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Technical Specifications (In-Cash Procurement)

TECHNICAL SPECIFICATION FOR CWS BUTTERFLY VALVES

This purpose of this document is to support the PR release, the appendix A will be integrated in next version.

TECHNICAL SPECIFICATION FOR CWS BUTTERFLY VALVES

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1. Scope of Work

This specification defines the material, fabrication, inspection, examination, and testing requirements for butterfly valve used in the CWS under procurement from the year 2018 to 2021. The bill of materials of valves and actuators will be provided in the Appendix, but the total number of valves is subject to change with the finalization of design for each subsystem of CWS.

The valves are pressure accessories in accordance with DIRECTIVE 2014/68/EU [Ref.[2.1]]. All the CWS valves in this technical specification are not classified for ESPN classification [2.55] [2.56]. The Supplier shall design, fabricate, assemble, test and deliver the valves and actuators in accordance with this technical specification including required accessories, spare parts, special tools, and documentation to the IO.

2. Reference Codes, Standards, and Requirements

The revisions of the following codes, standards, and regulatory requirements that apply to this specification are provided for below in the "Codes and Standards". The documents provided for in the "General References" are documents that will be provided by the IO to the Supplier as requirements that shall be respected during the planning and execution of the Specification. Any conflict between requirements shall be brought to the attention of IO for resolution.

General References

[2.1] DIRECTIVE 2014/68/EU of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment – EN (RZ6PAK v1.0)
[2.2] French Decree 2015-799 , and Article R557 of the French Environmental Code
[2.3] Compliance ASME B16.34 and ESP/ESPN (33YHTZ v1.1)
[2.4] NA
[2.5] Load Specification for Cooling Water System (3YGYH7 v4.0)
[2.6] EDH Guide A: Electrical Installations for SSEN Client Systems (2EB9VT v2.4)
[2.7] EDH Part 4: Electromagnetic Compatibility (EMC) (4B523E v3.0)
[2.8] Plant Control Design Handbook (27LH2V v7.0)
[2.9] ITER Procurement Quality Requirements (ITER_D_22MFG4)
[2.10] Order dated 7 February 2012 relating to the general technical regulations applicable to INB - EN (7M2YKF)
[2.11] Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)
[2.12] Requirements for Preparing and Implementing a Manufacturing and Inspection Plan (ITER_D_22MDZD)
[2.13] Procedure for management of Nonconformities (22F53X v7.0)
[2.14] Procedure for the management of Deviation Request (2LZJHB v5.5)
[2.15] Quality Assurance for ITER Safety Codes Procedure (258LKL)

Codes and Standards

[2.16] ANSI/ FCI 70-2-2013, "Control Valve Seat Leakage"
[2.17] API 598 9th edition 2009
[2.18] ASME B1.1-2003, "Unified Inch Screw Threads, UN and UNR Thread Form"
[2.19] ASME B31.3-2010, "Process Piping"

[2.20] ASME B16.5-2013, “Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard”
[2.21] ASME B16.10-2009, “Face-to-Face and End-to-End Dimensions of Valves”
[2.22] ASME B16.25-2012, “Butt welding Ends”
[2.23] ASME B16.34-2013, “Valves – Flanged, Threaded and Welding End”
[2.24] ASME B&PV Code Section II, “Materials”, 2013 Edition
[2.25] ASME QME-1-2012, “Qualification of Active Mechanical Equipment Used in Nuclear Power Plants.”
[2.26] ASTM A312M, “Standard Specification for Seamless, Welded, and Heavy Cold Worked Austenitic Stainless Steel Pipes”
[2.27] ASTM D4285-12, “Standard Test Method for Indicating Oil or Water in Compressed Air”
[2.28] ASTM D4417-14, “Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel”
[2.29] ASTM D5162-08, “Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates”
[2.30] ISO 15848-1:2006, “Industrial Valves – Measurement, Test, and Qualification Procedures for Fugitive Emissions – Part 1: Classification System and Qualification Procedures for Type Testing of Valves”
[2.31] NACE RP0287-02, “Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape”
[2.32] NACE SP0188-06, “Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates”
[2.33] NF EN 10204: 2005, “Metallic Products – Types of Inspection Documents”
[2.34] NF EN 12570:2001, “Industrial Valves: Method for Sizing the Operating Element”
[2.35] SSPC-PA-2, “Procedure for Determining Conformance to Dry Coating Thickness Requirements”
[2.36] SSPC-SP-1, “Solvent Cleaning”
[2.37] SSPC-SP-2, “Hand Tool Cleaning”
[2.38] SSPC-SP-5, “White Metal Blast Cleaning”
[2.39] SSPC-SP-10, “Near-White Blast Cleaning”
[2.40] ASME NQA-1-2012, “Quality Assurance Requirements for Nuclear Facility Applications”
[2.41] IEEE 323-2004, “Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations”
[2.42] IEEE 344-2013, “IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations”
[2.43] IEEE 383-04, “IEEE Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations”
[2.44] IEEE 382-2007, “IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations”
[2.45] ANSI/MSS SP-55-2011, “Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components – Visual Method for Evaluation of Surface Irregularities”
[2.46] ANSI/MSS SP-25-2013 - Standard Marking System for Valves, Fittings, Flanges, and Unions
[2.47] ANSI 60529-04 -Degrees of Protection Provided by Enclosures (IP Code)
[2.48] NEMA MG 1-2011-Motors and Generators
[2.49] API 6D-latest, “Specification for Pipeline Valves”
[2.50] Provisions for implementation of the generic safety requirements by the external interveners (SBSTBM v1.1)

[2.51] Propagation of the Defined Requirements for Protection Important Components Through the Chain of External Interveners (BG2GYB v3.3)
[2.52] List of ITER-INB Protections Important Activities (PSTTZL v2.2)
[2.53] Safety Important Functions and Components Classification Criteria and Methodology (347SF3 v1.8)
[2.54] Chemical composition and impurity requirements for materials (REYV5V v2.3)
[2.55] System Design Description Document (DDD) of CCWS (9K984A v2.1)
[2.56] System Design Description Document (DDD) of CHWS-H2 (TL6YM4 v1.1)
[2.57] PED Hazard Categorization of Piping and Valves (CCWS, CHWS and HRS) (QCKABL v1.2)

3. Abbreviations

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASN	Autorité de Sûreté Nucléaire
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
CWS	Cooling Water System
CCWS	Component Cooling Water System
DM	Demineralized Water
EDH	Electrical Design Handbook
ESPN	Equipements Sous Pression Nucléaire
IAEA	International Atomic Energy Agency
INB	*Installation nucléaire de base*, Basic Nuclear Installation.
IEEE	Institute of Electrical and Electronics Engineers
IDM	ITER Document Management
IO	ITER Organization
ISO	International Organization for Standardization
MIP	Manufacturing and Inspection Plan
MQP	Management and Quality Program
PED	Pressure Equipment Directive
PIA	Protection Important Activity
PIC	Protection Important ComponentQA Quality Assurance
QCR	Quality Control Review
QP	Quality Plan
SEP	Sound Engineering Practice
SIC	Safety Important Class
SRD	System Requirement Document
SSC	Structures, Systems and Components
SSPC	Steel Structures Painting Council

4. Functions and Boundaries

The valve's primary function is to provide positive shutoff or to control flow of the process fluid. The process fluid will be as described in the Valve Data Sheets (see Appendix A).

Boundaries of jurisdiction shall be the valve ends where the valve's pressure boundary connects to the adjoining piping. The valves are pressure accessories in accordance with DIRECTIVE 2014/68/EU [Ref.[2.1]].

5. Technical Requirements

5.1 Design Conditions

The CWS valves and actuators shall be designed to ASME B16.34 [Ref. [2.23]]. Each valve purchased in accordance with this Specification is described in, and its detailed design data, including special technical requirements, are provided in the Valve Data Sheets of Appendix A.

The material of the valve shall be compatible with the CWS piping, which is either ASTM A312M [Ref. [2.26]] grade TP304L or TP316L and the intended process fluid as described in the Valve Data Sheets (see Appendix A).

The body, bonnet or cover, body joint bolting, and body-bonnet or cover bolting, shall be constructed of materials as listed in the respective ASTM specifications referred to in ASME B16.34 Table 1 [Ref. [2.23]]. Identical materials in accordance with the ASME Boiler and Pressure Vessel Code, Section II [Ref. [2.24]] may also be used for these parts.

5.2 Design/ Construction Details

The valve shall have a design life of 20 years at the specified conditions, excluding items such as gaskets, packing, elastomer parts, and lubrication materials. Valve components of the same type and size shall be mutually interchangeable.

5.3 Environmental Conditions

All valves and actuators shall be designed to operate during the combination of the loads as defined in the Load Specification [Ref. [2.5]]. Additional environmental conditions are provided for in Appendix A of this Specification.

5.4 Valve Dimensions

End-to-end dimensions and face-to-face dimensions for butt welding-end valves and for flanged-end valves shall be in accordance with ASME B16.10 [Ref. [2.21]]. Each valve shall be examined to ensure it meets the dimensional requirements of this section.

5.5 Valve Body

The internals of the valve body shall be designed to limit the deposition of possible corrosion product and other erogenous materials inside the valve body. This may be performed by in the design of the internals eliminating:

- sharp angles
- strong reductions
- spaces likely to trap the deposits of products of corrosion
- zones of retention

- socket welds
- materials which do not have an optimum surface quality

For valves that require a certain installation orientation, an arrow shall be provided on the external surface of the valve body depicting the required flow direction through the valve.

5.6 Bonnet or Cover Plate

Valves having threaded bonnet joints (other than union joints) shall not be used. Bonnet or cover plate closures shall be: flanged, secured by at least four bolts with gasketing conforming to ASME B31.3 para. 308.4 [Ref. [2.19]], or proprietary, attached by bolts, lugs, or other substantial means, and having a gasket design that increases gasket compression as fluid pressure increases; or secured with a full penetration weld made in accordance with para. M311 [Ref. [2.19]]; or secured by a straight thread sufficient for mechanical strength, a metal-to-metal seat, and a seal weld made in accordance with paragraph M311 [Ref. [2.19]], all acting in series.

5.7 Valve Seat

Valves with double seated designs that can trap fluid subjected to heating and expansion shall provide a means of pressure relief to avoid excessive pressure build up between the seats. Hot fluid could also be trapped and lead to sub-atmospheric pressure when it cools down. The valve shall maintain its sealing capacity during this condition.

The valve seat leakage rate shall conform to the requirements of Class IV – valve leakage classification per ANSI/FCI 70-2 [Ref. [2.16]] or API 598 9th edition 2009 [Ref. [2.17]].

5.8 Valve Stem

Valve shall be specially designed to prevent stem leakage to the environment. Valves shall be designed so that the stem seal retaining fasteners (e.g., packing, gland fasteners) alone do not retain the stem. Specifically, the design shall be such that the stem shall not be capable of removal from the valve, while the valve is under pressure, by the removal of the stem seal retainer (e.g. gland) alone.

The leak tightness of the valve stem seal shall follow the requirements of class “A” from table 1 of ISO 15848-1 [Ref. [2.30]].

5.9 Manual Operator

Hand-wheels shall be of spoke design preferably with not more than six spokes. Webbed or disc hand-wheels shall not be used. Valves of sizes DN400 and above shall be provided with gear operation. Clockwise operation of the hand-wheel shall give closing movement of the valve, unless stated otherwise. The manual force required to operate the manual operator shall meet the requirements of NF EN 12570 Section 5.1 [Ref. [2.34]].

Chain wheel with sprocket rim and chain guides on both sides of the wheel shall be provided to facilitate operation of valves located above ground level. The chain shall be of adequate length so as to operate from a level 1.5 meter above the floor.

5.10 Valve Actuator

The actuator shall be stiff enough to maintain the valve stem position when the unbalanced forces on the plug change suddenly. The force necessary to compress the actuator spring a

distance equal to 100% of the valve stroke, under bench conditions, shall be large relative to the unbalanced force on the stem when the plug is subjected to the maximum differential pressure listed on the Valve Data Sheets as in the Annex 1.

Control valve actuators shall be furnished with a manual override to open or close the valve in the event of loss of electric or pneumatic power. For safety reasons, it is required that a manual declutch mechanism be included. Engaging the declutch mechanism changes the operation from electrical/ pneumatic powered to manual (handwheel) operation. The declutch mechanism may be provided with a locking device to prevent unauthorized manual operation. In most applications, the handwheel should not turn while in electrical/ pneumatic powered operation as a safety precaution.

5.11 Actuator Gearing

Actuator gearing shall be totally enclosed within the oil-filled gear case suitable for operation at any angle. Grease lubrication is not permissible. All gearing must be of metallic construction. The design shall be such as to permit the gear case to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

5.12 Actuator Housing

All wiring supplied as part of the actuator shall be contained within the main enclosure for physical and environmental protection. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed for site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed. External conduit connections between components will not be accepted.

A means for safely hoisting the actuator, either separately or assembled to the valve, shall be provided. Lifting lugs or areas where straps may be secured without damaging any of the components on the actuator housing or valve will be considered acceptable.

5.13 Actuator Shaft and Bearings

The actuator shaft shall be of a noncorrosive material and shall be securely fastened to the valve shaft in a manner such that there is no possibility of play, misalignment, or other undesirable characteristics occurring between the actuator and valve shaft and disc assembly. An external replaceable shear key shall be provided. The output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator.

The shaft bearing shall be lifetime self-lubricating bearings of the sleeve type.

5.14 Actuator Design

The stroke time and the fail position of the actuator are provided for in the data sheet in Appendix A.

5.15 Actuator Sizing

The Supplier shall perform the sizing calculation for the actuator based upon the sum of the maximum shut-off pressure and resulting torque requirements.

Each valve actuator shall have ample power capacity for accurately seating, unseating, and positioning the valve when subjected to the most severe operating condition, including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly.

The Supplier shall install, pipe and/or wire the actuator and all required accessories on a typical "test" valve and test the actuator per this specification.

5.16 Actuator Yoke Design

The valve actuator yoke design shall be such that it will accept installation of required accessories such as the air set, limit switches and position indicator. The yoke material shall be austenitic stainless steel.

5.17 Pneumatic Actuators

The actuator action shall be as indicated on the Actuator Data Sheets [air to open, air to close, or double acting]. Within this limitation the pneumatic actuator may be spring and diaphragm, spring and piston or double acting piston or diaphragm whichever is the most suitable for the specified conditions.

The pneumatic actuators for the valves shall be in austenitic stainless steel material (e.g. AISI 304L or 316L) and/or in material with low relative magnetic permeability (e.g. from 1.003 to 1.005)

For diaphragm actuators, the material shall be specified in the Actuator Data Sheets of Appendix A and shall be adequately designed to withstand the full supply air pressure to the actuator.

Piston operators shall be of the pneumatic type. The cylinders shall be capable of utilizing the instrument air supplied to give full travel of the air piston from fully open to fully closed and vice versa. The design of the piston operator linkage shall utilize the optimum mechanical advantage to ensure positive positioning of the valve from open to the closed position. The piston cylinder shall be sealed against leakage when the piston is in any position. Actuators shall be provided with self-lubricated piston rings and stem seals. The piston shall be adequately supported to provide direct linear-motion. Orientation of the piston operators with respect to flow direction through the valve or to adjacent space limitations shall be subject to IO's approval. The actuators shall have a visible indication of the valve position, to facilitate operator's assessment of valve position.

5.18 Electric Actuators

The motors for the electric actuators shall be properly designed and protected to operate within the magnetic field, it is to be installed per the guidelines in the EDH Part 4 [Ref.[2.7]].

The electric actuators shall be provided with integral controls including control and switching elements, all electrical components such as limit switches, torque switches, thermo switches, selector switches (Local-Remote-Off), and all monitoring elements, indicators, position transmitters etc. as a self-contained unit.

The Electric Actuator shall include a motor, reduction gearing and limit switches. The motor shall have a low inertia high torque design, class F insulated with a class B temperature rise, giving a time rating of 15 minutes at 40°C at an average load of at least 33% of maximum valve torque [Ref. [2.48]]. The temperature shall be limited by thermostats embedded in the motor end windings and integrated into its control. The unit shall be so designed that a torque

impulse is imparted to the stem nut in both opening and closing direction to start the disc in motion. The motor shall attain full speed before the stem load is encountered.

The maximum seating or unseating torque required by the valve shall not exceed the rated torque. The design basis of rating of motor and calculations justifying torque and kW rating of the motors in tabular form shall be submitted by the Supplier. A means for automatic 'torque switch bypass' shall be provided to inhibit torque-off during valve unseating and latching to prevent torque switch hammer under maintained or repeated control signals.

5.19 Mechanical Stops

Adjustable mechanical stops shall be provided to prevent over-travel of the valve in the open and closed position. All mechanical stops shall be designed to absorb the full operator torque.

5.20 Manual Operators

All valve actuators shall be provided with manual operators that shall be self-locking. The hand-wheel drive must be mechanically independent of the drive mechanism of the actuators and shall permit valve operation in a reasonable time with manual force. The manual force required to operate the manual operator shall meet the requirements of NF EN 12570 Section 5.1 [Ref. [2.34]]. Orientation of the manual operators with respect to the direction of flow through the valves or accessibility for manual operation shall be subject to the IO's approval. Clockwise operation of the hand-wheel shall give closing movement of the valve, unless stated otherwise.

5.21 Limit Switches

The limit switches shall be electrically compatible with the IO control power parameters provided in the Plant Control Design Handbook section 4.5.5 [Ref.[2.8]]. The limit switches shall, as a minimum, meet the qualification standards of IEEE-323 [Ref. [2.41]], IEEE-344 [Ref. [2.42]], and IEEE-383 [Ref. [2.43]]. Furthermore, the qualification of the limit switches shall encompass the environmental parameters and operating requirements. The switches shall be enclosed in weather proof enclosures conforming to IP-65 requirements as per ANSI 60529 [Ref. [2.47]].

The mounting of the limit switches or limit switch actuating mechanism shall be such as to permit smooth continuous adjustment and exact fixing of the switch actuating point. The design of the actuating mechanism shall permit the adjustment of switch over travel without disturbing the valve. The limit switch should be rigidly mounted on the valve such that it does not get disturbed by pipe line vibrations. Red, green and yellow lights corresponding to open, closed and intermediate valve positions shall be provided on the actuator display. Contact wiring details shall be shown in the manufacturer's drawings in the form of detailed wiring diagram.

5.22 Operating Solenoids

The solenoids shall be electrically compatible with the ITER power supply parameters specified in Appendix A of this Specification. The solenoid operators shall, as a minimum, meet the qualification standards of IEEE-323 [Ref. [2.41]], IEEE-344 [Ref. [2.42]], and IEEE-383 [Ref. [2.43]]. Furthermore, the qualification of the solenoids shall encompass the environmental parameters and operating requirements.

5.23 Earthing

All electrical conducting components of the control valve actuator located with the vacuum vessel or cryostat shall be able to be electrically connected to earth in accordance with Section 8.1.1.1 of EDH Part 4: EMC [Ref. [2.7]].

5.24 Local Controls

The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

5.25 Induction Effects

The actuators shall be designed per guidance from EDH Part 4: EMC [Ref.[2.7]], to minimize the induction effects within the various components of the actuators.

5.26 Threaded Fasteners

Threaded fasteners shall have unified series screw threads conforming to ASME B1.1 [Ref. [2.18]]. All threaded pressure retaining fasteners shall be provided with corrosion resistant positive locking devices. Frictional locking devices are not acceptable. All nuts and bolts shall have hexagonal heads unless otherwise specified.

5.27 Auxiliary Connections

Auxiliary connections, e.g., for bypass connections, shall be designed, fabricated, and examined so as to warrant at least the same pressure-temperature ratings as the valve and shall be installed prior to the test of the valve to which they are attached.

Welded auxiliary connections shall be butt welded directly to the wall of the valve, socket welding shall not be used. If the size of the connection requires reinforcement, then a boss shall be added satisfying the requirements of para. 6.3.5 [Ref. [2.23]].

5.28 Valve Lifting Attachments

Heavy components of valves shall be provided with a method of handling, such as lugs or eye-bolts.

5.29 Position Indication

The position indication of the valve shall be designed such that components of the indicating means cannot be assembled to falsely indicate the valve open or closed position.

5.30 Valve Body Joints

Valve body joints, other than bonnet or cover plate joints, shall conform to para. M307.2(b)(2) [Ref. [2.19]].

5.31 End Connections

Valve ends shall have ends that are of the same material and schedule as of the pipe to which the valve will connect. Socket welded and threaded connections are not permitted for the end connections of the valves.

5.32 Buttweld Ends

The details for the welding end preparation for valves shall be in accordance with ASME B16.25 [Ref. [2.22]] with the tolerances for the inside and outside diameter conforming to ASME B16.34 para. 6.2.1 [Ref.[2.23]].

5.33 Flanged Ends

Flanged ends shall be prepared with flange facing, nut-bearing surfaces, outside diameter, thickness, and drilling in accordance with ASME B16.5 [Ref. [2.20]] requirements for

a) Flanged fittings for Class 150 and 300 valves

All flanged valves shall have flanges corresponding to the pressure-temperature rating of the valves. Flanges furnished with tapped holes, shall provide full effective thread engagement, not including the chamfered thread, for a length at least equal to the nominal diameter of the bolt thread.

5.34 Welding

Weld fabrication and heat treatment of welds shall be performed in accordance with ASME B16.34 para 2.1.6(b) [Ref. [2.23]].

5.35 Surface Preparation Requirements

Selection, qualification, and application of coating materials shall be in accordance with applicable sections of the Steel Structures Painting Council (SSPC) specifications. Surface preparation activities shall be in accordance with the following standards or recommended practices as applicable:

SSPC-SP-1 [Ref. [2.36]], SSPC-SP-2 [Ref. [2.37]], SSPC-SP-5 [Ref. [2.38]], and SSPC-SP-10 [Ref. [2.39]]

Other coating, testing, and inspection activities shall be in accordance with the following standards or recommended practices as applicable:

ASTM D 4285 [Ref. [2.27]], ASTM D 4417 [Ref. [2.28]], ASTM D 5162 [Ref. [2.29]], NACE SP0188 [Ref. [2.32]], NACE RP0287 [Ref. [2.31]], and SSPC-PA-2 [Ref. [2.35]]

All coating systems must be applied in accordance with the Supplier's recommendations. The blast-cleaned surfaces shall be coated with the base coat within 4 hours after blasting and before rusting occurs. All surface preparation and painting work shall be subject to the approval of IO. Colour selection shall be subject to the approval of IO prior to application of the topcoat.

5.36 Coating Material

IO will provide the coating material requirements for the valves in the Purchase Order.

The Supplier shall submit his coatings procedure, detailing surface preparation and coatings application to IO for review and approval.

5.37 Required Documentation

The Supplier shall supply ITER-IO with metal tags on each piece of equipment, indicating the following information: coating manufacturer used, brand name of primer and finish coat, and colour.

5.38 Nameplate

The valve shall be permanently identified with a stainless steel tag, with the following stamped or chemical, mechanical, or electrical etched:

- The IO's supply Order and Item Numbers
- Tag Number
- Manufacturer's Name and Address
- Manufacturer's Serial Number
- Manufacturer's Model Identification
- Year of Manufacture
- Service Description
- Valve type
- Applicable data such as pressure, temperature, size, material, etc
- IO Serial Number (to be provided to Supplier)

The stainless steel tag shall be firmly attached to the main body of the valve or attached with a corrosion resistant stainless steel wire.

5.39 "CE" Marking and Declaration of Conformity

"CE" marking is required for valves in the scope of PED [Ref.[2.1]] and ESP [Ref.[2.2]].A declaration of conformity shall be drawn up and signed certifying that the valves comply with the PED [Ref.[2.1]].

5.40 PED classification

For PED classification refers to Reference [2.57]. The piping and valves of CCWS-1 up to DN 300 are classified as Sound Engineering Practice (SEP), whereas the larger ones (DN 350 and above) are classified as Category-1. CCWS-2A pipes and valves having diameter up to DN 250 are under SEP category, whereas the larger than DN 250 are of Category-1. For CCWS-2B up to DN 350 is categorized as SEP, whereas for larger diameters (DN 450 and above) piping are classified as Category-1. In CCWS 2C and 2D up to DN 300 is classified as SEP, from DN 400 and above pipes and valves are categorized as Category-1. For CHWS-H2, the piping and valves of smaller diameter up to DN 300 are classified as Sound Engineering Practice (SEP) whereas the larger ones (DN 350 and above) are classified as Category-1. For CHWS-H1, the piping and valves of smaller diameter up to DN 400 are classified as Sound Engineering Practice (SEP) whereas the larger ones (dn 450 and above) are classified as Category-1.

5.41 Material Specifications

5.41.1 Chemical Composition

The material of the valve shall be compatible with the CWS piping, which is either ASTM A312M [Ref. [2.26]] grade TP304L or TP316L as described in the Valve Data Sheets (see Appendix A).

5.41.2 Prohibited Materials

Mercury shall not be used in any manner, including construction of the valve, which can result in exposure of valve parts to the metal or its vapour. The use of lead or other low melting point metals in contact with the working fluid is prohibited. The use of nitrided surfaces exposed to the working fluid is prohibited. Care shall be taken to prevent contamination of valve material by red lead-graphite-mineral oil, molybdenum disulphide lubricants, halides, sulphur, copper, zinc and phosphorus. Teflon and similar elastomers may not be used. The use of Halogen products is prohibited. The use of materials containing asbestos or PCBs shall be prohibited.

5.42 Testing Requirements

All materials used in the construction of the valve shall be subject to mill tests for chemical and physical properties as required by the ASME/ASTM material standard listed in ASME B16.34 Table 1, Material group 2.3 [Ref. [2.23]] or an identical material in accordance with ASME BPVC, Section II [Ref. [2.24]]. Certificates (test reports) showing that required tests have been carried out at the source should be submitted. Type 3.1 certificate of EN 10204 [Ref. [2.33]] shall be provided for main pressure retaining materials.

ISO standards for tensile and impacting testing shall be used.

5.43 Impact and Tensile Testing

Mechanical properties shall be obtained from test specimens that represent the final heat-treated condition of the material required by the material specification.

Unless other values are required in accordance with other criteria that shall be taken into account, a material is considered as sufficiently ductile if, in a tensile test carried out by a standard procedure, its elongation after rupture is no less than 14 % and its bending rupture energy measured on an ISO V test-piece is no less than 27 J, at a temperature not greater than 20 °C but not higher than the lowest scheduled operating temperature.

ISO standards for tensile and impacting testing shall be used.

Use of ISO standards for tensile and impacting testing is allowed.

5.44 Hardness Test

Shore hardness test of the rubber parts used in the valve, shall be carried out and certificate of compliance for the rubber components shall be submitted.

5.45 Shell leak Test

Shell leak test shall be conducted on each valve in accordance with the requirements of ASME B16.34 Section 7.1 [Ref. [2.23]] and API 598 [Ref. [2.17]]. Testing shall be performed prior to any painting or coating of the valves.

5.46 Backseat Test

Backseat test shall be conducted on each valve, which has the backseat feature (applies in the case of globe valve and gate valve), in accordance with the requirements of API 598 [Ref. [2.17]]. The backseat test shall be conducted prior to the shell test to prevent the damage of the seal of stem or shaft to bonnet.

5.47 Valve Closure and Leak Tightness Test

Each valve shall be given a closure test in accordance with the requirements of ASME B16.34 Section 7.2 [Ref. [2.23]] and API 598 [Ref. [2.17]].

For ball valve, metal to metal seat, the maximum allowable leakage rates for the closure test refer to Class IV of ANSI/FCI 70-2 [Ref.[2.16]], or API 6D [Ref.[2.49]].

The closure and leak tightness test requirements shall conform to the requirements specified in the Valve Data Sheets in Appendix A.

5.48 Additional tests in power operated valves

For power operated valves, type tests on actuators as per IEEE 382 shall be carried out as specified in Appendix A.

Each actuator must be performance tested and individual test certificates shall be supplied. The test equipment shall simulate a typical valve load and the various parameters including actuator output speed, operating time etc. shall be recorded. Torque tests shall be carried out on all actuators. Electric actuator shall be tested for capability to start at 80% of rated voltage with full load. High voltage test on motor and control wiring at 1500 V for 1 minute shall be carried out. In addition, the test certificate shall record the details of specification such as gear ratios for both manual and automatic drive, closing direction, wiring diagram code number etc.

Each valve shall be tested along with its actuator to check valve seat leakage, and proper functioning of the valve. Opening and closing times shall be recorded. Valve shall be opened against pressure and closed for minimum three times.

For electric actuators, current drawn by the motor shall be measured during opening and closing. Functioning of limit switches shall be checked.

5.49 Functional Testing

All power operated valves shall be subjected to functional qualification test at the design service pressure as stated in Appendix A.

Before testing all power operated valves shall be fully calibrated including setting of limit switches, mechanical stoppers, position indication etc. as applicable. During valve operation, the limit switch setting shall also be checked. Operating air supply shall be used with limits as indicated in VSS. Power operated valves shall be operated with actuator with the help of motive power and performance to be checked. The opening and closing time of valves has to be recorded.

6. Analysis and Qualifications

6.1 Seismic Qualification by analysis

The Supplier is responsible for assuring the identified valve(s) in the Valve Data Sheets operate under the seismic conditions specified herein. All valves shall maintain their pressure boundary integrity after a seismic event.

The valve(s) shall be made to withstand an equivalent simultaneous seismic static loading, as described in the Load Specification for Cooling Water System [Ref. [2.5]]. The load shall be applied at the center of gravity of each component or part. Appendages shall be considered as separate pieces of equipment, mounted in place, for analysis and design. The allowable working stress range of materials involved will not be increased for the required seismic loadings. The methodology for seismic qualification of valves can be obtained from ASME QME-1 Non mandatory Appendix QR-A [Ref. [2.25]]. The Supplier shall prepare and submit a Seismic Qualification by analysis report.

6.2 Seismic Qualification by experimental test

[The following requirements under Section 6.2 shall be considered optional and will be applicable when defined so in the contract.]

If the integrity or functional capability of items cannot be demonstrated with a reasonable degree of confidence by analysis, the experimental test is needed to verify or to assist in seismic qualification. The Supplier is responsible to make the experimental test to simulate the operation conditions and simultaneous seismic static loading, as described in the Load Specification for Cooling Water System [Ref. [2.5]]. The Supplier shall submit a Seismic Qualification by experimental report.

6.3 Weak Link Analysis

A weak link analysis shall be performed on the valve and its various components to determine the maximum loads they can be subjected to. The analysis will review each component in the valve to determine the maximum load the weakest component can safely sustain. The backseat shall be included in weak link analysis. All weak link analyses shall use the same coefficient of friction (COF). Weak link evaluation shall distinguish between torque and thrust limitations.

6.4 Environmental Qualification

An environmental qualification of the non-metallic components of valves shall be performed at the bounding environmental conditions, as specified in the Valve Data Sheets, to evaluate the function of the valve component whose failure could prevent the valve from performing the intended function. The qualification shall meet the requirements of ASME QME-1 Non-mandatory Appendix QR-B [Ref. [2.25]]. The material environment capabilities shall be identified, including references to the verification documentation.

6.5 Non-destructive Examination

Non-destructive examinations shall be performed on the cast, forged, rolled, wrought, or fabricated material after heat treatment required by the material specification either prior to or after the finish machining if it is indicated in materials procurement specifications. Surfaces shall be clean and free of surface conditions that may mask unacceptable indications.

6.5.1 Radiography (RT)

6.5.1.1Castings

The radiographic procedures and acceptance standards to be used shall be in accordance with ASME B16.34 para. 8.3.1.1 and Mandatory Appendix I [Ref. [2.23]].

6.5.1.2Forgings, Bars, Plates, and Tubular Products

Forgings, bars, plates, and tubular products are radiographically examined in accordance with the procedure and standards in ASME B16.34 Mandatory Appendix I and para. 8.3.2.1 [Ref. [2.23]].

6.5.2 Surface Examination

All exterior and all accessible interior surfaces of bodies, bonnets, and covers shall be given a surface examination. For surface examination, liquid penetrant examination shall be used. Liquid penetrant examination shall be in accordance with the procedure and acceptance standards of ASME B16.34 Mandatory Appendix III [Ref. [2.23]].

6.5.3 Ultrasonic Examination

6.5.3.1Castings

For castings, ultrasonic examination is performed in accordance with ASME B16.34 para. 8.3.1.3 [Ref. [2.23]].

6.5.3.2Forgings, Bars, Plates, and Tubular Products

For forgings, bars, plates, and tubular products, ultrasonic examination shall be performed in accordance with ASME B16.34 Mandatory Appendix IV and para. 8.3.2.1 [Ref. [2.23]]. If during the examination, ultrasonic indications are not interpretable due to, for example, grain size, the material shall be radiographed using the procedure requirements of para. 8.3.1.1 [Ref. [2.23]].

6.5.4 Weld Examination

All fabrication welds of bodies and bonnets consisting of an assembly of welded segments of castings, forgings, and bars, tubular products, or plates, or combinations thereof, shall receive non-destructive examination in accordance with the ASME B16.34 para. 2.1.6(c) [Ref. [2.23]].

6.5.5 Visual Examination

The rubber parts used in the valve shall be visually inspected for any nicks, gouges, cuts, or any discontinuities that may compromise the physical integrity or function of the part. A complete visual inspection of the pressure boundary parts on all valves is required before final assembly and on accessible pressure boundary parts without disassembly after hydrostatic testing. The purpose of the visual inspection is to verify all surfaces are free of cracks, hot tears, arc strikes, prod marks and/or other detrimental discontinuities. All finished welds shall be subject to visual examination.

6.5.6 Wall Thickness Measurements

Wall thickness measurement requirements are supplementary to Code requirements. The Supplier shall submit its procedure and drawings for wall thickness measurements, with the critical dimensions to be measured specified, to ITER-IO for approval. Wall thickness measurements shall be performed after machining operations have been completed. As a minimum, the wall thickness shall be measured at 4 points 90 degrees apart on each nozzle and on the neck of the valve. Flange thickness of the bonnet and the thickness of the nozzle flanges in the case of flanged-end valves shall be measured at 4 points 90 degrees apart. Supplier shall take several measurements in a general area, giving special attention to suspect locations and shall record the location of the measurements on the drawings.

7. Other requirements

7.1 Material requirement in high radiation zone

[The following requirements under Section 7.1 shall be considered optional and will be applicable when defined so in the Supply Order.]

The majority of CWS valves are normally installed in low radiation area outside the bio-shield, but the exception is for the ones located in the Port Cells which are in high radiation zone. The supplier shall provide material with radiation resistant for valve bodies and actuators in these zones. The material shall comply with the requirement of Section 7.2 in Reference [2.54].

For specific austenitic steel in high radiation zone shall with a low level (0.05% compared with the standard 0.25%) of cobalt (Co).

7.2 Material requirement in high magnetic field

[The following requirements under Section 7.2 shall be considered optional and will be applicable when defined so in the Supply Order.]

The supplier shall provide material of valve bodies and actuators with proper magnetic compatibility in some high magnetic fields in Tokamak Complex. The pneumatic actuators for the valves shall be in austenitic stainless steel material (e.g. AISI 304L or 316L) and/or in material with low relative magnetic permeability (e.g. from 1.003 to 1.005)

7.3 PERFORMANCE GUARANTEE

The Supplier shall guarantee that all valves and any accessories furnished therewith are entirely suitable for the service conditions indicated in this specification and meet the performance requirement called for in this specification, and applicable regulations in the France where the valves will be installed and operated.

If performance test results deviate from the guaranteed values, the Supplier shall correct the deficiencies or replace the valve with the one that meets guaranteed values at no extra cost to the IO.

Guarantee Period shall be 20 years. If the subject valve or any part thereof is found defective during the stipulated guarantee period, the Supplier shall replace the same with new one at no extra cost to the IO.

The Supplier shall obtain similar guarantees from each of his sub-vendors. However, the overall responsibility shall lie with the Supplier.

7.4 SPARE PARTS AND MAINTENANCE TOOLS

The Supplier shall furnish a list of recommended spare parts adequate for three years of operation. The Supplier shall also furnish a list of special tools and tackles necessary for maintenance/operation of individual valve/equipment. The list shall be complete with quantities and unit prices. The IO shall have the option to increase or decrease the quantities of spare parts as required.

7.5 CLEANING, PROTECTION AND PAINTING

All valves shall be free of mill scale. The inside surface of the valve shall be degreased and then flushed with clean filtered water (preferably demineralised). It shall be visibly clean, free of sand, dirt and any other foreign matter.

A sack containing silica gel desiccant shall be firmly attached to the inner surface on the cover of one end of each valve.

For the valves having welded ends, the ends should be properly cleaned and treated with a suitable rust preventive other than grease and then securely fitted with plastic or wooden caps.

For power operated valves, actuators and positioners shall be painted with a coat of paint to protect them against corrosion.

It should be the intention of the Supplier to despatch valves to ITER site as part of piping spools, wherever possible.

The outside surface of the valves shall be applied with two coats of red lead primer or approved equivalent primer as required to prevent corrosion. Final painting shall be carried out as per painting requirements.

7.6 PACKING AND MARKING

For valves having welded ends, the ends shall be properly cleaned and treated with a suitable rust preventive other than grease and then securely fitted with plastic or wooden caps. A method of moisture control shall be provided for with the packaging of the valves, using silica desiccant gel firmly attached to the inner surface of the cover for the valve end. The desiccant shall be non-corrosive and shall not liquefy under saturated conditions. The valve shall then be enclosed in a clean heavy-duty plastic and openings tightly sealed. Small openings such as coupling, threadolets, and nipples shall be sealed by use of small light corrosion resistant stainless steel or plastic inserts pressed in and retained with a seal of waterproof tape.

The IO may require inspecting and approving of the packing before the items are dispatched. However, the Supplier shall be entirely responsible for ensuring that the packing is suitable for the mode of shipment and such inspection will not exonerate the Supplier from any loss or damage due to faulty packing.

The valve body and attached plate shall be marked with the information called for in MSS SP-25 [Ref. [2.45]].

At least following data concerning the valve shall be shown on the valve or on the permanent stainless steel name plate attached to the valve.

1. Valve tag number
2. Body size
3. Body material
4. Type
5. Service for which the valve is used
6. Primary pressure and temperature ratings
7. Manufacturer’s name, year of manufacture

For power operated valves, at least following data concerning the actuator shall be shown. The actuator name plate may be combined with the valve name plate.

1. Actuator Tag number
2. Size
3. Type
4. Air supply pressure (maximum air pressure for operation) for pneumatic
5. actuators
6. For electric actuators, the details of electric motor such as Motor kW rating, motor time rating, motor supply voltage, nominal motor phase current, auxiliary switch rating etc.
7. Maximum torque setting

8. Actuator type, wiring diagram number/catalogue number, actuator serial number etc.
9. Manufacturer's name, year of manufacture

Each valve shall be attached with an identification tag with corrosion resistant wire. The identification tag shall show purchase order number, valve identification etc. The same numbers shall appear on any loose accessories packaged and shipped with the valve.

All parts shall be properly packed, boxed, gated or otherwise protected for preventing any possible damage during transportation. Following general instructions shall be followed for packing.

1. The interior of the valve shall be clean and dry.
2. All exterior finished or machined carbon steel surfaces shall be protected against corrosion with a liberal coating of an approved and easily removable compound.
3. All machined surfaces shall be protected against mechanical damage.
4. All openings shall be adequately sealed.
5. The construction and lining of the boxes shall provide protection for their contents.

The packaging shall also include adequate cushioning, blocking, bracing, skidding, hoisting and the tie-down provisions. The packaging shall be subject to the approval of the IO.

7.7 VALVE SPECIFICATION SHEETS

Valve Specification Sheets are attached along with this specification, see Appendix A.

7.8 SHIPMENT

No valves or materials shall be dispatched without prior consent (acceptance certificate) of the IO. The Supplier shall be responsible for loading the packing on the board of ship.

7.9 DATA/DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF SUPPLY ORDER

The Supplier shall be required to submit following documents/drawings after placement of the Supply Order.

1. Detailed activity schedule covering submission of drawings, procedures, MIP, procurement of material and sub orders, manufacture, inspection, type tests, routine tests, submission of instruction manuals and test reports, packing, shipment etc.
2. Mutually agreed detailed Manufacturing and Inspection Plan (MIP)
3. Dimensioned cross-section drawings of valves with part list and MOCs
4. Manufacturer's drawings, data sheets, catalogues
5. Welding and weld repair procedures
6. Heat Treatment procedures
7. NDE procedures
8. Hydrostatic body and seat test procedures
9. Air leak body and seat test procedures
10. Leakage test of air/motor for power operated valves
11. Static and dynamic performance test procedures for control valves
12. Seismic analysis and test procedures
13. Valve characteristic curves
14. Sizing calculations/curves for actuator selection
15. Order placement of bought out items of requirement
16. Cleaning, painting, paint testing, packing procedures

17. Any document/drawing/procedure that needs prior approval by the IO as mentioned elsewhere in this specification.

7.10 DATA/DOCUMENTS TO BE SUBMITTED ALONG WITH THE DELIVERY/AT FINAL STAGE BEFORE SHIPMENT

The SUPPLIER shall be required to submit following documents/drawings along with the delivery of the valves.

1. Bound History dockets five sets each comprising following documents:
   a. Copies of Supply Order
   b. CE -Declaration of Conformity
   c. Approved as-built drawings
   d. Valve characteristics
   e. Approved MIPs
   f. Approved Procedures
   g. Material test certificates
   h. NDE reports
   i. Radiography films (if applicable)
   j. Stress relief Time-Temperature charts
   k. Welding procedures and Welder's Qualification certificates/reports
   l. Hydrostatic (body and seat) test reports
   m. Air leak (body and seat) test reports
   n. Performance test procedure and performance test reports with curves
   o. Dimensional reports
   p. Shipping release copies
   q. All design concession reports if any
   r. Guarantee and compliance certificates
2. Five hard and soft copies/sets of Operation and Maintenance Manuals
3. Five numbers of reproducible copies for every drawing on magnetic media, preferably CDs
4. Five hard and soft copies of approved Seismic Qualification Reports, if applicable

7.11 Deliverables Summary

The deliverables shall be based on the above section 7.9 and 7.10, and will be further clarified under each Supply Order t.

8. Quality Assurance

Quality Requirements shall be in accordance with the "ITER Procurement Quality Requirements" [Ref.[2.9]]. The ITER Quality Assurance Program shall be applied to all the work under this Contract. The ITER QA Program is based on IAEA Safety Standard GS-R-3 and on conventional QA principles and integrates the requirements of the INB Order dated 7 February 2012 [Ref.[2.10]] on the quality of design, construction and operation in Basic Nuclear Installation. For this purpose, the Supplier and Subcontractors carrying out contracts placed under this Contract shall be in compliance with the QA requirements under the relevant ITER QA classifications, the requirements of the INB Order and shall have an IO approved QA Program or an ISO 9001 accredited quality system, complemented with the above mentioned requirements.

Prior to commencement of any work under this Contract, a "Quality Plan" (QP) [Ref.[2.11]] shall be produced by the Supplier and Subcontractors and submitted to the IO for approval, describing how they will implement the ITER Procurement Quality Requirements.

Prior to commencement of any manufacturing, a "Manufacturing and Inspection Plan" (MIP) [Ref.[2.12]] shall be produced by the Supplier and Subcontractors and approved by the IO, who will mark up any intended intervention point. MIPs are used to monitor Quality Control and acceptance tests during the execution of the Contract. It should be noted that interventions additional to those required in this Technical Specification may be included on the MIP by the IO. The right of the IO listed above shall apply in relation to any Subcontractor and in this case the IO will operate through the Supplier. The overseeing of the quality control operation by the IO shall not release the Supplier from his responsibility in meeting any aspect of this Technical Specification.

Subcontractors not performing Critical Quality Activities (i.e. activities that if not performed correctly may affect safety, functionality or reliability) may be exempted from the requirement to supply Quality Plans and Manufacturing & Inspection Plans, subject to agreement by the IO.

All requirements of this Technical Specification and subsequent changes proposed by the Supplier during the course of execution of this Contract are subject to the Deviation Request process described in [Ref.[2.13] [2.14]].

Documentation developed as the result of this Contract shall be retained by the Supplier for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with "Quality Assurance for ITER Safety Codes Procedure" [Ref.[2.15]].

9. Safety requirements

ITER is a nuclear facility (an "INB", for *Installation nucléaire de base*, "Basic nuclear installation" in French regulation) identified in France by the number "INB no. 174" [2.10].

The supplier must comply with the all requirements expressed in Reference [2.50]. For each requirement, the external intervener must explain in its quality system the dispositions taken to implement the requirements stipulated in Reference [2.50]. The chemical composition and impurity requirements for materials and components must comply with the Reference [2.54].

In every contract involving PIA and PIC, it must be clearly stated that defined requirements on PIC and PIA have to be fulfilled. For PIC and their defined requirement, the procedure [2.51] applies. For PIA and their defined requirement, the document [2.52] applies. The classification corresponding to the graduated approach of PIC is specified in Reference [2.53].

Safety Importance Class (SIC) describes a classification scheme for structures, systems and components (SSC) of ITER that perform a safety function and contribute towards meeting the General Safety Objectives at ITER during incident/accident situations. Components classified SIC are divided into:

- **SIC-1** are those required to bring to and to maintain ITER in a safe state;
- **SIC-2** are those used to prevent, detect or mitigate incidents or accidents, but not SIC-1 (not required for ITER to reach a safe state).
- All other components are described as "**non-SIC**". However, some components, while not being SIC, may have some relevance to safety. These components are labelled "**Safety Relevant**", **SR**. They are not credited in the safety analysis and their failure would not impact any safety function.

The CWS valves in this technical specification can be classified to SIC-2, SR and Non-SIC for different systems, buildings and zones.

Appendix A

A.1 Valve Data Sheets

To be defined in the Supply Order.

A.2 Total Quantity of Valves summary

The following quantities are estimated, and are subject to change with the finalization of design for each subsystem of CWS..

Valve type	DN	Actuator Type	Safety Class	Seismic Class	Quality Class	Quantity
Butterfly valve	40	Pneumatic	SIC-2	SC-1(S)	QC-1	2
	50	Motorized	SIC-2	SC-1(S)	QC-1	4
	80	Pneumatic	SIC-2	SC-1(S)	QC-1	2
		Motorized	SIC-2	SC-1(S)	QC-1	2
	150	Pneumatic	SR	SC-2	QC-2	1
		Motorized	SIC-2	SC-1(S)	QC-1	1
	200	Manual	NON-SIC	NSC	QC-2	4
		Pneumatic	SIC-2/SR	SC-1(S)/SC-2	QC-1/QC-2	5
		Motorized	NON-SIC	NSC	QC-2	4
	250	Manual	SR	SC-2	QC-2	1
		Pneumatic	SIC-2/SR	SC-1(S)/NSC	QC-1/QC-2	8
		Motorized	NON-SIC	NSC	QC-2	8
		Manual	SR	SC-2	QC-2	3
		Pneumatic	SIC-2/NON-SIC	SC-1(S)/NSC	QC-2	9
	400	Motorized	NON-SIC	NSC	QC-2	2
	450	Motorized	NON-SIC	NSC	QC-2	1
	Total					57