SPECIFICATION PREFACE SHEET

DEPARTMENT: Engineering / Electrical	SHEET 1 OF 11	
AREA: Norðurál Grundartangi Reduction Plant	SPEC No: 00/07/TS006	REV: C2

STANDARD TECHNICAL SPECIFICATION FOR INSTRUMENTATION

CONTROL VALVES

This Standard Technical Specification is subject to change without prior notice. The most current issue will at all times be located on the Nordural web site, www.nordural.is

REV	BY	DATE	CHK'D	APPROVED	REVISIONS
C1	HRY	01/03/1999	GP	TMS	Issued for Construction
C2	IMJ	29.3.2004	TDS	ÓJ	Issued for Construction

NORÐURÁL - ENGINEERING

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TECHNICAL SPECIFICATION

1.0 INTRODUCTION

In this Document the following words and expressions shall have the meaning hereby assigned to them except where the context otherwise requires:

Engineer: The Owner or any person or organization employed or engaged at any time by the Owner and authorized by the Owner, in writing, from time to time to act on behalf of the Owner in the execution of the items covered by this Document, in whole or in any part, for any or all purposes provided in this Technical Specification.

Owner: Norðurál hf (Nordic Aluminum Corporation Ltd.), an independent legal entity owned by Century Aluminum.

2.0 CONTROL VALVES

2.1. VALVE SIZING

Control valves shall be standardised wherever possible and shall be sized for optimum control. The sizing calculations shall include CV, noise and cavitation calculations and shall be submitted to the Engineer for approval.

Valves bodies shall in all cases match the piping pressure and temperature rating specifications as a minimum and the operating point on the valve characteristic ie lift/throughput curve should be within the 60-70% operating range.

2.2 VALVE BODIES

For normal service duties valve bodies shall be of carbon steel with end connections flanged raised face, unless process conditions dictate or otherwise specified. Flange type connections shall in all cases match the Norðurál piping specification 00/04/TS001

Single-seated valve bodies (less than 25 mm) shall be supplied with heavy duty top guiding of the plug. For sizes of 25 mm or larger double-seated bodies with top and bottom guiding of the plug shall be supplied. Valve bodies shall in all cases match the piping specification as a minimum.

On applications with relatively high pressure drop, balanced seat valves with high friction type trim to give low noise characteristics shall be used.

For liquid services with high pressure drop cage-guided control valves shall be provided having the plug supported at the critical area.

For severely erosive service the fluid-impact area inside the valve body shall be covered by welded stellite.

2.3 PLUG CHARACTERISTICS

A linear characteristic shall be provided when the pressure drop across the control valve under all operating conditions is more than 2/3 of the pressure drop across the valve in the closed position. Unless otherwise approved, an equal percentage characteristic shall be provided for all other cases.

2.4 TRIM MATERIAL AND STEM PACKING

Control valve trims shall be of stainless steel AISI 316 or equivalent as a minimum where appropriate according to the service, fluid and conditions.

Hardened and/or stellite plug and seat rings shall be used for the following applications:

(a) Erosive Service.
(b) Wet steam service with pressure drop above 5 bar.
(c) General service with pressure drops greater than 5 bar.

For the above applications valves up to and including 38 mm shall have their plug and seat rings made from solid stellite. For larger sizes, the plug and seat rings shall be made from stainless steel, AISI 316 and be completely metal coated with Stellite No.6.

Valves shall be provided with Engineer approved quality packing and a lubricator assembly. For services with fluid temperatures above 200°C or below 10°C a normalising bonnet shall be provided to keep the packing box at ambient temperature.

Bellow seals shall be used on valve stem packing for services with dangerous/poisonous fluids. Suitable valve stem materials shall be provided on valves used on chlorine-service or other services which become corrosive when in contact with a moist atmosphere.

2.5 VALVE TYPES

For normal duty services globe type valves shall be used.

Where very large sizes are involved (on high flows), or low pressure drops and low static pressures are a determining factor, making globe valves unattractive or impossible, butterfly type valves shall be used. They shall be of "balanced torque" type disc usable to the fully open position (90E opening). The overall shaft rating shall be at least 25% above the static pressure as differential across the closed valve.

Multi-stage valves shall be used on services, e.g. steam and gas having very high pressure drops which would result in supersonic velocity inside a conventional body and shock waves in the piping, creating unacceptable noise levels.

Angle valves shall be provided as follows:

(a) For steam pressure reducing desuperheating stations of the " combination" type.
(b) For erosive service, e.g. slurries.
(c) On applications where solid contaminants might settle in the valve body.
(d) On hydrocarbon services with tendency for coking.

Ball valves shall be used for on-off and throttling services under moderate operating conditions and where agreed by the Engineer.

Where alternative specifications are considered more appropriate then details and justification shall be submitted to the Engineer for approval.

2.6 INSTALLATION

The installation shall include for upstream and downstream isolating valves and a bypass valve for each control valve on all services. Unless otherwise agreed by the Engineer the bypass valve shall have a similar characteristic as the control valve but shall provide tight shut-off. Any exceptions or variations to this requirement shall be subject to the approval of the Engineer.

Where a service is subject to pressure above 3 barg, a 25 mm vent valve shall be provided between the upstream and downstream isolating valves, in order to relieve the pressure to enable maintenance to be carried out on the control

valve. Control valves shall be adequately supported in all cases and shall be accessible for maintenance.

3.0 ACTUATORS

3.1 GENERAL

Unless otherwise specified actuators for modulating valves and dampers shall either be pneumatic or electrically operated. Self-contained sealed hydraulic units may be considered where high thrusts or high speeds of operation are required but each application shall be to the approval of the Engineer.

Actuators for ON/OFF duty or manually positioned units shall generally be electrical motor driven, however the use of solenoid types on small valves shall be allowed dependent on duty.

The various types and sizes of actuators shall be rationalised and as far as possible each type shall be from a common manufacturer to facilitate interchangeability and spares.

The operation of all actuators, control valves and driven units, shall be so arranged as to ensure the safety of the `plant' under failure of control or actuating supplies.

Unless specified otherwise, the failure of a control signal or actuator power supply shall either:

(a) Cause the actuator to move to a safe position.
(b) Freeze in its last operating position.

With either action the failure mode shall be suitably monitored and the plant operator informed by some form of alarm.

Where pneumatic actuators are used, an internal bias spring shall be used to obtain motive power to reach the safe position in the event of supply failure.

Where the type of actuator offered does not have the appropriate fail-safe facilities described above then the valve/damper shall have a second valve/damper in series or parallel as appropriate, designed to provide the correct failure response.

When an actuator is locked or moves to a safe position on failure detection, it shall not be allowed to return to automatic control without resetting action by the operator after restoration of the supply/control signal. Similarly remote manual control should not be allowed to return automatically if this would allow the possibility of large disturbances to be injected into an operating plant.

The failure response of all actuators in the event of the loss of the prime mover (air pressure, oil pressure, electrical power) shall be indicated on the Piping and Instrumentation (P. & I.) diagrams valve schedules, etc.

Where direct position control is provided on a remote control panel an actuator position feedback signal and indication shall be provided which is independent of the position demand signal.

Where control requirements call for split range operation the computing of the split range shall be carried out externally from the actuator such that standard signal inputs to the actuator are maintained.

All actuators shall include a mechanical device to show the true position of the operating mechanism.

All actuators shall have a handwheel for direct manual operation. The diameter of the handwheel and geared effort shall be such that they are reasonably operable by one man. A lockable mechanical clutch mechanism shall be provided to inhibit power control of the actuators when the handwheel is operated. The disengagement for hand control shall signal remotely to indicate that the normal operation of the actuator is inhibited.

All actuators shall be provided with a local control facility that in general will be used for test purposes only. Such controls may take the following forms, as appropriate or specified:

(a) Control initiations (ie raise, lower, etc) with lockable local/remote selection when appropriate either on the actuator, in the direct vicinity of the actuator or on its associated switchgear.

(b) A portable test facility for injecting the appropriate position demand signal either at the actuator or drive unit (switchgear or power amplifier).

If electrical actuation signal is of the Binary type, the Actuator has to be equipped with indicator light/lights to display if the actuating signals are present or not.

3.2 ELECTRICAL ACTUATION

Two classes of actuators are identified; firstly the motorized actuator which shall cover the isolating actuator type and including actuator type required for open loop (binary) control; secondly the modulating actuator which shall cover the switched types and continuous control type required for closed loop control.

3.3 ELECTRICAL ACTUATORS FOR ISOLATING AND BINARY CONTROL

Unless specified integral or separate switch and actuator units may be offered for which the contactors may be of the mechanical or static switch type. If a static switch is offered then the switch unit and actuator shall be supplied by the same manufacturer as a complete system.

The following features shall be provided for each actuator:

(a) DC open and close (raise and lower) command interposing relays.
(b) Open and close travel limit switches (each with change over contacts).
(c) Open and close indicating lamps.
(d) Open and close push buttons.
(e) Instantaneous voltage phase sequence/failure monitoring relay.
(f) Padlockable local/remote control selector switch.
(g) Analogue actuator position signal shall only be supplied when specified.
(h) Thermal overload protection.

The DC interposing relays (above shall be energised by the control and instrumentation system power supplies and shall therefore be rated to be compliant with the standard binary signal level (24 V).

All switch units and actuators shall be incorporated in enclosures with a protection class of at least IP 55. Better type enclosures shall be provided where specified for special applications. The main controls and contactors shall be incorporated directly on the actuator mechanism. Contactors if not integral with the actuator shall be incorporated in the Actuator Boards, in individual compartments logically arranged according to their function.

3.4 ELECTRICAL ACTUATORS FOR MODULATING DUTIES

These actuators shall be provided for closed loop control functions. Two principal types are recognised:

3.4.1 Switched Actuators

Each actuator shall be driven by a duration modulated switched power signal at the full AC supply voltage. Each shall feature either electromagnetic or mechanical braking. However, the latter will only be accepted on low power single-phase actuators and a brake life in excess of 10 operations shall be guaranteed by the Contractor. They shall not be used when full travel times of less than 20 seconds are required.

3.4.2 Continuous Control Actuators

For each actuator the drive voltage and current or frequency of the a.c. power source shall be continuously varied to regulate the rate of operation. Each shall be capable of slow creep operations as well as rapid stroke action and the operating torque shall be sensibly independent of the speed of operation.

The continuous control actuator should be provided for all demanding modulating control applications in which high torque, a wide range of stroke rate and frequent correction is anticipated.

Static power amplified/switch units shall be provided for either type of modulating actuator.

The actuator and associated power amplifier unit shall be manufactured as a composite system with a minimum of three years of proven service reliability. The actuator and drive unit shall be rated continuously for the stalled condition and three phase motors shall be provided for all actuators with ratings above 250 watts.

The following features shall be provided for each actuator:

(a) The drive unit shall accept an analogue (4-20 mA) actuator position demand signal or pulsed raise and lower signals if an external position loop is provided.
(b) Analogue actuator feedback position signal (4-20 mA)
(c) A test facility.
(d) An override facility for stroking the actuator in either direction for binary control interventions.

(e) Monitoring of common fault conditions such as thyristor drive fault, motor temperature high, AC power supply failure, circuit continuity fault, etc.
(f) All necessary protection devices to protect the actuator and drive unit against abnormal operating conditions.

Generally the actuator drive units shall either be located within the system cubicle in the equipment room or be grouped and mounted within cubicles of appropriate enclosure standard. Unless otherwise specified the latter cubicles shall be located in an electrical switchroom to obtain protection from the normal plant environment.

The approval of the Engineer shall be required where different types of actuators are offered to those specified above or where the drive unit and actuator are selected from different ranges of manufacture. Additionally these shall be subject to a type test, approved by the Engineer, to prove their satisfactory performance under equivalent operation conditions.

3.5 PNEUMATIC ACTUATORS

Pneumatic actuators shall cause the valve or driven unit to operate over its full stroke, from a 0,2 to 1,0 bar signal by means of any of the following:

(a) Pneumatic signal direct to the actuator.
(b) Pneumatic signal to a positioner.
(c) Electronic signal to electro/pneumatic convertor.
(d) Electrical signal to solenoid pilot valve.

Pneumatic actuators and drive units shall automatically return to the rest position upon signal and/or air supply failure unless "process control" or the Specification requirements dictate for "stay-put" response.

Where "lock up" devices are provided on those services requiring the actuator to remain in the position prevailing immediately before an operating medium failure, the following two methods of "freezing" are acceptable:

(a) The pneumatic system may be locked, but equipment used for this purpose shall always be installed between a positioner output and an actuator input.
(b) The final regulator may be locked by mechanical means upon receipt of a falling supply pressure signal.

All pneumatic control equipment, control drives and control valves shall be capable of satisfactory operating on a main air supply pressure of approximately 7 barg normal down to 5,5 barg minimum.

Positioners/actuators accepting standing or pulsed position reference signals are equally acceptable.

Positioners shall be used on all modulating duties/applications unless agreed otherwise with the Engineer.

On positioners where the output control air is of equal range to that of the input signal air (eg 20 - 100 KPA) they shall be furnished with integral pneumatic "bypass switch" facilities for applying signal air direct to the actuator.

All positioners and electro/pneumatic convertors shall be furnished with three pressure gauges, air supply signal, input and control air output and an air filter regulator set.

Where an electro-pneumatic convertor precedes or is integral with the positioner then facilities are to be provided for the connections of portable test equipment for the injection of electrical reference signals or pulses to allow the stroking of the actuator for test purposes.

3.6 ELECTRO-HYDRAULIC ACTUATORS

Generally these actuators shall only be used where high thrusts are required combined with fast operating times and standard range of actuators cannot meet the applicational requirements.

The units offered shall be of the self contained fully sealed types that allow removal of the complete unit to a clean room for any maintenance requirements.

Units accepting either 4-20mA signals or pulsed input signals shall be acceptable.

Failure of the internal hydraulic supply shall result in the actuator locking in its last operating position or stroking to its fail safe position and a suitable alarm being given to the operator.