainless Steel Forged SA-182 Grade F316
- b) Discs: AMS 5385 (Stellite 21)
- c) Backseat bushing:
For SA-105 valves - ASME SA182 Grade F6A CL. 2
For SA-182 Grade F316 valves - ASME SA564 Grade 630

4.1.2 All other materials shall be as specified in outline drawings indicated in Section 11.

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4.1.3 Certified Material Test Reports (CMTR's) are furnished for body, disc, backseat bushing and stem. Material impact tests are not required.

4.2 Special Requirements

4.2.1 Annealing

Austenitic stainless steel materials shall be annealed by heating the materials to a temperature between 1900 and 2100°F. Minimum holding time at this temperature shall be one hour per inch of thickness or 30 minutes, whichever is greater. Following annealing, the material shall be rapidly cooled and shall comply with ASTM A262 Practice A or E for detecting susceptibility to Intergranular Attack. Austenitic stainless steel shall not be reheated above 800°F after solution annealing except for welding or brazing.

4.2.2 Precipitation Hardened Materials

The use of precipitation hardened materials shall be limited to ASME SA-564/ASTM A-564 Type 630 (17-4 PH). The material is initially cooled to room temperature, and then shall be aged for 4 hours at 1075°F. The material shall then be air or gas cooled to ambient temperature.

4.2.3 Normalizing

The SA-105 valve bodies shall be normalized after brazing for one hour per inch of thickness.

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5. Manufacturing Requirements

5.1 Valve Ends

Socketweld end bores shall be in accordance with ANSI B16.11.

5.2 Dimensions

5.2.1 End to End Dimensions

Nominal end to end dimensions shall be in accordance with the Anderson Greenwood Crosby valve outline drawing.

5.2.2 Minimum Wall Dimension

The body wall thickness, including the body neck, is designed to meet the ANSI B16.34 minimum wall as specified in NB-3542 to meet the design requirements of NB-3513.1.

6. Welding

6.1 Welding is limited to the disc seal weld. The Gas Tungsten Arc Welding Process is utilized.

6.1.1 Welding procedures and personnel are qualified in accordance with ASME Section IX and Section III NB-4000.

6.1.2 Base metal repairs by welding are prohibited.

7. Non-Destructive Examination

All pressure retaining materials for valves with inlet piping connections 2 inches nominal pipe size and less do not require non-destructive examination per NB-2510 of the Code. The disc seal weld shall be examined in accordance with NB-5000 by the solvent removable method.

8. Testing

8.1 Hydrostatic Tests

Prior to hydrostatic and seat leakage testing, valves shall be cleaned per ASME NQA-2-1989, Part 2.1.

8.1.1 Shell Test

All valves shall be hydrostatically shell tested in accordance with NB-6200 of the Code and ANSI B16.34.

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8. Testing (Continued)

8.1 Hydrostatic Tests (Continued)

8.1.2 Seat Leakage Test

Each valve is tested for leakage in the closed position. The hydrostatic seat leakage test pressure, equal to or greater than 1.1 times the 100°F pressure rating, is applied under the seat. The minimum length of the test shall be five minutes and seat leakage shall not exceed 2ml/hr of liquid per inch of nominal valve size. The backseat shall be tested for five minutes and leakage shall not exceed 10 ml/hr/nominal inch of valve size.

8.1.3 Functional Test

After completion of hydrostatic tests, all valves shall be stroked at least 3 times from the fully open to fully closed position, to demonstrate continued operability.

9. Inspections

9.1 Code Inspector

The qualifications, rights and duties of inspectors shall be in accordance with Section NCA-5000 of the Code. Hold points routinely include layout prior to assembly, hydrostatic testing and nameplate attachment. The Authorized Nuclear Inspector may designate additional hold points.

9.2 Buyer's Inspector

The Buyer's inspector shall have free access to the Seller's manufacturing facilities to inspect and report on the work in all phases of design, manufacture, examination and test. Witness points are provided for hydrostatic testing and final inspection prior to packaging.

10. Preparation for Delivery

10.1 General

Cleaning, painting and packaging shall be performed per ASME NQA-2, Part 2.2 and N45.2.2-1978, Level C.

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10. Preparation for Delivery (Continued)

10.2 Cleaning

- 10.2.1 Prior to hydrostatic tests, all valves shall be thoroughly cleaned internally and externally of oil, grease, scale, rust, chips, organize matter, loose particles and other foreign matter.
- 10.2.2 Final flushing of carbon steel valves shall be with water treated with a rust preventative compound. Final flushing of stainless steel valves shall be with demineralized water.
- 10.2.3 Drying shall be accomplished with the use of filtered dry air.

10.3 Valve Painting

- 10.3.1 All carbon and alloy steel surfaces shall be cleaned and painted in accordance with Anderson Greenwood Crosby standard painting procedure.
- 10.3.2 Stainless steel surfaces shall not be painted.

10.4 Marking and Identification

- 10.4.1 Each valve shall be marked and stamped in accordance with the Code and B16.34.
- 10.4.2 Nameplates shall be permanently attached to the yoke.

10.5 Packaging

- 10.5.1 Valve ends shall be closed with suitable non-metallic covers or plugs. The ends shall be sealed with pressure sensitive tape. Packaging materials will be such as not to injure the surface finish, material properties or metallurgical structure of the materials.
- 10.5.2 All valves shall be boxed or packaged to the requirements of ANSI N45.2.2 and NQA-2, par 2.2 (Level C) to protect against damage during shipment, storage and handling.
- 10.5.3 Installation, Operation and Maintenance Manuals will be attached to each valve.

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11. Drawings and Procedures

Anderson Greenwood Crosby Data Sheet Drawings DS-138-1000 Revision E and DS-138-1001 Revision D are part of this specification. Documents as required by Appendix A are to be submitted to the Buyer for approval.

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12. Reports and Records

All required reports and permanent record shall be submitted to the Buyer prior to or with shipment of the valves. The Buyer shall forward these to the Owner for permanent retention.

- a) Design reports including the seismic qualification analysis in accordance with Section NB of the Code for Class 1 valves
- b) Data report for Class 1 valves in accordance with Section NCA of the Code.
- c) Certified Materials Test Reports (CMTR's) for the body, disc, backseat bushing, welding and brazing materials in accordance with Section NB of the Code. CMTR's for the stem will be provided in accordance with the material specification
- d) Results of all non-destructive examinations
- e) Brazing and heat treatment time-temperature reports
- f) Wall thickness measurement report
- g) Hydrostatic, seat leakage and functional test report
- h) Statement of Conformance indicating that Anderson Greenwood Crosby has met all the requirements of this design specification
- i) Cleaning Certificate of Conformance

13. Quality Assurance Requirements

13.1 Quality Program

13.1.1 Anderson Greenwood Crosby maintains a Quality Assurance Program which is in accordance with Article NCA-4000 of the Code and this Specification.

13.1.2 Anderson Greenwood Crosby's Quality Assurance Program is as described in its Quality Assurance manual.

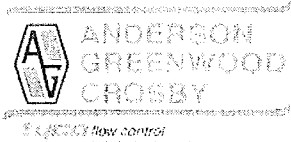
13.1.3 Copies of Anderson Greenwood Crosby's Quality Assurance manual are available upon request.

13.2 Safety Classification

13.2.1 The pressure retaining items listed in Paragraph 3.1.1 are supplied as safety related.

13.3.2 The valve stem is supplied as safety related.

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13. Quality Assurance Requirements (Continued)

13.3 Reporting of Defects and Non-Compliance

Anderson Greenwood Crosby shall be responsible for complying with the requirements of 10CFR21 regarding reporting of defects and non-compliance. In the event of a potentially reportable condition, Anderson Greenwood Crosby will contact the buyer to determine if a significant safety hazard exists. Copies of all documents and reports sent to the NRC shall be transmitted to the Buyer on the same day.

13.4 Certificate of Authorization

Anderson Greenwood Crosby holds N and NPT Certificates of Authorization issued by ASME and shall notify the Buyer of any changes to its certification, including revocation, revision or renewal.

13.5 Identification of Enforcement Authorities

It shall be the responsibility of the Owner or his Designee to file the data reports with enforcement authorities.

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APPENDIX A
PROCEDURES

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EXCELLENCE IN FLOW CONTROL

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The following procedures shall be submitted to the Buyer for approval:

- 1) Age Hardening Procedure (Disc)
- 2A) Brazing Procedure (F-316)
- 2B) Brazing Procedure (SA-105)
- 3) Cleaning Procedure
- 4) Coating Procedure
- 5) Hydrostatic Test Procedure
- 6) Liquid Penetrant Examination Procedure
- 7) Minimum Wall Procedure
- 8) Packaging and Shipping Procedure
- 9A) Welding Procedure Specification
- 9B) Welding Procedure Qualification
- 10) Quality Assurance Manual (Nuclear)

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