







Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-PIP-552-CA-0002</b>	Contract No. <b>66-6695</b>
	<b>Spares Philosophy</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
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## 1 Aim / Purpose

This section covers the general requirements regarding the spares and maintenance tools and tackles for all the system and equipments in NALCO Alumina Refinery Project.

This document provides minimum requirement of the Plant Operation, however Contractor shall include all the spares needed for construction, erection, mechanical completion, pre-commissioning and commissioning.

Spare parts will be required for all mechanical equipment, piping items, electrical equipments and the instruments supplied.

Through this specification, the term "spare parts" is used in a broad sense, i.e. component parts of any piece of equipment. The spare philosophy defined as under shall be followed by Contractor.

## 2 Mandatory Spares

Contractor shall supply "Mandatory Spares" are described discipline-wise in the attached annexures. Contractor must note that these mandatory spares shall not be used during construction, erection, mechanical completion, pre-commissioning and commissioning. The price for the mandatory spares shall be included in the lumpsum price.

### LIST OF MANDATORY SPARES

- a) Process items (Annexure 1)
- b) Rotating equipment (Annexure 2)
- c) Static equipment (Annexure 3)
- d) Piping & Material handling items (Annexure 4)
- e) Electrical items (Annexure 5)
- f) Instrumentation items (Annexure 6)

## 3 Mandatory Spares - Contractor Responsibility


Mandatory spares defined in equipment specifications / Material requisition / Spare philosophy shall be considered as a minimum requirement. Contractor shall be responsible for confirming (where listed in tender documents), recommending, where not listed in tender documents and supplying the spares. Contractor shall list out the spares for equipment or items not defined in the Annexures but included in the scope of the package. **Bidder shall furnish list of Mandatory spares (List only with unpriced bid and list with price for price bid) which will be included in the proposal and will be taken into account for bid evaluation.**

When the spare parts need to be tested / inspected together with the equipment / package, Contractor shall assure that they are available at manufacturer's workshop during the equipment testing and inspection.

Consideration shall also be given to ordering complete assemblies and instrument assemblies, for appropriate utilization of spares. Furthermore various installation materials (e.g. instrument cables fittings, tubing's, terminal blocks, etc) shall be included as required. Separate price shall be provided by contractor.

## 4 Commissioning Spares

These spares shall be marked for use during Pre-commissioning / Commissioning activities only. The quantity of commissioning spares shall be provided based on actual requirement by contractors & shall be included in lump sum price.

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## 5 Selection of Commissioning Spare Parts



The price of Commissioning Spares shall be included in the basic package price. They shall be separately identified, listed and provided by Contractor based on the requirement stated in Technical specification or elsewhere in this tender. Commissioning Spares are not included in the 1 years operational spares inventory.

Commissioning spare parts, including Construction and Pre-commissioning spare parts, are replacement spare parts that would be required during the start-up of various systems of the plant. Upon completion of commissioning, Contractor shall inventory all unused Commissioning spare parts.

Owner and Contractor shall agree on the spare parts to be transferred to Owner from any remaining Commissioning spare parts and consumables purchased by Contractor and not used or consumed during Commissioning.



## 6 One year operational & Maintenance spares

Recommended spares list for "One year operational and maintenance spares for trouble free operation" shall be quoted **along with the bid (list only for unpriced bid and list with price for price bid. Nalco will consider the list with successful bidder.** The price for such spares shall not be included in the lump sum price of the Contract.

**The validity period of the offer for spare parts shall be one year.**

## 7 Installed Spares

Installed spare requirements shall be as per requirements specified in respective technical specification or spare philosophy of individual disciplines (as per attached annexures) and shall be part of package/packages. The price of installed spares shall be included in contract price at no extra cost.

## 8 Spare philosophy for package items

Mandatory spares for Package items shall be as per the spare philosophy of the equipment / component. Mandatory spares shall be included in the contract price.



An adequate stock of start-up / Commissioning spares shall be made available at the site such that the start-up and commissioning of the equipment / systems, performance testing and handing over the equipment / systems can be carried out without hindrance and delay.

Spares for Instrumentation and Controls for Packages are indicated in Spare Philosophy - Instrumentation attached to this document as an annexure.

Contractor shall supply all equipment and instruments of latest version and ensure that spares support shall be at least for 15 years from the date of commissioning.

## 9 General

- The bids not including the above mentioned categories of spare parts, shall be considered as incomplete bid, and shall be liable for rejection.
- Wherever the word "SET" is used, it means the quantity sufficient for complete replacement of that part in one machine / equipment. However, Contractor shall furnish the detailed break up list of spares especially against the items mentioned as "SET of Spares".
- Minor items like fastening screws for wear rings, springs, washers etc. for impeller nut, retaining rings, lock washers etc. for bearings and similar parts shall be considered to be included along with the main parts and hence shall not be listed separately.
- Contractor shall note that the spares shall be identical in all respects to the main equipment parts including dimensions, material of construction etc. for all the items.
- Contractor shall recommend the spare parts inventory and future ordering schedule for safe conditions/trouble free operation.

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- F) Contractor shall ensure that all start up spares shall be delivered at site well before start up and commissioning of the Plant.
- G) In the event of any equipment being changed during engineering, Contractor shall supply start up spares and maintenance tools pertaining to this equipment. The cost of these spares and tools are included in the package price.
- H) Contractor shall also note that the Owner, if required, shall approach directly the individual equipment manufacturers / suppliers for procuring recommended spare parts and shall not necessarily procure these spare parts through Contractor.
- I) Commissioning spare and special tools shall be purchased with equipment and shall be included in equipment purchase order placed by Contractor.
- J) Contractor shall mutually agree upon on the Spare part Inventory System in order to achieve plant wide interchangeability check, with existing plant spare plant inventory system.

#### 10 **Quality Control**

Contractor shall ensure that QA / QC program used by respective Vendor/s for spare parts manufacture is the same program previously approved by Contractor for use on the original equipment purchase.

#### 11 **Availability of Spare Parts**

Contractor shall guarantee the availability of spare parts for their supplied equipment for a period of 15 years from equipment delivery date or as required by Owner

If any part becomes obsolete, Contractor shall guarantee equivalent and suitable parts consistent with original equipment purchased.

#### 12 **Packing, Shipping and Preservation.**

Packing and shipping of spare parts shall be consistent with that of original equipment purchased. Preparation for shipment and packing may be subjected to Inspection by Inspector.

All spares are to be packed and store in a manner to ensure a minimum shelf life of 5 years. Contractor shall provide recommended method of preservation and storage of spare parts to achieve requires minimum shelf life.

#### 13 **Selection of One year Operation & Maintenance Spares**

Contractor is responsible for selection of 1 years operation spares; however as general guidelines following should apply.



- Key operation and safety function of the equipments
- Current delivery Time and transportation time to site of items not stocked.
- Possibility of damage during installation and commissioning
- Expected normal wear and tear during first two years of operation
- Service interval recommended by manufacture's maintenance policy
- Possible repair and exchange items

#### 14 **Maintenance Tools & Tackles**

Contractor shall include all necessary maintenance tools required for maintenance of the plant supplied by him. A comprehensive list of maintenance tools is to be furnished in the bid in the Schedule of Maintenance Tools and Tackles by the Contractor.

For some of the equipment/systems, requirement of maintenance tools and tackles has been specified in Data Sheets. Contractor shall necessarily supply these tools in addition to other tools and tackles as required. Total price of all the maintenance tools and tackles shall be included in the quoted lump sum price.



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Contractor shall note that if any other tools are found to be necessary during the engineering and erection stage of the contract, the same shall be supplied by Contractor and no price implication due to same would be accepted.



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**Contractor shall ensure that in case of common tools required for several equipment or functions, multiple sets are included so as to take care of likely simultaneous requirement.**

#### **Special Tools and tackles**

These are the tools, jigs and fixtures, including hand held and portable spot measurement instruments which are necessary to carry out maintenance activities on all parts of the Plant. Special Tools that are recommended by Manufactureres and/or required for smooth execution of the work shall be included in supply by Contractor. **Bidder shall furnish list of special tools and tackles (List only with unpriced bid and list with price for price bid) which will be included in the proposal and will be taken into account for bid evaluation.**



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#### **Selection of Special Tools and tackles**

Special tools are those tools which are not readily available. Special tools shall be identified by the equipment Vendor and Contractor shall purchase them when procuring the equipment items to which they relate. Contractor shall transfer all special tools to Owner upon completion of Plant.

#### **Annexure 1**

Spare Philosophy for Process

#### **Annexure 2**

Spare Philosophy for Rotating Equipment

#### **Annexure 3**

Spares Philosophy for Static Equipment

#### **Annexure 4**


Spare philosophy for Piping & Material Handling Items

#### **Annexure 5**

Spare Philosophy for Electrical Items



#### **Annexure 6**

Spare Philosophy for Instruments

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## 1 MANDATORY SPARES LIST FOR PROCESS ITEMS



Sr. No.	Item Description	Spare Parts Description	Quantity per Equipment
1	Trays / Tower Internals	• Bolting	10% of total of each type / size (min.10 nos. of each size)
		• Camp Assemblies	10% of total of each type / size (min.10 nos. of each size)
		• Gasket	100% of each type & size
		• Sealing Foils	200% of each size
		• Random Tower packing	15% of carbon and ceramic, 10% for metallic and Plastic
		• Spray Nozzels	10% (Min. 1 nos of each type)
		• Demister Pad	100% of each type & size
2	Ejector & Ejector System	• Gaskets	200%
		• Boltings	20%
		• Steam Nozzels	100%
3	Filters	• Filter Elements / Cartridge / for / Cartridge Filter	100% Filter element per Filter
		• Nuts & Bolts for Filters / Coalescers	10%
		• Gasket	100% of each type & size
4	Pressure Relief Valves	• Disc	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.
		• Expansion Bellow	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.
		• Spring	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.
		• Gasket set	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.
		• Breather Valves	1 set of seal kit for each Valve
		• Flame Arresters	One no. of Flame Arrestor Element & one set Gasket for each Type, Size, Rating and material
		• Rupture Disc	4 Nos. of Gaskets & 4 Nos. of Spare Discs for each Tag.



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## 1 MANDATORY SPARES LIST FOR ROTATING EQUIPMENT



### 1.1 CENTRIFUGAL PUMPS (HORIZONTAL) ONE/TWO STAGES

Equipment Item No.    Total No. of Units Installed:

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
	<b>MECHANICAL</b>								
	<b>PUMP</b>								
1	Set of Impellers (Full Dia)	1	1	1	1	1	2	2	
2	Set of Shaft with keys	1	1	1	1	1	2	2	
3	Set of Interstage Shaft sleeves	1	1	1	1	1	2	2	
4	Set of Case wearing rings	1	1	2	3	3	3	3	
5	Set of Impeller wearing rings	1	1	2	3	3	3	3	
6	Set of Casing liners	1	1	2	3	3	3	3	
7	Set of Gaskets, O-rings	2	4	6	8	8	8	8	
8	Set of Interstage Bushings	1	1	1	1	1	2	2	
9	Set of Mechanical Seals alongwith Shaft Sleeves under seals with gland plates for Cartridge seals/ without gland plate for other seals	1	1	2	2	3	3	3	
10	Set of gland packings	2	4	6	8	8	8	8	
11	Set of Labyrinths for bearing housing	1	1	2	3	3	3	3	
12	Set of Oil Seals for bearing housing	1	2	3	4	4	4	4	
13	Set of bearings (Non-drive end side)	1	1	2	3	3	3	3	
14	Set of bearings (Drive end side)	1	1	2	3	3	3	3	
15	Set of flexible element of coupling	1	1	1	1	1	2	2	
16	Set of 'V' belts(if applicable)	2	2	2	2	2	2	2	

NOTE:

- The Word "Set" means the quantity required for full replacement of that part in one machine.
- The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
- Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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## 1.2 CENTRIFUGAL PUMPS (VERTICAL)



Equipment Item No.

Total No. of Units Installed:

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Set of Impellers (Full Dia)	1	1	1	1	1	2	2	
2	Set of Shaft with keys (excluding driver & column shaft)	1	1	1	1	1	2	2	
3	Set of Interstage Shaft sleeves	1	1	1	1	1	2	2	
4	Set of Interstage Bushings								
5	Set of Case wearing rings	1	1	2	3	3	3	3	
6	Set of Impeller wearing rings	1	1	2	3	3	3	3	
7	Set of Casing liners	1	1	2	3	3	3	3	
8	Set of Gaskets, O-rings	2	4	6	8	8	8	8	
9	Set of Line Bearings (Spider Bearings)	1	1	2	3	3	3	3	
10	Set of Mechanical Seals alongwith Shaft Sleeves under seals with gland plates for Cartridge seals/ without gland plate for other seals	1	1	2	2	3	3	3	
11	Set of gland packings	2	4	6	8	8	8	8	
12	Set of Vapour Seals	1	2	3	4	4	4	4	
13	Set of bearings	1	1	2	3	3	3	3	
14	Set of flexible element of coupling	1	1	1	1	1	2	3	
15	Set of 'V' belts(if applicable)	2	2	2	2	2	2	2	

NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.



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### 1.3 CENTRIFUGAL HORIZONTAL PUMPS (MULTI-STAGE)

Equipment Item No.

Total No. of Units Installed :



S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
	<b>RADIAL SPLIT AND AXIAL SPLIT PUMPS</b>								
1	Complete Rotor assembly dynamically balanced including balance drum	1	1	1	1	1	2	2	
2	Set of case wearing rings	1	1	2	3	3	3	3	
3	Set of Impeller wearing rings	1	1	2	3	3	3	3	
4	Set of Intermediate bushings	1	1	2	3	3	3	3	
5	Set of Balance Drum Sleeve (Bushing)	1	1	2	3	3	3	3	
6	Set of Mechanical Seal alongwith Shaft Sleeves under seals with gland plates for Cartridge seals without gland plate for other seals	1	1	2	2	3	3	3	
7	Set of Labyrinths for bearing housing	1	1	2	3	3	3	3	
8	Set of Gaskets, O-rings	2	4	6	8	8	8	8	
9	Set of Bearings, NDE	1	1	2	3	3	3	3	
10	Set of Bearings, DE	1	1	2	3	3	3	3	
11	Set of Flexible elements of Coupling	1	1	1	1	1	2	2	
	Following shall be applicable against "rotor assembly" mentioned above for <b>RADIALLY SPLIT DOUBLE CASE PUMPS</b>								
1	Complete replaceable inner-case element consisting of all rotating & stationary hydraulic elements	1	1	1	1	1	2	2	
	<b>Lube Oil Pump Rotary</b> (main + standby)								
1	Complete bare pump assembly excluding driver, couplings & baseplate	1	1	1	1	1	2	2	
2	Set of bearings	1	1	2	3	3	3	3	
3	Set of Mechanical Seals	1	1	2	2	3	3	3	
4	Set of Gaskets & O-rings	2	4	6	8	8	8	8	

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	<b>Lube Oil Filters</b>								
1	Filter cartridge / element alongwith set of gaskets, 'O' rings	1	2	3	3	3	3	3	
	<b>Lube Oil Coolers</b>								
1	Set of Gaskets, 'O' Rings	2	4	6	8	8	8	8	

**NOTE:**

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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#### 1.4 RECIPROCATING PUMPS (PLUNGER TYPE)



Equipment Item No.

Total No. of Units Installed :

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Set of Suction Valve Assembly	1	1	2	2	3	3	3	
2	Set of Discharge Valve Assembly	1	1	2	2	3	3	3	
3	Set of bearings	1	1	2	3	3	3	3	
4	Set of Gaskets, 'O' rings	2	4	6	8	8	8	8	
5	Set of Plungers	1	1	1	1	1	2	2	
6	Set of Plunger Packings	2	4	6	8	8	8	8	

#### NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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## 1.5 POSITIVE DISPLACEMENT PUMPS (CONTROLLED VOLUME)



Equipment Item No.

Total No. of Units Installed :

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Set of Suction Valve Assembly	1	1	2	2	3	3	3	
2	Set of Discharge Valve Assembly	1	1	2	2	3	3	3	
3	Set of bearings	1	1	2	3	3	3	3	
4	Set of Gaskets, 'O' rings	2	4	6	8	8	8	8	
	Additional Spares for <b>Plunger Pumps</b>								
1	Set of Plungers	1	1	1	1	1	2	2	
2	Set of Plunger Packings	2	4	6	8	8	8	8	
	Additional Spares for <b>Diaphragm Pumps</b>								
1	Set of Diaphragms	2	2	4	6	6	6	6	
2	Set of Hydraulic piston packings/ rings	2	2	4	6	6	6	6	
3	Oil refill valve assembly	1	1	2	2	3	3	3	
4	Oil relief valve assembly	1	1	2	2	3	3	3	

### NOTE:

- The Word "Set" means the quantity required for full replacement of that part in one machine.
- The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
- Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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## 1.6 ROTARY PUMPS

Equipment Item No.



Total No. of Units Installed :

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Set of Rotors	1	1	1	1	1	2	2	
2	Casing Insert (Stator) (only for screw pump)	1	1	1	1	1	2	2	
3	Set of bearings (Drive End)-Each Screw	1	1	2	3	3	3	3	
4	Set of bearings (Non-Drive End)-Each Screw	1	1	2	3	3	3	3	
5	Set of Gaskets, 'O' rings	2	4	6	8	8	8	8	
6	Set of Labyrinths	1	1	2	3	3	3	3	
7	Set of Oil Seals	1	2	3	4	4	4	4	
8	Set of Mechanical Seals alongwith Shaft Sleeves under seals with gland plates for Cartridge seals/ without gland plate for other seals	1	1	2	2	3	3	3	
9	Set of Gland Packings (where applicable)	2	4	6	8	8	8	8	

### NOTE:



1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.



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## 1.7 ROTARY COMPRESSOR (SCREW / LOBE TYPE)

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
	<b>MECHANICAL</b>								
	<b>COMPRESSOR</b>								
1	Set of Rotors	1	1	1	1	1	1	1	
2	Set of Radial Bearings (DE + NDE)	1	2	3	4	4	4	4	
3	Set of Thrust Bearings	1	2	3	4	4	4	4	
4	Set of Shaft Seal Assembly (DE + NDE) and sleeves under seals	1	2	3	3	3	3	3	
5	Set of Timing Gears	1	1	1	1	1	2	2	
6	Set of Gaskets & O-rings	2	4	6	8	8	8	8	
7	Set of air filter elements	2	4	6	8	8	8	8	
	<b>Lube Oil Pump Rotary (Main + Standby)</b>								
1	Complete bare pump assembly excluding the driver, couplings & baseplate	1	1	1	1	1	2	2	
2	Set of bearings	1	1	2	3	3	3	3	
3	Set of Mechanical Seals	1	1	2	2	3	3	3	
4	Set of Gaskets & O-rings	2	4	6	8	8	8	8	
	<b>Lube Oil Filters</b>								
1	Filter cartridge / element along with set of gaskets & O-rings	1	2	3	3	3	3	3	
	<b>Oil Coolers</b>								
1	Set of Gaskets & O-rings	2	4	6	8	8	8	8	

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NOTE:

1. The Word “Set” means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRCTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as ‘Not Applicable’ against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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### 1.8 GEAR BOX (SPECIAL / GENERAL PURPOSE)

Equipment Item No. Total No. of Units Installed :

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Set of High Speed/Low Speed Gears & Shaft Assembly	1	1	1	1	1	1	1	
2	Set of Radial Bearings	1	2	3	4	4	4	4	
3	Set of Thrust Bearings	1	2	3	4	4	4	4	
4	Set of Labyrinths, Oil Seals	2	3	4	4	4	4	4	
5	Set of all Gaskets, O-rings	2	4	6	8	8	8	8	
6	Complete bare lube oil pump (if integral with gear box)	1	1	1	1	1	1	1	

#### NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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## 1.9 AGITATORS & MIXERS

Equipment Item No.



Total No. of Units Installed :

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	-	-	-	-	
1	Bearings for Gearbox & Agitator lantern	1	1	3	-	-	-	-	
2	Oil-seals for Gearbox & Agitator lantern	1	1	2	-	-	-	-	
3	Shaft sleeve	1	2	2	-	-	-	-	
4	Set of shaft packings or Lip-seal	1	1	2	-	-	-	-	
5	Complete mechanical seal or Seal cartridge (as appl.)	1	2	3	-	-	-	-	
6	Set of flexible elements for couplings (for flexible couplings)	1	1	2	-	-	-	-	
7	Impeller with shaft	1	1	2	-	-	-	-	
8	Set of V-Belts (if applicable)	2	2	3	-	-	-	-	

2

### NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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#### 1.10 FANS & BLOWERS



Equipment Item No.

Total No. of Units Installed:

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
1	Complete Rotor dynamically balanced	1	1	1	1	1	1	1	
2	Set of Labyrinths	1	2	3	4	4	4	4	
3	Set of Shaft Seal Assembly (DE + NDE) including sleeves under seals	1	2	3	4	4	4	4	
4	Set of Gaskets, O - rings	2	4	6	8	8	8	8	
5	Set of flexible element of coupling	1	1	1	1	1	2	2	
6	Set of Air filter elements (for air service only)	1	1	1	1	1	1	1	
7	Damper/ IGV Seals 100% Actuator-1 set of each type	1	1	1	1	1	1	1	

#### NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.

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### 1.11 LIQUID RING VACUUM PUMPS

Equipment Item No.    Total No. of Units Installed:

S.No.	Part Description	Quantity Required (Based on No. of Installed Units)							Quoted (Yes / No / Not Appl.)
		1	2	3	4	5	6	7	
	<b>MECHANICAL</b>								
	<b>PUMP</b>								
1	Rotor	1	1	1	1	1	1	1	
2	Set of bearings (DE + NDE)	1	2	3	4	4	4	4	
3	Set of Shaft Seal Assembly (DE+NDE) including sleeves under seals	1	2	3	3	3	3	3	
4	Set of Gaskets, O-rings	2	4	6	8	8	8	8	
5	Set of Cones	1	1	1	1	1	1	1	
6	Complete set of Coupling of each type	1	1	1	1	1	1	1	
	<b>Coolers</b>								
1	Set of Gaskets, O-rings	2	4	6	8	8	8	8	
2	Set of V-Belts(if applicable)	2	2	2	2	3	3	4	

NOTE:

1. The Word "Set" means the quantity required for full replacement of that part in one machine.
2. The LSTK CONTRACTOR shall quote for all the mandatory spares as defined above and as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable' against that spare supported with proper technical explanation.
3. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction and heat treatment.



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#### STATIC EQUIPMENT – MANDATORY SPARES


For Erection and commissioning

Sr. No.	Item Description	Spare Parts Description	Quantity Per Equipment
1	Shell & Tube Heat Exchanger	Gaskets – Per flanged joint (including Girth flange joints)	200%
		Studs / 2 Nuts / Washers – Per flanged joint (including Girth flange joints)	10% (Min. 2 nos.)
		Test flange / Test ring /dummy shell for site hydro testing	1 set per exchanger as applicable
2	Vessel / Column / Reactor / Tank	Gaskets – Per flanged joint (including body / cover flange joint)	200%
		Studs / 2 Nuts / Washers – Per flanged joint (including body / cover flange joint)	10% (Min. 2 nos.)
		Internal Gaskets	200%
		Internal bolting / Washers	10% (Min. 2 nos.)
		Sight / Light Glass	4 Sets for each installed glass
3	Plate Heat Exchanger	Internal Gaskets	5% (Min. 2 nos.)
		Internal Plates	5% (Min. 2 nos of each type)
4	Refractory material	Bricks, Ceramic materials, mortar etc	10% of each type of refractory based on composition, shapes and sizes
5	Spray nozzles	Ceramic / plastic nozzles for Towers	10% (Min. 1 nos of each type)
<b>6</b>	<i>Burner spares (if Burner is applicable in Bid)</i>	<i>Spares for Burner as per Burner manufacturer recommendations</i>	<i>As per recommendations of Burner manufacturer</i>

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## 1.0 GENERAL

This document describes the Spare Quantity Philosophy for Piping and Material handling items.

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## 2.0 SPARE PHILOSOPHY FOR PIPING

### 2.1 MANDATORY SPARES

Sr.No.	Part Description	Quantity Required(%)	Remarks
1.0	Pipes and Fittings (1/2" to 1 1/2")	2	Note-2
2.0	Pipes and Fittings (2" to 8")	2	Note-2
3.0	Pipes and Fittings (10" to 36")	2	Note-2
4.0	Pipes and Fittings (above 36")	NIL	
5.0	Valves and Flanges(1/2" to 1 1/2")	2	Note-2
6.0	Valves and Flanges(2" to 4")	2	Note-2
7.0	Valves and Flanges(6" to 8")	2	Note-2
8.0	Valves and Flanges(10" & above )	Note-3	
9.0	Bolts , Nut & Gaskets (All sizes)	10	Note-4
10.0	Steam Traps (All sizes)	2	Expect process traps


#### NOTES:

1. % of quantity required to be left mandatory spares is for each and every item consumed in as built including for packaged items. No substitution is allowed.
2. As a minimum one peice (one pipe lenght, 6mtr.) per item spare shall be supplied. No substitution in size and material allowed.
3. For rating CL 900 and above and size 10" and above, minimum one valve surplus shall be supplied for each piping class and for each size, rating and material.
4. As a minimum one set of bolts/nuts.



### 2.2 ONE YEAR OPERATIONAL AND MAINTENANCE SPARES

Contractor shall consider **One** year operational and maintenance spares based on their experience and furnish the unpriced list with technical bid.

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## 2.3 COMMISSIONING SPARES

### 2.3.1 SPARE PERCENTAGES FOR PIPES



Material	size range (inch NB)	qty(m) 1 to 4	qty(m) 5 to 25	qty(m) 26 to 50	qty(m) 51 to 100	qty(m) 101 to 200	qty(m) 201 to 300	qty(m) above 300	minimum order qty(m)
		spares ( % )	spares ( % )	spares ( % )	spares ( % )	spares ( % )	spares ( % )	spares ( % )	
Carbon Steel	1/4 " To 1 1/2"	50	30	30	30	20	20	20	6
	2" To 4"	50	15	15	15	10	10	10	6
	5" To 6"	50	10	10	10	10	10	10	6
	8" To 12"	20	10	10	10	10	8	8	3
	14" To 20"	20	10	10	8	8	5	5	3
	22" and above	20	5	5	3	3	3	3	3
Alloy Steel/SS	1/4 " To 1 1/2"	50	25	25	25	15	15	15	6
	2" To 4"	50	10	10	10	10	10	10	6
	5" To 6"	50	10	10	10	10	10	10	6
	8" To 12"	20	10	10	10	8	5	5	3
	14" To 20"	20	10	10	8	8	5	5	3
	22" and Above	20	5	5	3	3	3	3	3
Non-Ferrous	1/4 " To 1 1/2"	50	20	20	20	15	15	10	6 *
	2" To 4"	50	10	10	10	5	5	5	6 *
	5" To 6"	50	8	8	8	5	5	5	6 *
	8" To 12"	20	5	5	5	5	5	3	3 *
	14" To 20"	20	5	5	3	3	2	2	3 *
	22" and Above	20	0	0	0	0	0	0	3 *
Plastic	1/4 " To 1 1/2"	50	25	25	25	15	15	10	6
	2" To 4"	50	10	10	10	10	10	10	6
	5" To 6"	50	10	10	10	10	10	10	6
	8" To 12"	20	10	10	10	10	8	8	3
	14" To 20"	20	10	10	8	8	5	5	3
	22" and Above	20	5	5	3	3	3	3	3

**\* Minimum requirement to be decided by Contractor.**







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### 2.3.5 SPARE PERCENTAGES FOR MISCELLANEOUS ITEMS


material	size range (inch NB)		% spare	minimum order qty(nos)
Gasket* *	1/4 " To 1 1/2"		30	10
	2" To 4"		20	10
	5" To 6"		20	10
	8" To 12"		20	10
	14" To 20"		20	6
	22" and above		20	6
Gasket Ring Joint	all sizes		10	2
Fastener	all sizes		30	NA
LineSteam/Air Trap	all sizes		5	NA
Temporary Strainer	all sizes		5	NA
Permanent Strainer	all sizes		0	NA

\*\* Except ring joint gaskets.

#### NOTES :

- 1) All % on calculation excluding pipes are rounded up to the next integer ( e.g. 1.08 becomes 1.0, 1.50 becomes 2.0 and 1.60 becomes 2.0)
- 2) Minimum order quantity is considered only for pipes and gaskets. For fittings, valves, & flanges for sizes  $\leq 1 \frac{1}{2}$ " in CS/AS/SS/Plastic MOC spares may be added by Contractor based on the project requirement.
- 3) Gasket requirement for hydrotest, flushing and cleaning are not considered.
- 4) For lined pipes, fittings & flanges no spares are considered as these are tailor made.
- 5) For all the special parts e.g. bellows, sight glass, couplers, funnels etc. and for the primary, secondary & special supports , Contractor should provide the spares based on the project requirement.



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### 3.0 SPARE PHILOSOPHY FOR MATERIAL HANDLING EQUIPMENT

Contractor shall supply the spares as described below based on the equipment applicability for the specific package. In case a particular type or equipment is not appearing, contractor shall include the spares for the same based on their experience.

#### 3.1 COMMISSIONING SPARES :

Contractor shall include and supply all types of commissioning spares which shall be required during Erection, Mechanical completion, start up, precommissioning and commissioning of the entire package.



#### 3.2 MANDATORY SPARES :

##### 3.2.1 Stacker and Bucket Wheel Reclaimer :



Sr.No.	Item Description	Total Quantity
1	Wheel assy along with drawing for each type.	1 Set
2	Bucket for bucket wheel.	1 No
3	Input shaft & oil seal set for each type of gear box.	1 Set

##### 3.2.2 Belt Conveyors :

Sr.No.	Item Description	Quantity (% of total quantity used)
1	Idlers of each type	10%
2	Belting of each type / size	10%
3	Low speed coupling of each type / size	1 No
4	Resilient plate and fusible plug for High Speed coupling	1 No each
5	Pulley with bearing and bearing housing for each type	1 set
6	Input shaft & oil seal set for each type of gear box.	1 Set

##### 3.2.3 Crusher :

Sr.No.	Item Description	Total Quantity
1	Hammers	1 Set

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#### 3.2.4 Vibrating Screen ( All type ):

Sr.No.	Item Description	Quantity (% of total quantity used
1	Vibrating screen rods with rubber spacer.	10%
2	V belt	1 set
3	Screen supporting rubber bush / spring	1 Set





#### 3.3 ONE YEAR OPERATIONAL AND MAINTENANCE SPARES



Contractor shall consider **One** year operational and maintenance spares based on their experience and furnish the unpriced list with technical bid.



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	<b>ANNEXURE 5 SPARES PHILOSOPHY FOR ELECTRICAL EQUIPMENT</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
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## 1. MANDATORY SPARE PARTS

The following lists are guidelines illustrating the "type" of parts and quantities of spares to be specified and quoted by the LSTK Contractor.


ITEM NO.	SPARE PART	Quantity Required
1.	<b>11 kV Switchgear (one set of spare for each switchgear)</b>	Quantity is per switchboard
1.1.	Circuit Breaker Closing coil	1 No. of each Rating/Type
1.2.	Circuit Breaker Tripping coil	1 No. of each Rating/Type
1.3.	Circuit Breaker Spring charging motor	1 No. of each Rating/Type
1.4.	Vacuum contactor HT fuse	1 No. of each Rating/Type
1.5.	PT HT fuse	2 Nos. of each Rating/Type
1.6.	Bus support insulator	1 No. of each Rating/Type
1.7.	Micro switch (1 NO + 1 NC)	1 No. of each Rating/Type
1.8.	Aux. contact block (4 NO + 4 NC)	1 No. of each Rating/Type
1.9.	Vacuum Contactor Closing coil	1 No. of each Rating/Type
1.10.	Vacuum Contactor Tripping coil	1 No. of each Rating/Type
1.11.	Control fuses	20% spare of each Rating/Type
1.12.	Indication lamps	20% spare of each Rating/Type
1.13.	Glasses for indicating meters	20% spare of each Rating/Type
1.14.	Control terminal blocks	20% spare of each Rating/Type
 1.15.	MCB for all rating	20% spare of installed quantity
2.	<b>415 V PCC/MCC/EPCC or MV Switchboard (one set of spare for each Switchboard)</b>	Quantity is per switchboard
2.1.	Closing coil	1 No. of each Rating/Type
2.2.	Shunt trip coil	1 No. of each Rating/Type
2.3.	Indicating lamps	20% spare of installed quantity
 2.4.	LED ( Inside Panel)	20% spare of installed quantity
2.5.	Push buttons	20% spare of installed quantity
2.6.	Control fuse links	20% spare of installed quantity
2.7.	Control fuse base	20% spare of installed quantity
2.8.	Auxiliary Contactor ( 2 NO + 2 NC)	20% spare of installed quantity
2.9.	Auxiliary Contactor ( 4NO + 4 NC)	20% spare of installed quantity
2.10.	Fuse switch for all rating	20% spare of installed quantity
2.11.	HRC fuse links for all rating	20% spare of installed quantity
2.12.	Power Contactors for all rating	20% spare of installed quantity
2.13.	Electronic Overload relays for all rating	20% spare of installed quantity



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ITEM NO.	SPARE PART	Quantity Required
2.14.	Auxiliary Relay (trip circuit trip supervision, lock out, etc. )	20% spare of installed quantity
2.15.	Timers (as applicable) for all rating	20% spare of installed quantity
2.16.	Thermistor Relay for all rating	20% spare of installed quantity
2.17.	Glasses for indicating meters for rating all rating	20% spare of installed quantity
2.18.	Control terminal blocks for rating all rating	20% spare of installed quantity
 2.19.	MCB for all rating	20% spare of installed quantity
3.	<b>Miscellaneous switchgear</b>	
3.1.	ELCB for all rating	20% spare of installed quantity
3.2.	MCB/MCCB for all rating	20% spare of installed quantity
3.3.	HRC fuse for all rating	20% spare of installed quantity
3.4.	Aux. Contractor (2NO + 2NC)	20% spare of installed quantity
3.5.	Indicating lamp	20% spare of installed quantity
3.6.	Push button	20% spare of installed quantity
4.	<b>HV induction motors (One set of following for per motor ordered)</b>	
4.1.	Bearing ( DE & NDE )	one no.
4.2.	External fan	one no.
4.3.	End shield of DE	one no.
4.4.	End shield of NDE	one no.
4.5.	Terminal studs/bushing assembly	one no.
 5.	<b>LV induction motors (One set of following for each type and rating ordered)</b>	
5.1.	Bearing ( DE & NDE )	one no. of each type
5.2.	External fan	one no.
5.3.	End shield of DE	one no.
5.4.	End shield of NDE	one no.
5.5.	Terminal box cover	one no.
5.6.	Terminal/ bushing	one set each
6.	<b>Oil filled Distribution Transformer (One set of following items for each transformer)</b>	
6.1.	HV bushing complete with metal parts	1 no.
6.2.	LV bushing complete with metal parts	1 no.
6.3.	LV neutral bushing	1 no.
6.4.	Silica gel breather	1 no.
6.5.	Pressure relief valve	1 no.
6.6.	Plain oil level gauge	1 no.
6.7.	Set of gaskets for transformer	1 set

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ITEM NO.	SPARE PART	Quantity Required
6.8.	6" dial type OTI	1 no.
6.9.	Double float bucholz relay	1 no.
6.10.	6" dial type WTI	1 no.
6.11.	One valve of each type	1 set
7.	<b>LV Busduct ( per Busduct )</b>	
7.1.	Support insulator	4 Nos.
7.2.	Gasket	4 Sets.
7.3.	Copper flexibles	1 no. of each rating & type
8.	<b>DC System(one set of spare for each DC System)</b>	
8.1.	All fuse with fuse fitting	20% spare of installed quantity
8.2.	All cards such as input & output cards, power supply cards, processor cards etc.	1 no. of each rating & type
8.3.	Thyristors	1 no. of each rating & type
8.4.	Blocker Diode	Two nos.
8.5.	Fuse switch for all rating (Within DCDB)	20% spare of installed quantity
8.6.	HRC fuse links for all rating (Within DCDB)	20% spare of installed quantity
9.	<b>BATTERY (Per Set)</b>	
9.1.	Battery stand insulators	4 nos.
9.2.	Cell insulators	4 nos.
9.3.	Vent plug cum level indicators	2 nos.
9.4.	Complete dry cell	1 no.
9.5.	Battery intercell connector	2 nos.
9.6.	Battery interrow connector	2 nos.
10.	<b>LED Fixture</b>	
10.1.	Driver Card	20 % of installed quantity
10.2.	LED chip	20 % of installed quantity
10.3.	Glass for Well glass fitting/Low or Medium or high bay fitting/Bulkhead fitting/ Flood light fitting	20 % of installed quantity
11.	<b>Fire alarm system</b>	
11.1.	All cards	one no of each type
11.2.	Fuses	20 % of installed quantity
11.3.	Terminal blocks	20 nos.
11.4.	Fire detectors	5 % of total installed capacity of each type
11.5.	Glass for Break Glass Boxes/ Manual call point	10% of installed quantity
12.	<b>Variable Frequency Drive (one set of spare for each</b>	Quantity is per VFD

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ITEM NO.	SPARE PART	Quantity Required
	<b>VFD)</b>	
12.1.	Transistors/IGBT	One set of each rating & type
12.2.	All Cards	One type of each card
12.3.	Power & control fuses	20 % or one no (min) of each rating & type, whichever is more
13.	<b>UPS (one set of spare for each UPS system)</b>	
13.1.	Power transistors/IGBT	One No of each rating & type
13.2.	All Cards	One type of each card
13.3.	All fuses	20% spare of installed quantity
13.4.	Fuse switch for all rating (Within DCDB)	20% spare of installed quantity
13.5.	HRC fuse links for all rating (Within DCDB)	20% spare of installed quantity
14.	<b>LV POWER &amp; CONTROL CABLES AND WIRES</b>	
14.1.	Power cables ( Supply qty of each size exceed 5000 m)	500 meter of each size
14.2.	Control cables ( Supply qty of each size exceed 5000 m)	500 meter of each size
14.3.	Lighting wires	500 meter of each size & color
15.	<b>CABLE TERMINATION KITS, GLANDS &amp; LUGS</b>	
15.1.	MV cable termination kits	2 Nos of each type
15.2.	Cable Glands	10% of each type & size
15.3.	Cable lugs	10% of each type & size
16.	<b>Local Control Switch</b>	One of each type
17.	<b>Load Break Switch</b>	One of each Rating
 18.	<b>Socket (Single Phase &amp; Three Phase)</b>	2 nos. of each rating & type
 19.	<b>Power Junction Box</b>	2 nos. of each rating & type



## 2. GENERAL NOTES

1. The word 'set' means the quantity required for full replacement of that part in one machine.
2. The word TYPE means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
3. The Vendor shall supply all the mandatory spares as defined above & as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as 'Not Applicable against that spare supported with proper technical explanation.
4. Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction, heat treatment and inspection & testing requirement.
5. Above mentioned mandatory spares list defines the minimum requirement. LSTK Contractor to provide any additional items as recommended by manufacturer.

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6. Commissioning spares are part of scope of supply of LSTK Contractor. Mandatory spares as indicated above do not cover commissioning spares.
7. Commissioning Spare Parts shall be procured along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended spares shall be obtained along with the offer.
8. Mandatory spares as indicated above do not cover **One** year O & M spares. Vendor to submit spares list for **One** year operation and maintenance. The prices shall be valid for a period as indicated elsewhere in the tender.
9. Required Special Tools and Tackles shall be procured along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended special tools / tackles shall be obtained along with the offer.
10. Next rounded figure to be considered wherever % is specified. Example: For total 11 Nos. with 10% spares basis, 2 Nos. spares shall be provided.
11. The terminology used under SPARE PART is the commonly used name of the part and may vary from manufacturer to manufacturer.
12. It is the responsibility of the LSTK Contractor to get the details of the spare items from the package vendors.
13. Mandatory spares shall be applicable for electrical items of subpackages as per mandatory spare philosophy.
14. LSTK Contractor to develop the mandatory spare for any additional equipment's not covered and submit for Owner/Consultant approval.

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## 1) MANDATORY SPARES :



SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
<b>1.0</b>	<b>Field instruments</b>	
1.1	Pressure Gauges, Temperature Gauges, Differential pressure gagues, Draft gauge, Field indicators, RTD/Thermocouple (with thermowell), thermowells, Skin thermocouple sets, Speed probe and transmitters (other than coriolis mass flow meters, electromagnetic flow meters, vortex flowmeters )	10% subject to minimum 1 No. of each type
1.2	Transmitters only for coriolis mass flow meters, electromagnetic flow meters, displacer transmitter, vortex flow meters and transmitters/converters only for turbine and PD meters. Sensors/meter bodies shall not be considered for these instruments	10% subject to minimum 1 No. of each type
1.3	Transmitters for pressure, level, flow, temperature and differential pressure (complete transmitter with intergral manifold and mounting accessories like brackets, clamps etc.)	10% subject to minimum 1 no. of each type
1.4	All type of detectors for Fire & Gas system	5% subject to minimum 1 no. of total installed quantity for each type of detectors
1.5	Instrument Tubes (SS, Copper)	10% of installed quantity of each type.
1.6	Fittings/Nipples/Sockets/Plugs/Unions/Blinds	10% of installed quantity of each type
1.7	Instrument valves on impulse lines/ instrument air lines	10% of installed quantity of each type
1.8	Instrument branch cables	10% of total length of installed quantity of each type (refer note 10)
<b>2.0</b>	<b>Line mounted instruments- control valve, on-off valves, shutdown valves, deluge valves, PRDS &amp; De-superheaters, Self-actuated Pressure Control Valves, dampers etc.</b>	
2.1	Proximity switches	10% subject to minimum 1 no. of each type
2.2	Air filter regualtor	10% subject to minimum 1 no. of each type
2.3	Solenoid valves	10% subject to minimum 1 no. of each type
2.4	SMART electro-pnuematic positioners(Profibus/HART as applicable)	10% subject to minimum 1 no. of each type
2.5	Pneumatic actuator diaphragms	10% subject to minimum 1 no. of each type
2.6	Double acting pneumatic actuator seal kits	10% subject to minimum 1 no. of each type
2.7	All soft material required for opening and boxing-up of control/On-off valves and trim (like gland packings, gaskets, seal rings, O-rings etc.).	20% subject to minimum 1 no. of each type
2.8	Limit switches/position sensors/ I to P converters/accessories like boosters and air lock relays etc.	10% subject to minimim 1 no of each type
<b>3.0</b>	<b>Distributed control system / programmable logic controller/other control systems</b>	

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SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
3.1	Each type of module used in DCS/PLC/systems like I/O cards, all types of processor cards, all type of power supply modules/cards, communication cards, interface cards, etc. as required for the system	10% of total installed quantity subject to minimum 1 no. of each type
3.2	IS isolating Barriers/Isolators/ Signal multiplier/Trip Amplifier/Converters/Alarm Cards	10% of total installed quantity of each type subject to minimum 1 no. of each type
3.3	Prefabricated cables	1 set with connecting plugs for each type of peripherals and I/O hardware
3.4	Keyboard	1 nos. of each type
3.5	Hard Disk	1. no of each type
3.6	Display monitor	1 no. of each type
3.7	Relays	10% of total installed quantity of each type subject to minimum 1 no. of each type
3.8	Pushbuttons, Lamps, selector switches, switches	10% of total installed quantity of each type subject to minimum 1 no. of each type
3.9	MCBs	10% of total installed quantity of each type subject to minimum 1 no. of each type
3.11	System cabinet air filter	100%
3.11	Annunciators	
	- Power supply module	10% of total installed quantity subject to minimum 1 no. of each type
	- Flasher module	10% of total installed quantity of each type subject to minimum 1 no. of each type
	- Tone generator card	10% of total installed quantity of each type subject to minimum 1 no. of each type
	- I/O module	10% of total installed quantity of each type subject to minimum 1 no. of each type
	- Lamps	50% of total installed quantity subject to minimum 1 no. of each type
	- Fuses	50% of each type and rating subject to minimum 1 no. of each type
4.0	<b>Other system oriented items like Analysers/machine monitoring system etc.</b>	a) 10% of installed quantity( minimum 1 no. ) of each type of electronic module/sensor/detector/probe/filters/pressure regulators/flow meters and indicators.  b) 10% of installed quantity (minimum 1 no.) of each type of analyser sample handling



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SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
		system component.
<b>5.0</b>	<b>Contractor shall supply adequate number of gas cylinders (calibration/operation) for analysers and any other instrument requirements for the project considering the time required for vendor supply and in transit so as to ensure continuous availability of gas at site without any interruption.</b>	As required

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## 2) INSTALLED SPARES (Shall be available at the end of commissioning)

SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
2.1	Spare channels per I/O modules for each type of modules/cards in complete wired condition upto terminal blocks	20% of total channels
2.2	Components installed in marshalling and I/O cabinets ( like isolators/barriers, fuses, MCBS, switches etc. )	20% of installed quantity
2.3	Spare space in I/O and marshalling cabinets	20% of total space for each type of component (like Relays, barriers, terminal block, MCB, termination panels, I/O chasis, I/O modules, conduits, etc.)
2.4	Power distribution	10% installed spare feeders for each type of power supply.
2.5	Cable duct, tray and RCC trenches	40% spare space(note 9)
2.6	Multicore cables	20% (Refer note 5)
2.7	Terminal blocks in junction boxes	20% of total installed terminal blocks
2.8	Air distribution manifolds/pots	01 spare outlet per manifold equipped with valves and plugs


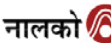
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### 3) START UP AND COMISSIONING SPARES

SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
3.1	Start up and comissioning spares for all instrument items	Shall be provided as per actual requirements. These shall be supplied in addition to mandatory spares, installed spares and consumables indicated in this document.

### 4) CONSUMABLE SPARES (to be provided after comissioning and hand over)

SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
4.1	Printer Paper (Applicable for Contractors but not applicable for Free Issue Material(FIM)s)	For six month operation (Minimum 10 boxes of each type)
4.2	Printer head (Applicable for Contractors but not applicable for Free Issue Material(FIM)s)	For six month operation (Minimum 2 nos. per printer)
4.3	Magnetic cartridge Tape (Applicable for Contractors but not applicable for Free Issue Material(FIM)s)	For six month operation (Minimum 2 nos.)
4.4	CDs/ DVDs ( Blank recordable media ) (Applicable for Contractors but not applicable for Free Issue Material(FIM)s)	For six month operation (Minimum 10 nos. CDs and 10 nos. DVD)
4.5	Printer Ribbons/Toner catridges (Applicable for Contractors but not applicable for Free Issue Material(FIM)s)	For six month operation (Minimum 10 nos. per printer)
4.6	Fuses	100% of each type
4.7	Lamps	50% of total installed quantity of each type.
4.8	Standard solutions, reagents etc. required for calibration and operation of analysers	For six month operation and calibration (Minimum 1 no. of each type)
4.9	Gas cylinders required for calibration and operation of analysers, gas detectors and any other instruments as applicable.	For six months operation and calibration from date of completion of Site Acceptance Test (Minimum 1 no. of each type).



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## 5) RECOMMENDED SPARES FOR 1 YEAR OPERATION AND MAINTENANCE

SR.NO.	PART DESCRIPTION	QUANTITY REQUIRED (% of total installed quantity as applicable)
	The spares list for 1 year operation and maintenance of all instrument items shall be obtained from respective vendors by the contractor and provided to owner.	Spares list for 1 year operation and maintenance of all instrument items from each vendor

## 6) NOTES :

- 1) The part descriptions given above are generic and may differ from actual part names used by vendors.
- 2) The word "type" means make, model number, type, range, dimensions (e.g. size, length etc. ), rating, material as applicable.
- 3) Wherever spare quantities are identified in fractions, actual quantities shall be as per the next rounded figure.(for e.g. quantity 11.1 shall be rounded to 12; similarly 9.7 shall be rounded to 10 etc.)
- 4) All multicore cables shall be completely terminated at both sides(i.e. field side as well as control room/remote I/O sides). 20% of total cores/ conductors/ pairs/ triads in each cable, suitably terminated at both ends shall be kept as spares.
- 5) Minimum 20% spares capacity shall be ensured in each segment with all intermediate accessories. Suppose control system vendor's segment design philosophy allows 10 instruments to connect on a particular segment, then only 8 instruments shall be connected on that particular segment for this project and provision for 2 instruments shall kept as spares for future use by connecting field instrument & cable.
- 6) A complete spare parts catalogue shall be provided with the maintenance instructions.
- 7) Compatible spares shall be readily available from the bidder to ensure that the equipment achieves the economic operating life subject to operation in accordance with the Bidder's Operating and Maintenance Instructions
- 8) Branch cable shall include all types of cables indicated in General Specifications for Instrumentation and shall be provided @ 10% of total branch cable length in un-cut condition for each type.
- 9) The spare philosophy specified above shall also be applicable to all Free Issue Materials and Packages. Spares shall be supplied by the Contractor accordingly for FIM and Packages.
- 10) The contractor/FIM vendors shall also supply spares as indicated in the licensor package in addition to those mentioned above.
- 11) The contractor/FIM vendors shall submit an itemwise mandatory spares list indicating installed quantity and calculated spare quantity of each item for consideration of OWNER. OWNER at his own discretion may procure all/some of the selected items from the list submitted by contractor/FIM vendors.
- 12) Installed spares for various control systems shall be explicitly indicated in relevant system documentation. Installed spares for other items shall be explicitly indicated in relevant documents.
- 13) Adequate number of gas cylinders required for calibration and continuous operation of analysers shall be provided permanently.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID	Contract No. 66-6695			
 thyssenkrupp	Annexure 6 Spares Philosophy for Instrumentation Items				नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
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- 14) As package units may have special detectors/control elements in the field, mandatory spares shall also be supplied for any other instrument connected to control room or field indications. The quantity shall be 10% of installed quantity subject to minimum one of each type.
- 15) The contractor shall furnish mandatory spare list as per the above philosophy in the “Spare List Submission Format” indicated below.

## 7) SPARE LIST SUBMISSION FORMAT

### 7.1) Index For Mandatory Spares

Sr. No	Item Description	Vendor Name	Purchase Order No.	Remarks
1	Electronic Transmitters	M/s Endress+Hausser	XXXX	
2	Control Valve	Fisher	YYYY	

### 7.2) Spare List

Sr. No	PR Ref No.	Item Description	%Spares	Make	Model No	Actual Qty	Spare Qty (Nos)
1	AAAA	Transmitters for Pr, Level, Flow, Temp, DPT.	10% subject to min 1 of each type	E&H	XXXX	40	4
					ZZZZ	21	3
					BBBB	1	1
					MMMM	45	5
2	DDDD	Pressure Gauges	10% subject to min 1 of each type	Guages Boudon	PPPP	19	2
					NNNN	65	7
					LLLL	4	1
3	GGGG	Pressure Gauges	10% subject to min 1 of each type	WIKA	RRRR	25	3
					SSSS	32	4
					TTTT	11	2