

SPECIFICATION PREFACE SHEET

DEPARTMENT: Engineering / Electrical

SHEET 1 OF 13

AREA: Norðurál Grundartangi Reduction Plant

SPEC No: 00/07/TS010

REV: C2

**STANDARD TECHNICAL
SPECIFICATION
FOR
INSTRUMENTATION**

INSTALLATION COMMISSIONING

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

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NORÐURÁL - ENGINEERING

CONTENTS

<i>SPECIFICATION PREFACE SHEET</i>	<i>1</i>
<i>TECHNICAL SPECIFICATION</i>	<i>3</i>
1.0 INTRODUCTION	3
2.0 SCOPE	3
3.0 STANDARDS AND CODES OF PRACTICE	3
4.0 INSTRUMENT INSTALLATION	4
5.0 INSTRUMENT AND CONTROL PANELS	4
6.0 PLC AND SCADA SYSTEMS	5
7.0 INSPECTION AND TESTING	5
8.0 PRECOMMISSIONING	7
9.0 COMMISSIONING	7
APPENDICES	8

TECHNICAL SPECIFICATION

1.0 INTRODUCTION

This Specification is issued to give general guidelines and to outline basic requirements to contractors to cover the testing and pre-commissioning of instrumentation and control systems. It is intended to ensure that the equipment installed is as specified by the design and that installation materials are of specified type and quality correctly installed and in all respects suitable for commissioning to the Engineer's requirements.

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 SCOPE

This procedure together with its appendices covers the scope of work, inspection and testing of all instrument equipment from arrival on site up to and including pre-commissioning.

3.0 STANDARDS AND CODES OF PRACTICE

In addition to the requirements of this specification the installation shall comply with:

Icelandic Government Electrical Codes and Regulations no:264/1971

Icelandic Government Health and Safety at Work Act no:46/1980

BS6739 : 1986 - Instrumentation in process control systems -installation design and practice.

IEC 61508 Functional safety of electrical / electronic / programmable electronic Systems.

Norðurál Standard Technical Specifications as applicable

4 0 INSTRUMENT INSTALLATION

The installation of all sensors shall conform to good measuring practice so that a truly representative signal of the variable is obtained. They must be installed according to European EN Standards. Equipment shall be positioned to permit easy access for visual inspection and maintenance but shall be protected from damage by personnel or passing or falling objects. The equipment shall not be bracketed directly from pipework or handrails. Care shall be taken to ensure equipment is not damaged or obstructed by subsequent lagging/steelwork etc.

Provision shall be made for the adequate isolation of impulse lines and for the removal of sensors for repair or calibration.

Equipment shall in all cases be installed with due regard for the safety of personnel.

5.0 INSTRUMENT AND CONTROL PANELS

When instrument/control panels arrive at site they will normally be prefabricated and prewired. The Contractor will be responsible for lifting such panels and it shall be the contractor's responsibility to ensure the panel is correctly positioned and bolted down in accordance with his requirements.

The Instrument Installation/Commissioning Contractor shall make the following checks. A proportion of these checks shall be repeated in the presence of the Engineer.

A general visual check for damage, deformation and quality of construction.

A dimensional and detailed physical check to ensure that all dimensions are correct against specifications and drawings.

Earthing arrangement checks shall be made to ensure they are to Norðurál requirements and that earth conductors have continuity and are adequately rated.

Checks shall be made to ensure that gland plates are of a size sufficient to accommodate all cabling and piping and that any internal trunking is of sufficient size to accommodate any field wiring.

Warning and general labels shall be checked to see if the descriptions are correct and these are sufficient.

A function and calibration check shall be carried out on each instrument. Where necessary the equipment shall be recalibrated.

All test equipment used shall be certified and certificates made available to illustrate compliance.

6.0 PLC AND SCADA SYSTEMS

Microprocessor based control systems are not covered by this procedure except in so far as the tests detailed can be applied to components of a system.

On site check-out and pre-commissioning would usually be carried out by specialist personnel from the equipment vendor or alternatively by reference to the manufacturer's specific instructions.

Nevertheless, the basic requirement remains that every input and output signal must be checked through from its field initiation point to control room display unit or vice versa. All control functions must be checked for operability in accordance with the manufacturer's stated performance characteristics.

All checks must be recorded on loop test sheets and the forms as attached may be used as applicable.

All test methods must be agreed with the Engineer.

7.0 INSPECTION AND TESTING

Visual checks shall be made on all primary element installations and impulse piping to ensure equipment has been installed in accordance with specifications and drawings. Primary elements and their impulse lines shall be examined for correct location to meet standard flow metering codes and tank zero datum for contents.

The orientation and access to all sensors shall be inspected to verify correct location in the plant and serviceability of installation.

Isolation provided shall be checked together with slope on impulse lines i.e. at least 1 in 12.

Field mounted transmitters shall be check calibrated to ensure they agree with calibration/functional test certificates, where necessary they shall be re-calibrated.

A detailed physical check shall be made against specifications and drawings. Tagging/labels shall be inspected.

An inspection shall be made of all junction boxes, earthing checks performed, cabling arrangements inspected for neatness and accessibility.

A check shall be made that internal connections are as per drawing and are satisfactory.

Location of labels to drawings shall be checked.

All cabling and piping shall be inspected against specification and drawings. Wiring shall be checked for correct materials, correct identification and physical installation ensuring that kinks and strains have been avoided. Piping shall be inspected likewise.

All fittings and connections shall be inspected for correct installation and possible absence or misapplication of sealing compounds.

A check shall be made to ensure that signal cabling is adequately segregated from power cabling. Cable tray, trunking and brackets shall be inspected for firm fixing, no sharp edges, protection of cut edges and acceptable routing.

Glanding and terminations shall be examined to ensure correctness of same and correct termination of conductors, screen or shield. All connections shall be inspected for security.

Insulation and continuity tests shall be carried out core to core for insulation value and continuity. Testing shall be carried out with approved equipment and before final connection to electronic equipment.

Pressure tests shall be carried out on all pipework with suitable isolation to protect connected equipment. For lines containing pressure above 2 bars the pressure tests decay shall not exceed 66 millibar (1 lb/ins²) in 10 minutes. For lines containing less than 2 bar, pressure slightly above the maximum to be encountered on normal service shall be applied through a bubble flow indicator. The bubble rate shall not exceed one bubble in 10 seconds. After pressure testing, test gauges and equipment shall be disconnected, connections remade and tested with soap solution when under service pressure.

Power supplies, electric and pneumatic shall be inspected to ensure installed supplies are to specification and the drawings are suitable for supplied equipment. Earthing facilities as well as fusing/circuit breaker values shall be as required.

Control valves and actuators shall be inspected to ascertain correct installation in process pipework, accessibility, serviceability and correct flow direction.

A check against specification for type and accessories shall be made to ensure they are correctly assembled and calibrated. Control valves shall be stroked to verify they operate correctly over the full range, if incorrect they shall be adjusted accordingly. Wherever possible they shall be check-calibrated in the contractor's workshop.

Generally all instruments shall be inspected, checked and calibrated/function tested before installation.

8.0 PRECOMMISSIONING

Loop testing shall be carried out to prove the installed instrument system functions correctly. In general each complete instrument loop shall be tested as a system, where necessary adjustments shall be made to the calibration. Associated alarms and trips shall be checked during loop testing.

As part of loop testing various parameters of the panel mounted instruments may require configuring. This shall be carried out utilising an acceptable configurator.

When loop testing is complete and 'signed off' by the Engineer the complete system may be considered suitable for hot commissioning.

9.0 COMMISSIONING

Following pre-commissioning and at a time agreed with the Engineer the Contractor shall have an instrument commissioning engineer available to assist in plant commissioning.

Test certificates shall be issued to illustrate that complete testing has been completed. Certificates shall take the form of certificates as illustrated in Appendix A.

The contractor shall provide these sheets or his own equivalent to the Engineer before testing for client verification.

The certificates must highlight test equipment used with its manufacturer's name, model number, serial number, test certificate number and issue date as a minimum.

APPENDIX A

Alarm System Check Sheet

Instrument Pre-Installation Calibration Sheet

Calibration Check Sheet

Instrument Loop Check Sheet

NORÐURÁL hf	ALARM SYSTEM CHECK SHEET
PROJECT TITLE:	PACKAGE TITLE
AREA:	PACKAGE No:

TAG No:	LOCATION:	
ANNANCIATOR TYPE	SIZE	SERIAL No
MANUFACTURER	ORDER No	SPEC.No

GENERAL CHECK

GENERAL CONDITION SATISFACTORY	<input type="checkbox"/>	AUDIABLE ALARM OPERATES	<input type="checkbox"/>
ENGRAVING CORRECT TO SPEC	<input type="checkbox"/>	ACK & TEST BUTTONS OPERATE	<input type="checkbox"/>
ELECT. SUPPLY SETTING CORRECT	<input type="checkbox"/>	_____	<input type="checkbox"/>
ALARM SEQUENCE CORRECT	<input type="checkbox"/>	_____	<input type="checkbox"/>

ALARM LOOP CHECK

POINT No	ALARM No	ALARM ACTUATOR CHECK					
		TAG No	DESCRIPTION	ALARM SETTING	OPERATION CORRECT	INSTALLATION CORRECT	ALARM OPERATION CORRECT

REMARKS

TEST EQUIPMENT USED	MANUFACTURER	MODEL	SERIAL No	CERTIFICATE No	DATE

CHECKED BY	DATE	WITNESSED BY	DATE
ACCEPTED BY	FOR		DATE
ALARM SYSTEM No			

GRUNDARTANGI REDUCTION PLANT

NORÐURÁL hf	INSTRUMENT PRE INSTALLATION, CALIBRATION SHEET
PROJECT TITLE: AREA:	PACKAGE TITLE PACKAGE No:

TAG No:	LOCATION:	
TYPE	SIZE	SERIAL No
MANUFACTURER	ORDER No	SPEC.No
SIGNAL RANGE	DIAL/CHART RANGE	

PHYSICAL CHECK	PROCESS CONNECTION CORRECT <input type="checkbox"/>	PNEU/ELECT. CONN.CORRECT <input type="checkbox"/>
	BODY MATERIAL CORRECT <input type="checkbox"/>	RANGE/SPAN CORRECT <input type="checkbox"/>
	ELECT. SUPPLY SETTING CORRECT <input type="checkbox"/>	AIR SUPPLY CORRECT <input type="checkbox"/>
	GENERAL CONDITION SATISFACTORY <input type="checkbox"/>	ANCILLARY EQUIPMENT SUPPLIED <input type="checkbox"/>
	SHIPPING STOPS REMOVED <input type="checkbox"/>	<input type="checkbox"/>

CALIBRATION CHECK

INPUT		READING OR OUTPUT					
% SPAN	ACTUAL	RISING			FALLING		
		ACTUAL	% SPAN	ERROR %	ACTUAL	% SPAN	ERROR %
0							
25							
75							
100							

MANUFACTURERS QUOTED ACCURACY _____ %

CONTROL MODE:	PROPORTIONAL <input type="checkbox"/>	INTEGRAL <input type="checkbox"/>	CONTROLLER CHECK <input type="checkbox"/>
	ON/OFF <input type="checkbox"/>	DIFF. GAP <input type="checkbox"/>	DERIVATIVE <input type="checkbox"/>
CONTROLLER ALIGNMENT	CORRECT <input type="checkbox"/>	AUTO/MANUAL CORR. <input type="checkbox"/>	<input type="checkbox"/>
CONTROL ACTION	DIRECT <input type="checkbox"/>	REVERSE <input type="checkbox"/>	<input type="checkbox"/>

SETTINGS	ALARM SETTING	TIME DELAY SETTING
	LIMIT SWITCH SETTING -HIGH	LIMIT SWITCH SETTING -LOW
	OUTPUT LIMIT SETTING -HIGH	OUTPUT LIMIT SETTING -LOW
	DIFF. GAP _____ %	

CORRECTIONS	AUTOMATIC TEMPERATURE CORRECTION RANGE	
	S.G. DENSITY CORRECTION SETTING	
	ZERO ELEVATION/SUPPRESSION SETTING	
	THERMO COUPLE BURN OUT DRIVES	
	SHIPPING STOPS REFITTED <input type="checkbox"/>	UPSCALE <input type="checkbox"/>
		DOWNSCALE <input type="checkbox"/>

ANCILLARY EQUIPMENT LIST _____

REMARKS _____

TEST EQUIPMENT USED	MANUFACTURER	MODEL	SERIAL No	CERTIFICATE No	DATE
CHECKED BY	DATE	WITNESSED BY			DATE
ACCEPTED BY	FOR				DATE
			INSTRUMENT TAG No		

GRUNDARTANGI REDUCTION PLANT

NORÐURÁL hf	INSTRUMENT LOOP CHECK SHEET
PROJECT TITLE: AREA:	PACKAGE TITLE PACKAGE No:

LOOP No:	LOCATION:	
SYSTEM No	EQUIPMENT No	
LINE No		

MECHANICAL/ELECTRICAL CHECKS

MEASURING ELEMENT:	INSTALLATION CORRECT	<input type="checkbox"/>	LOCATION CORRECT	<input type="checkbox"/>
	ISOLATING VALVES CORRECT	<input type="checkbox"/>	MATERIALS CORRECT	<input type="checkbox"/>
	TAPPING(S) POSITION CORRECT	<input type="checkbox"/>	ORIFICE DIAMETER	_____
IMPULSE CONNECTIONS:				
	CORRECT TO HOOK UP	<input type="checkbox"/>	MATERIALS CORRECT	<input type="checkbox"/>
	PRESSURE TESTED	<input type="checkbox"/>	TEST PRESSURE	_____
	CONNECTIONS: TRACED	<input type="checkbox"/>	LAGGED	_____
<input type="checkbox"/>				
FIELD INSTRUMENTS	INSTALLATION CORRECT	<input type="checkbox"/>	AIR SUPPLY CORRECT	<input type="checkbox"/>
	WEATHER PROTECTED	<input type="checkbox"/>	POWER SUPPLY CORRECT	<input type="checkbox"/>
PANEL INSTRUMENTS	INSTALLATION CORRECT	<input type="checkbox"/>	AIR SUPPLY CORRECT	<input type="checkbox"/>
	SCALE/CHART CORRECT	<input type="checkbox"/>	POWER SUPPLY CORRECT	<input type="checkbox"/>
CONTROL VALVES	INSTALLATION AND LOCATION CORRECT	<input type="checkbox"/>	SIZE AND TYPE CORRECT	<input type="checkbox"/>
	STROKE TESTED	<input type="checkbox"/>	POSITIONER CHECKED	<input type="checkbox"/>
	LIMIT SWITCHES SET	<input type="checkbox"/>	I/P. TRANSDUCER CHECKED	<input type="checkbox"/>
AIR SUPPLIES	CONNECTIONS CORRECT TO DRAWINGS	<input type="checkbox"/>	BLOWN CLEAR AND LEAK TESTED	<input type="checkbox"/>
TRANSMISSION				
PNEU. <input type="checkbox"/>	LINES INSPECTED, BLOWN CLEAR & LEAK TESTED	<input type="checkbox"/>		
ELECT. <input type="checkbox"/>	INSULATION CHEKED-CORE TO CORE	<input type="checkbox"/>	CORES TO EARTH	<input type="checkbox"/>
	CONTINUITY CHEKED	<input type="checkbox"/>	LOOP IMPEDANCE CHECKED	<input type="checkbox"/>
	EARTH BONDING CHECKED	<input type="checkbox"/>	ZENER BARRIERS CORRECT	<input type="checkbox"/>
TEMPERATURE LOOPS	T/C OR R/B CHECKED	<input type="checkbox"/>	CABLE TO SECIFICATIONS	<input type="checkbox"/>
	CONTINUITY CHECKED	<input type="checkbox"/>	LOOP IMPEDANCE CHECKED	<input type="checkbox"/>
GENERAL	SUPPORTS CHECKED	<input type="checkbox"/>	TAGGING CORRECT	<input type="checkbox"/>

LOOP TEST

	TRANSMITTER INPUT	TRANSMITTER OUTPUT	LOCAL INST. READING	PANEL INST. READING	
MEASUREMENT					

	CONTROLLER OUTPUT	TRANSDUCER OUTPUT	VALVE POSITION O/P	CONTROL VALVE POS.	
CONTROL					

TEST EQUIPMENT USED	MANUFACTURER	MODEL	SERIAL No	CERTIFICATE No	DATE
CHECKED BY	DATE	WITNESSED BY	DATE		
ACCEPTED BY	FOR				DATE
INSTRUMENT TAG No					

GRUNDARTANGI REDUCTION PLANT
