

PURCHASER



NUCLEAR POWER CORPORATION OF INDIA LTD. (NPCIL)
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT

2x700 MW RAJASTHAN ATOMIC POWER PROJECT (UNIT 7&8)
KOTA, RAJASTHAN, INDIA

CONTRACTOR



JACKING OIL BLOCKS SPECIFICATION

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JACKING OIL BLOCKS SPECIFICATION

Table of contents:

1	General.....	5
1.1	Responsibility	5
1.2	Definitions.....	5
1.3	Foreseen application and purpose.....	5
1.4	Categories and criticality.....	5
1.5	Scope of supply	5
1.6	Supplier	7
2	Material properties requirements.....	7
2.1	Oil properties	7
2.2	Mechanical properties.....	7
2.3	Electrical properties	7
2.4	Other properties.....	7
2.5	Prohibited materials, treatments and processes	7
3	Form, fit and function requirements.....	7
3.1	Design	7
3.2	Construction	8
3.3	Hardware	8
3.4	Reliability	8
3.5	Maintainability	8
3.6	Availability.....	8
3.7	Interchangeability.....	8
3.8	Performance characteristics	8
3.9	Energy efficiency	8
3.10	Human factors	8
3.11	Dimensions.....	8
3.12	Weight	8
3.13	Color.....	8
3.14	Finish.....	9
3.15	Workmanship.....	9
3.16	Batch and lot requirements	9
3.17	Required documents.....	9
4	Testing and verification requirements.....	10
4.1	Testing procedure	10
4.2	Records of material / performance tests	11
4.3	Reporting.....	11
5	Process requirements	11
5.1	Specific process requirements.....	11
5.2	Specific process monitoring requirements and records.....	11
6	Associated standards.....	11
6.1	Listing of applicable documents and standards.....	11
6.2	Order of precedence.....	12
7	Transportation and logistics requirements.....	12

Dept.	Document No.	Type	Rev. Released	Lang.	Status
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Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 3/20
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7.1 Delivery requirements12

7.2 Marking, identification requirements.....12

7.3 Packaging and preservation requirements12

7.4 Environment, health and safety requirements13

8 Notes13

8.1 General notes13

8.2 Identification of changes13

9 Annex14

9.1 Datasheet14

9.2 Example from typical Supplier (with 5 flow regulators per block)19

9.3 Spare parts Template20

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----	ES002C	A	2014-02-26	EN Approved

1 General

1.1 Responsibility

The Supplier is responsible for compliance with all requirements listed in this specification. Purchaser's approval of the application of the equipment does not relieve the Supplier's responsibility in any way.

1.2 Definitions

- | | | |
|----|-----------|--|
| 1) | Project | Nuclear project localized in Asia: 2x700 MW RAJASTHAN ATOMIC POWER PROJECT (UNIT 7&8) KOTA, RAJASTHAN, INDIA |
| 2) | 4133 | Turbine Lube Oil System |
| 3) | Purchaser | Responsible for the turbine hall |
| 4) | Supplier | Responsible for the jacking oil injection blocks |

1.3 Foreseen application and purpose

This specification establishes the requirements for design, materials, fabrication, shop testing, and delivery of jacking oil injection blocks for the nuclear steam turbine-generator shaft line relative to RAWATBHATA Project.

The purpose of the jacking oil injection blocks is to control oil flows and pressures to the steam turbine-generator bearings in order to lift the shaft line. The aim is to allow the creation of thin oil films in order to enable the rotation at low speed (and some other short-time operating cases).

1.4 Categories and criticality

The jacking oil blocks are not safety related but critical for the turbine operation during start-up and shutdown sequences.

1.5 Scope of supply

- Eight (8) jacking oil injection blocks for the steam turbine bearings. Each block shall include but not be limited to:
 - One (1) drilled block
 - Two (2) flow regulators
 - One (1) inlet flange
 - Two (2) outlet flanges
 - Two (2) pressure taps
 - Two (2) self sealing couplings for pressure test points
 - One (1) inlet blind flange
- Two (2) jacking oil injection blocks for generator bearings. Each block shall include but not be limited to:
 - One (1) drilled block
 - One (1) pressure regulator

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES0002	ES0002	A	2014-02-26	EN Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 5/20
--	---	-----------	--------------------	-------------	---------------

- One (1) flow regulator
- One (1) inlet flange
- One (1) outlet flange
- One (1) pressure tap
- One (1) self sealing coupling for pressure test point
- One (1) inlet blind flange
- One (1) jacking oil injection blocks for the generator exciter bearing. The block shall include but not be limited to:
 - One (1) drilled block
 - One (1) pressure regulator
 - One (1) flow regulator
 - One (1) inlet flange
 - One (1) outlet flange
 - One (1) pressure tap
 - One (1) self sealing coupling for pressure test point
 - One (1) inlet blind flange
- Gaskets,
- Spare parts,
- Special tools,
- Documents.

1.5.1 Terminal points

- Inlet & outlet BW end of flanged connections and pressure taps

1.5.2 Scope of work

- Calculations, design, drawings,
- Equipment manufacturing,
- Workshop assembly,
- Tests,
- Marking, identification and labeling,
- Packing,
- Transportation,

1.5.3 Exclusions

- Site erection and commissioning (in scope of purchaser),
- Electrical wiring
- Fastenings

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES0002	A	2014-02-26	EN	Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 6/20
--	---	-----------	--------------------	-------------	---------------

2 Material properties requirements

2.1 Oil properties

Mineral oil ISO VG 32 is according to ISO 3448 [2] and with properties according to ISO 8068 [3] and HTGD 90117 [20].

2.2 Mechanical properties

Not applicable.

2.3 Electrical properties

Not applicable.

2.4 Other properties

Not applicable.

2.5 Prohibited materials, treatments and processes

See project general specification [24].

3 Form, fit and function requirements

3.1 Design

3.1.1 Mechanical

All components included in the scope of supply shall be designed for installation in Nuclear Power Plant turbine hall environment having characteristics listed in Project general specification.

The fluid used is ISO VG32 mineral oil.

All components included in the scope of supply shall be designed for a design pressure of 315 bar gauge and a design temperature of 60°C.

Piping, bends, reducers, ends, flanges, orifice plates, gaskets, bolting, and valves shall be in accordance with piping class manual [26]:

SZ98 – jacking oil

Minimess pressure taps shall be available on the block to measure the pressure at the outlet of each regulator. Refer to chapter 5.4 of document RAW/78/S/-----/ES/018 [23].

Each drilled block shall have provisions to be able to be mounted onto or against a fixed support provided by the Purchaser. Technical proposal shall be made by the Supplier for Purchaser's approval.

Block, piping, tubing and fittings material shall be 304L stainless steel.

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES0002		A 2014-02-26	EN	Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 7/20
--	---	-----------	--------------------	-------------	---------------

3.2 Construction

3.2.1 Bolts & Nuts

See project general specification [24].

Each jacking injection oil block shall have two (2) through holes for installation of M10 studs. The holes shall be located on diagonally opposite corners of the block (see example in Annex 9.2).

3.3 Hardware

Not applicable.

3.4 Reliability

3.4.1 Life time

See project general specification [24].

3.4.2 Operating time

The equipment must operate 24 hours per day.

3.5 Maintainability

See project general specification [24].

3.6 Availability

Not applicable.

3.7 Interchangeability

See project general specification [24].

3.8 Performance characteristics

Not applicable.

3.9 Energy efficiency

Not applicable.

3.10 Human factors

Not applicable.

3.11 Dimensions

Each assembled jacking oil injection block shall fit in an envelope of:

- L x W x H: 145 x 295 x 245 mm³

3.12 Weight

Supplier's standard.

3.13 Color

Not applicable.

Dept.	Document No.	Type	Rev.	Released	Lang.	Status
9010	RAW78SGGR-----	ES0002C	A	2014-02-26	EN	Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 8/20
--	---	-----------	--------------------	-------------	---------------

3.14 Finish

See project general specification [24].

3.15 Workmanship

Not applicable.

3.16 Batch and lot requirements

See project general specification [24].

The Supplier shall propose a list of spare parts and special tools for Purchaser's approval. The list shall include at least the following information: description, references, associated quantities and associated lead-time.

Refer to Annex 9.3 for spare parts template.

3.17 Required documents

All documents shall be written in English.

The Supplier shall provide the following documentation required by the Purchaser:

Pos.	JACKING OIL BLOCKS Title of documents	Delivery dates	
		t1= Site delivery date	
		t0= date of signature of the contract	
		Due date	Cross if needed
1	Planning & Engineering documentation		
1.1	Time schedule (bar chart)	t0	X
1.2	Monthly progress report	Each month	X
1.3	Foundation drawing with loads, forces and civil requirements		
1.4	General arrangement & interface drawings	With the offer 18 weeks after t0	X
1.5	List of air consumers / data Sheet		
1.6	List of consumables	18 weeks after t0	X
1.7	List of cooling water consumers / Data Sheet		
1.8	List of documents, drawing list	With the offer 18 weeks after t0	X
1.9	List of lubricants and lubrication points		
1.10	List of special tools and spare parts	18 weeks after t0	X
1.11	Noise Emission Sheet		
1.12	Vibration Emission Sheet		
1.13	Parts list / list of components	With the offer 18 weeks after t0	X
1.14	Piping and instrumentation diagram		
1.15	Sectional & assembly drawings	18 weeks after t0	X
1.16	Detailed drawings	18 weeks after t0	X
1.17	Technical data sheet (according to specific datasheet given)	With the offer 18 weeks after t0	X
1.18	Static calculation		
1.19	Dynamic fluid & structure calculation		
1.20	Design justification memo	18 weeks after t0	X
1.21	Document reference table		
1.22	Equipment functional analysis		

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 9/20
--	---	-----------	--------------------	-------------	---------------

Pos.	JACKING OIL BLOCKS Title of documents	Delivery dates	
		t1= Site delivery date	
		t0= date of signature of the contract	
		Due date	Cross if needed
1.23	Complete studies for production		
2	I&C documentation		
2.1	Cable list		
2.2	Circuit / wiring diagram		
2.3	Connection diagram		
2.4	List of electrical consumer		
2.5	List of measuring points		
2.6	List of setting and limit values		
3	Quality assurance documentation		
3.1	Manufacturing Report	t1	X
3.2	Inspection test plan to be submitted to purchaser before manufacturing for approval. This I&T plan shall contain at least: <ul style="list-style-type: none"> All references of non-conformances which occurred during production References of inspection records issued during production. Validation of each inspection step by quality control manager from supplier 	With the offer 4 weeks prior t1	X
3.3	Test certificates (welding tests, hydraulics tests & others). Attached to this inspection and test plan, the supplier will provide at least the following documents: <ul style="list-style-type: none"> Hydraulic test report Welding book Inspection reports Copy of all non-conformances 	t1	X
3.4	On site tests certificates		
3.5	Material test certificates (content equivalent to certificate level 3.1 – EN10204)	4 weeks prior to t1	X
3.6	Feedback for FMD studies including MTBF, MTTR.		
3.7	Complete FMEA for the equipment / HAZOP		
3.8	Quality assurance plan with witness points	With the offer 18 weeks after t0	X
3.9	Declaration of conformity / Manufacturer certificate of compliance		
3.10	Compliance to ASME BPVC Sec. VIII [1]		
3.11	Documentation for cleanliness of material following ISO 16431 [4]	4 weeks prior to t1	X
4	Transportation & Packing documentation		
4.1	Packing list with weights and dimensions	4 weeks prior to t1	X
4.2	Document of readiness for shipment	4 weeks prior to t1	X
4.3	Shipping and declaration documents	4 weeks prior to t1	X
4.4	Storage instructions	18 weeks after t0	X
5	Erection, Operating & Maintenance Manual (EOMM)		
5.1	EOMM in accordance with IBV WD0002 [21]	4 weeks to prior t1	X

Dept. Document No. 9010 RAW78SGGR-----ES0002C
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4 Testing and verification requirements

4.1 Testing procedure

The supplier shall submit their inspection and testing (I&T) plan to the Purchaser for approval in accordance with Inspection & Test Plan [22].

4.1.1 Hydraulic tests

Hydraulic tests shall be conducted on unpainted equipment using **demineralized** water.

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 10/20
--	---	-----------	--------------------	-------------	----------------

Hydraulic tests shall be carried out 350 bar gauge.

No leakage or seepage is permitted.

Following testing, the equipment shall be drained and hot air dried before painting, protection and conditioning.

For delivery, the new gaskets shall be provided with the equipment. The type of gaskets used during testing shall be the same as those for delivery of the equipment.

4.2 Records of material / performance tests

Not applicable.

4.3 Reporting

Test reports shall be issued to Purchaser after completion of all tests and inspections.

5 Process requirements

5.1 Specific process requirements

Pressure taps shall be in accordance with the requirements listed in [25].

5.2 Specific process monitoring requirements and records

Not applicable.

6 Associated standards

6.1 Listing of applicable documents and standards

6.1.1 Code & Standards

See project general specification [24].

Table 1: International standards

N°	Standard	Title
[1]	ASME BPVC VIII	Boiler Pressure Vessel Code
[2]	ISO 3448	ISO Viscosity Classification, 1993
[3]	ISO 8068	Specifications for lubricating oils for turbines, 2006
[4]	ISO 16431	Hydraulic fluid power – verification of cleanliness

6.1.2 Purchaser's documents

Table 2: Purchaser's documents

N°	Standard	Title
[20]	HTGD 90117	Lubricating and control oils for gas and steam turbines – specification and supervision
[21]	IBV WD0002	“External Supplier” documentation to be included in the EOMM
[22]	IT GBVR98821	Jacking oil blocks inspection & test plan
[23]	RAW/78/S/-----/ES/018	Turbine specific instrumentation
[24]	RAW/78/S/-----/GS/002	Project general specification
[25]	RAW/78/S/-----/GS/040	Instrumentation and Control Taps
[26]	RAW/78/S/-----/GS/140	Pipe class manual (SZ98 – Jacking oil)
[27]	RAW/78/S/GGR-----/FD/003	Piping and Instrumentation Diagram - Turbine Jacking Oil System

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES002C		A	2014-02-26	EN Approved

6.2 Order of precedence

In case of conflict between equipment specification, international standards and Purchaser documents, conflict point shall be discussed between the Supplier and the Purchaser for approval.

7 Transportation and logistics requirements

7.1 Delivery requirements

See project general specification [24].

7.2 Marking, identification requirements

See project general specification [24].

A label plate with the following information shall be attached to the jacking oil blocks:

- Supplier identification
- Fabrication data (place, year, work order number, serial number of equipment)
- Design conditions (temperature (°C), pressure (barg))
- Material
- Tag number of the equipment (in accordance with P&ID [27])

7.3 Packaging and preservation requirements

See project general specification [24].

The conditioning for the transport shall be done in order to keep the integrity of the equipment.

Packaging shall be able to maintain the cleanliness level. All sealing device shall be controlled and repaired if needed.

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 12/20
--	---	-----------	--------------------	-------------	----------------

7.4 Environment, health and safety requirements

Not applicable.

8 Notes

8.1 General notes

Not applicable.

8.2 Identification of changes

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Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----	ES0002	A	2014-02-26	EN Approved

9 Annex

9.1 Datasheet

9.1.1 Turbine bearings

PARAMETER	UNIT	DATA		
		Min Operating	Normal Operating	Max Operating
1. GENERAL				
Manufacturer	-	# (Recommended Bosh Rexroth)		
Type	-	Steam turbine bearing jacking oil injection block		
Function	-	Jacking oil flow & pressure control		
Quantity	-	8		
Functional item	-	N/A		
Arrangement	-	#		
2. CHARACTERISTICS				
Fluid	-	Mineral oil – ISO VG 32		
Inlet pressure	barg	N/A	285	300
Outlet pressure	barg	N/A	> 280	>295
Operating temperature	°C	35	55	65
Kinematics visc. @ operating temp.	cSt	40	18	13
Flow rate thru block	lpm	N/A	12 (6 per regulator)	16 (8 per regulator)
Design pressure	barg	315		
Design temperature	°C	60		
Test pressure	barg	350		
3. CONSTRUCTION				
Injection block				
Material	-	304L SST #		
Flow Regulator(s)				
Reference	-	#		
Quantity (per block)	-	2		
Regulator type	-	Flow control valve without check valve		
Actuator type	-	Manual rotary knob with scale for flow rate in lpm		
Maximum flow rate	lpm	#		
Body/Bonnet material	-	#		
Seat material	-	#		
Trim material	-	#		
Locking	-	Yes, with key		

Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES0002C	A	2014-02-26	EN	Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 14/20
--	---	-----------	--------------------	-------------	----------------

Item tags:			
Block 1	-		4135-CV-6010 / 11
Block 2	-		4135-CV-6012 / 13
Block 3	-		4135-CV-6014 / 15
Block 4	-		4135-CV-6016 / 17
Block 5	-		4135-CV-6018 / 19
Block 6	-		4135-CV-6020 / 21
Block 7	-		4135-CV-6022 / 23
Block 8	-		4135-CV-6024 / 25
Inlet connection(s)			
Quantity (per block)	-		1
Type	-		3/4", RTJ, BW, SAE 6000 Flange
Material	-		304L SST #
Gasket material	-		Viton
Outlet connection(s)			
Quantity (per block)	-		2
Type	-		1/2", RTJ, BW, SAE 6000 Flange
Material	-		304L SST #
Gasket material	-		Viton
Pressure tap(s)			
Quantity (per block)	-		2
Type	-		1/2" NPTF Minimes [23]
Pressure tap(s) coupling(s)			
Quantity (per block)	-		2
Type	-		Self closing coupling
4. INSTALLATION			
Overall height	mm		# (245 maximum)
Overall length	mm		# (295 maximum)
Overall width	mm		# (145 maximum)
Total unit weight	kg		#

by Supplier

9.1.2 Generator bearings

PARAMETER	UNIT	DATA		
		Min Operating	Normal Operating	Max Operating
1. GENERAL				
Manufacturer	-	# (Recommended Bosh Rexroth)		
Type	-	Generator bearing jacking oil injection block		
Function	-	Jacking oil flow & pressure control		
Quantity	-	2		
Functional item	-	N/A		
Arrangement	-	#		
2. CHARACTERISTICS				
Fluid	-	Mineral oil - ISO VG 32		

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 15/20
--	---	-----------	--------------------	-------------	----------------

Inlet pressure	barg	N/A	285	300
Outlet pressure	barg	102	N/A	150
Operating temperature	°C	35	55	65
Kinematics visc. @ operating temp.	cSt	40	18	13
Flow rate (thru block)	lpm	N/A	9	#
Design pressure	barg		315	
Design temperature	°C		60	
Test pressure	barg		350	
3. CONSTRUCTION				
Injection block				
Material	-		304L SST #	
Pressure Regulator(s)				
Reference	-		#	
Quantity (per block)	-		1	
Regulator type	-		Pressure control valve without check valve	
Actuator type	-		Manual rotary knob with scale for pressure in bar	
Maximum pressure drop	bar		#	
Body/Bonnet material	-		#	
Seat material	-		#	
Trim material	-		#	
Locking	-		Yes, with key	
Flow Regulator(s)				
Reference	-		#	
Quantity (per block)	-		1	
Regulator type	-		Flow control valve without check valve	
Actuator type	-		Manual rotary knob with scale for flow rate in lpm	
Maximum flow rate	lpm		#	
Body/Bonnet material	-		#	
Seat material	-		#	
Trim material	-		#	
Locking	-		Yes, with key	
<u>Item tags:</u>				
Block 1	-		4135-CV-6027	
Block 2	-		4135-CV-6028	
Inlet connection(s)				
Quantity (per block)	-		1	
Type	-		½", RTJ, BW, SAE 6000 Flange	
Material	-		304L SST #	
Gasket material	-		Viton	
Outlet connection(s)				
Quantity (per block)	-		1	
Type	-		½", RTJ, BW, SAE 6000 Flange	
Material	-		304L SST #	
Gasket material	-		Viton	

Pressure tap(s)	-	
Quantity (per block)	-	1
Type	-	1/2" NPTF Minimes [23]
Pressure tap(s) coupling(s)	-	
Quantity (per block)	-	1
Type	-	Self closing coupling
4. INSTALLATION		
Overall height	mm	# (245 maximum)
Overall length	mm	# (295 maximum)
Overall width	mm	# (145 maximum)
Total unit weight	kg	#

by Supplier

9.1.3 Generator exciter bearing

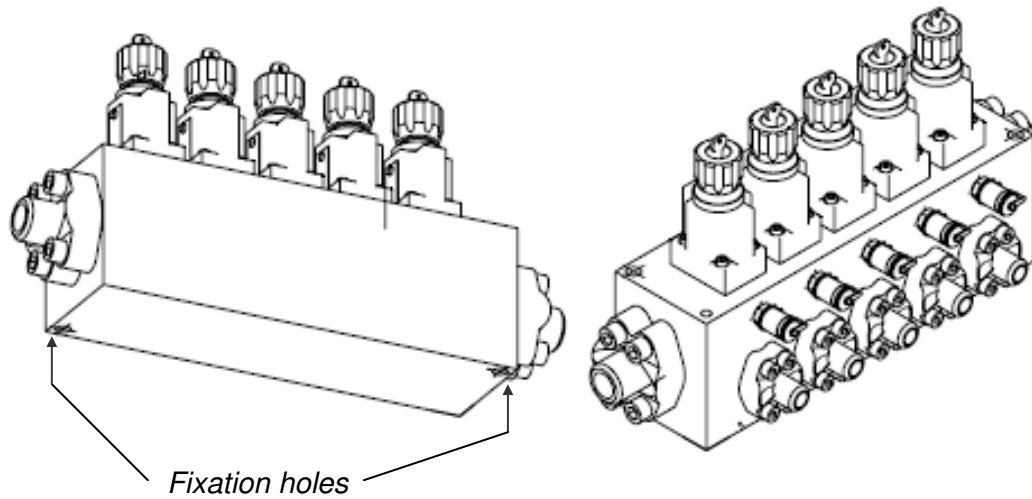
PARAMETER	UNIT	DATA		
		Min Operating	Normal Operating	Max Operating
1. GENERAL				
Manufacturer	-	# (Recommended Bosh Rexroth)		
Type	-	Geno exciter bearing jacking oil injection block		
Function	-	Jacking oil flow & pressure control		
Quantity	-	1		
Functional item	-	N/A		
Arrangement	-	#		
2. CHARACTERISTICS				
Fluid	-	Mineral oil - ISO VG 32		
Inlet pressure	barg	N/A	285	300
Outlet pressure	barg	102	N/A	150
Operating temperature	°C	35	55	65
Kinematics visc. @ operating temp.	cSt	40	18	13
Flow rate (thru block)	lpm	N/A	2.1	#
Design pressure	barg	315		
Design temperature	°C	60		
Test pressure	barg	350		
3. CONSTRUCTION				
Injection block				
Material	-	304L SST #		

Pressure Regulator(s)			
Reference	-		#
Quantity (per block)	-		1
Regulator type	-		Pressure control valve without check valve
Actuator type	-		Manual rotary knob with scale for pressure in bar
Maximum pressure drop	bar		#
Body/Bonnet material	-		#
Seat material	-		#
Trim material	-		#
Locking	-		Yes, with key
Flow Regulator(s)			
Reference	-		#
Quantity (per block)	-		1
Regulator type	-		Flow control valve without check valve
Actuator type	-		Manual rotary knob with scale for flow rate in lpm
Maximum flow rate	lpm		#
Body/Bonnet material	-		#
Seat material	-		#
Trim material	-		#
Locking	-		Yes, with key
<u>Item tags:</u>			
Block 1	-		4135-CV-6030
Inlet connection(s)			
Quantity (per block)	-		1
Type	-		½", RTJ, BW, SAE 6000 Flange
Material	-		304L SST #
Gasket material	-		Viton
Outlet connection(s)			
Quantity (per block)	-		1
Type	-		½", RTJ, BW, SAE 6000 Flange
Material	-		304L SST #
Gasket material	-		Viton
Pressure tap(s)			
Quantity (per block)	-		1
Type	-		½" NPTF Minimes [23]
Pressure tap(s) coupling(s)			
Quantity (per block)	-		1
Type	-		Self closing coupling
4. INSTALLATION			
Overall height	mm		# (245 maximum)
Overall length	mm		# (295 maximum)
Overall width	mm		# (145 maximum)
Total unit weight	kg		#

by Supplier

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 18/20
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9.2 Example from typical Supplier (with 5 flow regulators per block)



Dept.	Document No.	Type	Rev. Released	Lang.	Status
9010	RAW78SGGR-----ES0002	A	2014-02-26	EN	Approved

Originator ALSTOM NUCLEAR BUSINESS	Internal Identification Number RAW/78/S/GGR-----/ES/0002	Rev. A	Date 30.01.2014	Lang. En	Sheet 19/20
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