



شرکت مهندسين مشاور کاوشگران

**250 KTPY Iron Ore Concentrate
Plant**



راهبران فولاد اصفهان

Tender Document
for
Hydrocyclone 01

1402/02/13	01	A.neshati	R.Ghasemi	R.Ghasemi
1402/01/22	00	A.neshati	R.Ghasemi	R.Ghasemi
Date	Rev	Prepared by	Checked By	Approved



Rahbaran Foolad Isfahan



250 KTPY Iron Ore Concentrate
Plant of Rahbaran Foolad Isfahan



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1. Introduction

The project is of 250 KTPY Iron Ore Concentrate Plant of Rahbaran Foolad Isfahan of Iran, construction items include grinding, classification, magnetic separation, concentrating and filtering of concentrate & tailings.

1.1 Scope

Hydro cyclones are a type of cyclonic separators that separate product phases mainly on basis of differences in gravity with aqueous solutions as the primary feed fluid.

As opposed to dry or dust cyclones, which separate solids from gasses, hydro cyclones separate solids or different phase fluids from the bulk fluid. A hydro cyclone comprises a cylindrical shaped feed part with tangential feed; an overflow part with vortex finder; a conical part with an apex. A cyclone has no moving parts.

Working principle

Product is fed into the hydro cyclone tangentially under a certain pressure. This creates a centrifugal movement, pushing the heavier phase outward and downward alongside the wall of the conical part. The decreasing diameter in the conical part increases the speed and so enhances the separation. Finally, the concentrated solids are discharged through the apex. The vortex finder in the overflow part creates a fast rotating upward spiral movement of the fluid in the center of the conically shaped housing. The fluid is discharged through the overflow outlet.

Cyclone parameters

The following parameters are decisive for good cyclone operation:

- the design
- the specific weight difference between the two product phases
- the shape of the solids



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- the speed of the feed
- the density of the medium
- the counter pressure at the overflow and apex

See this technical specification for minimum requirement of design, materials, inspection and test of cyclone.

1.2 Site conditions

General

Elevation	1,495 m AMSL Max
Ambient temperature	+ 43 °C
Min ambient temperature	- 10 °C Relative
humidity	Average: 10-50 % Max. 69 %
Location of equipment	Inside mill building

1.3 Normative Codes and Standards

In general, internal standards indicated as below shall be followed for design, manufacture, inspection, painting, package and construction:

- American National Standards (ANSI)
- British Standards (BS)
- German Standards (DIN)
- Japanese Standards (JIS)
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- Minimum requirements for preservation, packing & marking as per ASTM, D3951,
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ISO 8501-1:2007	IDT	GB/T 8923.1-2011 Visual Evaluation of Surface Treatment Cleaness of Steels Before Painting
ISO 3746:1995	EQV	GB/T 3768-1996 Acoustics--Determination of sound power levels of noise sources using sound pressure--Survey method using an enveloping measurement surface over a reflecting plane
ISO 544:2003	MOD	GB/T 25775-2010 Welding Material Supply Technical Conditions-Product Type, Size, Tolerance and Symbol
ASME B16.5:2009, EN 1092-1:2007	MOD	GB/T 9124-2010 Technical Conditions of Steel Pipe Flange
API 598:2009	MOD	GB/T 26480-2011 Valve Inspection and Testing
ASME 16.5		FOR FLANGES

2. Design requirement

2.1 Design performance requirement

2.1.1 Cyclone supplied by seller shall comply with requirements specified in the technical specification, and supplied equipment specification shall be within sellers design and manufacturing experience scope, and it is reliable under natural environment and service condition of this project. Design and manufacture of cyclone shall meet or higher than



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related national, industrial technical norm and standard.

2.1.2 The recommended hydro cyclone unit shall be suitable for continuous operation under all flow rate between maximum and minimum flow rate condition. Each unit of hydro cyclone shall be provided with bracket or support/pedestal and etc. play a supporting role.

2.1.3 The operation environment of hydro cyclone unit shall be convenient for operator to conduct clean, adjustment, maintenance or monitoring. Equipment shall be provided with necessary dust or water proof measure, meanwhile shall be strong enough to withstand earthquake damage.

2.1.4 Mechanical design of hydro cyclone unit shall be comply with mechanical design standard specified by project.

2.1.5 Inner working surface of hydro cyclone shall be flat and smooth. For hydro cyclone less than 125mm of diameter, inner working surface is not allowed with concave-convex greater than 1mm; For hydro cyclone with 125~355mm of diameter, inner working surface is not allowed with concave-convex greater than 2mm; For hydro cyclone with 500-1000mm of diameter, inner working surface is not allowed with concave-convex greater than 5mm;

2.1.6 Same specification hydro cyclone inner working surface fabricated by same materials shall have unified cone. For hydro cyclone inner working surface fabricated by methane polyurethane methane, wear proof rubber is not allowed with bubble and defects, which depth greater than 2mm and area greater than 80mm².

2.1.7 Hydro cyclone side wall is not allowed with deformation under given pressure, each joint shall be without leakage.

2.1.8 Hydro cyclone shell can adopt steel plate for rolling or cast form.

2.1.9 Hydro cyclone exposed surface shall be painted with two coats of rust primer, and then finishing coat to be done. Painting shall be even without defects such as current



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ripple, peeling, crack and etc.

2.1.10 Supply scope of Hydro cyclone complete set includes spare parts and quick-wear parts specified in contract, such as overflow pipe, sand pipe, valve liner and etc.

2.1.11 Physical and mechanical properties of wear proof rubber liner shall be comply with requirement specified in table 2.

Table 2 Mechanical properties of wear proof rubber liner



S.N.	Physical properties	Number and Unit S.N.	S.N.	Physical properties	Number and Unit S.N.
1	Breaking strength	$\geq 015\text{N/mm}^2$	5	Hardness (shore A)	55 ± 5 degree
2	Breaking elongation	$\geq 450\%$	6	Akron abrasion	$0.6\text{cm}^3/1.61\text{km}$
3	Breaking permanent deformation	$\leq 35\%$	7	Ageing coefficient $91^\circ \times 24\text{h}$	0.65
4	Flexible	$\geq 35\%$	8	Factor of acid/al-kali-resistant	0.8

2.1.12 Quality of welding joints that exposed to the heavy impact and vibration should be inspected visually & UT/PT.

2.2 Quality guarantee

2.2.1 Manufacturer shall have same or similar equipment design and installation mining experience above 10 years, and to be certified by written document.

2.2.2 All materials shall be brand new, and satisfy other requirements from SDM and Owner. sufficient protection measures shall be provided for supplied equipment to ensure personal safety of operators.

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- 2.2.3 Spare parts do not satisfy all requirements shall be replaced by qualified spare parts without any additional cost.
- 2.2.4 Main outsourced spare parts constituting the whole system must be international famous make product, supplier shall submit vendor list, procurement and use only can be done after approval from buyer.
- 2.2.5 The design service life of main components shall be not less than 20 years. Other components with short service life shall be ease of replacement and maintenance. Supplier shall provide necessary spare parts to ensure equipment has sufficient working life according to operation and maintenance manual provided by supplier.
- 2.2.6 The appropriate pressure range for cutting size separation should be determined by the manufacturer.
- 2.2.7 The manufacturer must optionally provide a price for the list of consumable parts for one year.
- 2.2.8 For the place of installation of the pressure Transmitter, the manufacturer must make a necessary prediction.
- 2.2.9 To calculate the number of cyclones, the design factor should be considered 50%.
- 2.2.10 The minimum thickness of the elastic liner should be 12 mm

2.3 Main component

2.3.1 Cyclone

Cyclone liner shall adopt replaceable rubber liner. For cyclone supply, except installed underflow exit , another two under flow exits shall be provided for commissioning. Compare with installed underflow exit, specification of extra underflow exits shall be larger for one exit, another one shall be smaller. Cyclone inlet and overflow connection is suggested to use clamp connection.

Cyclone overflow parts include underflow exit, bush and etc shall be with sufficient

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service life under the project condition. Supplier shall make a commitment for service life of overflow parts of cyclone.

2.3.2 Distributor

Hydro cyclone unit is charged in general by feeding distributor; however, overflow and underflow products are respectively discharged after collection. Feeding distributor usually is of circle structure to ensure uniform pressure, flow and flow rate of pulp into each cyclone without eddy to improve classification effect of cyclone. Distributor shall be provided with feeding pipe, Rubber wear proof liner plate is adopted.

2.3.3 Overflow trough

Each cyclone overflow is collected through overflow through and discharged to next procedure through unified exit. Overflow trough shall be designed to ensure smooth discharge without accumulation. Rubber wear proof liner plate is adopted.

2.3.4 Underflow trough

Each cyclone underflow is collected through underflow through and discharged to next procedure through unified exit. Underflow trough shall be designed to ensure smooth discharge without accumulation. Rubber wear proof liner plate is adopted.



2.3.5 Valve

The type of valve to open and close the Hydrocyclone must be determined by the manufacturer.

2.3.6 Lifting lug

All large scale structural members shall use disassembly lifting lug. The design hoisting capacity of each lifting lug shall be double of hoisting weight and indicated at visible location. Lifting lug shall be fixed on each structural member before transportation.

Supplier shall provide related drawing to show hoisting method during transportation and installation. Equipments with weight above 20 kg shall be with suitable hoisting point. All lifting lug shall have certificate issued by related organization.

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2.3.7 Protective device

Platform and aisle shall be provided with handrail, knee stop and foot stop. All exposed part, rotating part, high temperature part without insulated layer shall be provide with mesh protective plate. Equipment is provided with locking device for maintenance. Locking device can totally avoid equipment start during maintenance.

To shift all safe protective device without interfere other components of equipment. While safe protective device clashes lubrication point, oil pipe and fixed remote oil nozzle shall be provided; so lubrication can be done without dismantling protective device. Protective device shall be provided with sufficient space for ease of drive component adjustment.

2.4 Mark, package, transportation and storage

2.4.1 Identification

Each cyclone shall be fixed with product tag at visible location, indicated with following content:

- Product name and model
- Main technical parameter
- Manufacturer name and address
- Manufacturer date
- Factory No.

2.4.2 Package

Packing should follow ASTM D3951 standard.

- 1) Hydro cyclone fastener must be painted with rust proof oil with rust proof period not less than 1 year.

Outer wall of package box shall have obvious mark, content includes:

- Manufacturer



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- Product name and model
- Consignee and address
- Net weight, gross weight, overall dimension, box No;
- Hoisting line and transportation mark.

2) Equipment parts for binding transportation shall be tied with signs at visible location.

2.4.3 Storage

Runner liner shall be avoided contact with acid, alkali, oil and organic solvent and other materials affecting rubber quality during transportation and storage, and required to be 3 meters away from hot source.

2.4.4 Transportation

Equipment package shall comply with land and waterway transportation requirement.

2.4.5 Technical documents along with equipment

- Product manual;
- Product quality certificate
- Product general layout and installation drawing
- Packing list

3. Technical Specification

3.1 Basic Process Data

Feed material	Grinded Iron Ore (magnetite / Hematite)
Specific Weight (Fresh Feed)	4 t/m ³
Feed rate (solid)	53 t/h
Feed capacity (slurry)	93-65 m ³ /h (related to feed solid percent)
Over flow rate	18.5 t/h
Circulation Load	0 % (Open Circuit)
Feed Solid concentration	40-50%
Over flow concentration	20-30%
Under flow concentration	60-70%



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Cut size	120 μm
Feed size	K80=270 μm
Process type	Direct circuit with ballmill

4. Inspection and Test



- 4.1 Feed port pressure shall use 0~0.6MPa of pressure gauge with precision not lower than 4 grade for measurement.
- 4.2 Inspection type shall be according to the ITP & QCP documents. ITP & QCP will be prepare be supplier and sent to client approval.
- 4.3 Test data shall be provided by rubber liner manufacturer.
- 4.4 Each set of hydro cyclones must pass inspection of manufacturer test department and satisfied, and attached with product quality certificate before delivery.
- 4.5 Hydro cyclone shall have one set sampling every 3 years at site for regular test.

5. Noise

Noise level during operation should be less than 85dB@1m.

6. Quality Guarantee and assurance

The Supplier should guarantee that the equipment can be run normally as per the stated process requirements. The supplied equipment should not have the defects caused by improper engineering, material or structure, and can be safe and reliable run in the scope of maximum load capacity; the manufacturer should guarantee to adopt the high quality materials and advanced technology, and the performance can accord with the requirements of this technical specification and annex. For performance guarantees it should be mentioned that capacity performance in full 24 hours operation in 5 consecutive days (based on the main contract) should be realized and guaranteed.

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6.1 Warranty

“Warranty Period” means 12 months of regular, reliable working of the Contract Plant commencing from the date of issue of Provisional Acceptance Certificate (PAC).



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Hydrocyclone 02

1402/02/13	01	A.neshati	R.Ghasemi	R.Ghasemi
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ISO 15609-5:2004	IDT	GB/T 19867.5-2008 Resistance Welding Process Regulation
ISO 2808:2007	IDT	GB/T 13452.2-2008 Determination of Paint Film Thickness of Color Paint and Varnish
ISO 8501-1:2007	IDT	GB/T 8923.1-2011 Visual Evaluation of Surface Treatment Cleaness of Steels Before Painting
ISO 3746:1995	EQV	GB/T 3768-1996 Acoustics--Determination of sound power levels of noise sources using sound pressure--Survey method using an enveloping measurement surface over a reflecting plane
ISO 544:2003	MOD	GB/T 25775-2010 Welding Material Supply Technical Conditions-Product Type, Size, Tolerance and Symbol
ASME B16.5:2009, EN 1092-1:2007	MOD	GB/T 9124-2010 Technical Conditions of Steel Pipe Flange
API 598:2009	MOD	GB/T 26480-2011 Valve Inspection and Testing
ASME B16.5		FOR FLANGE

2. Design requirement

2.1 Design performance requirement

2.1.1 Cyclone supplied by seller shall comply with requirements specified in the technical specification, and supplied equipment specification shall be within sellers design and manufacturing experience scope, and it is reliable under natural environment and service condition of this project. Design and manufacture of cyclone shall meet or higher than related national, industrial technical norm and standard.

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- 2.1.2 The recommended hydro cyclone unit shall be suitable for continuous operation under all flow rate between maximum and minimum flow rate condition. Each unit of hydro cyclone shall be provided with bracket or support/pedestal and etc. play a supporting role.
- 2.1.3 The operation environment of hydro cyclone unit shall be convenient for operator to conduct clean, adjustment, maintenance or monitoring. Equipment shall be provided with necessary dust or water proof measure, meanwhile shall be strong enough to withstand earthquake damage.
- 2.1.4 Mechanical design of hydro cyclone unit shall be complied with mechanical design standard specified by project.
- 2.1.5 Inner working surface of hydro cyclone shall be flat and smooth. For hydro cyclone less than 125mm of diameter, inner working surface is not allowed with concave-convex greater than 1mm; For hydro cyclone with 125~355mm of diameter, inner working surface is not allowed with concave-convex greater than 2mm; For hydro cyclone with 500-1000mm of diameter, inner working surface is not allowed with concave-convex greater than 5mm;
- 2.1.6 Same specification hydro cyclone inner working surface fabricated by same materials shall have unified cone. For hydro cyclone inner working surface fabricated by methane polyurethane methane, wear proof rubber is not allowed with bubble and defects, which depth greater than 2mm and area greater than 80mm².
- 2.1.7 Hydro cyclone side wall is not allowed with deformation under given pressure, each joint shall be without leakage.
- 2.1.8 Hydro cyclone shell can adopt steel plate for rolling or cast form.
- 2.1.9 Hydro cyclone exposed surface shall be painted with two coats of rust primer, and then finishing coat to be done. Painting shall be even without defects such as current ripple, peeling, crack and etc.



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2.1.10 Supply scope of Hydro cyclone complete set includes spare parts and quick-wear parts specified in contract, such as overflow pipe, sand pipe, valve liner and etc.

2.1.11 Physical and mechanical properties of wear proof rubber liner shall be comply with requirement specified in table 2.

Table 2 Mechanical properties of wear proof rubber liner

S.N.	Physical properties	Number and Unit S.N.	S.N.	Physical properties	Number and Unit S.N.
1	Breaking strength	$\geq 015\text{N/mm}^2$	5	Hardness (shore A)	55 ± 5 degree
2	Breaking elongation	$\geq 450\%$	6	Akron abrasion	$0.6\text{cm}^3/1.61\text{km}$
3	Breaking permanent deformation	$\leq 35\%$	7	Ageing coefficient $91^\circ \times 24\text{h}$	0.65
4	Flexible	$\geq 35\%$	8	Factor of acid/al-kali-resistant	0.8



2.1.12 Quality of welding joints that exposed to the heavy impact and vibration should be inspected visually & UT/PT.

2.2 Quality guarantee

2.2.1 Manufacturer shall have same or similar equipment design and installation mining experience above 10 years, and to be certified by written document.

2.2.2 All materials shall be brand new, and satisfy other requirements from SDM and Owner. sufficient protection measures shall be provided for supplied equipment to ensure personal safety of operators.

2.2.3 Spare parts do not satisfy all requirements shall be replaced by qualified spare parts

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without any additional cost.

- 2.2.4 Main outsourced spare parts constituting the whole system must be international famous make product, supplier shall submit vendor list, procurement and use only can be done after approval from buyer.
- 2.2.5 The design service life of main components shall be not less than 20 years. Other components with short service life shall be ease of replacement and maintenance. Supplier shall provide necessary spare parts to ensure equipment has sufficient working life according to operation and maintenance manual provided by supplier.
- 2.2.6 The appropriate pressure range for cutting size separation should be determined by the manufacturer
- 2.2.7 The manufacturer must optionally provide a price for the list of consumable parts for one year
- 2.2.8 For the place of installation of the pressure Transmitter, the manufacturer must make a necessary prediction
- 2.2.9 To calculate the number of cyclones, the design factor should be considered 50%
- 2.2.10 The minimum thickness of the elastic liner should be 12 mm



2.3 Main component

2.3.1 Cyclone

Cyclone liner shall adopt replaceable rubber liner. For cyclone supply, except installed underflow exit , another two under flow exits shall be provided for commissioning.

Compare with installed underflow exit, specification of extra underflow exits shall be larger for one exit, another one shall be smaller. Cyclone inlet and overflow connection is suggested to use clamp connection.

Cyclone overflow parts include underflow exit, bush and etc shall be with sufficient service life under the project condition. Supplier shall make a commitment for service life of overflow parts of cyclone.

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2.3.2 Distributor

Hydro cyclone unit is charged in general by feeding distributor; however, overflow and underflow products are respectively discharged after collection. Feeding distributor usually is of circle structure to ensure uniform pressure, flow and flow rate of pulp into each cyclone without eddy to improve classification effect of cyclone. Distributor shall be provided with feeding pipe, Rubber wear proof liner plate is adopted.

2.3.3 Overflow trough

Each cyclone overflow is collected through overflow through and discharged to next procedure through unified exit. Overflow trough shall be designed to ensure smooth discharge without accumulation. Rubber wear proof liner plate is adopted.

2.3.4 Underflow trough

Each cyclone underflow is collected through underflow through and discharged to next procedure through unified exit. Underflow trough shall be designed to ensure smooth discharge without accumulation. Rubber wear proof liner plate is adopted.

2.3.5 Valve



The type of valve to open and close the Hydrocyclone must be determined by the manufacturer.

2.3.6 Lifting lug

All large scale structural members shall use disassembly lifting lug. The design hoisting capacity of each lifting lug shall be double of hoisting weight and indicated at visible location. Lifting lug shall be fixed on each structural member before transportation.

Supplier shall provide related drawing to show hoisting method during transportation and installation. Equipments with weight above 20 kg shall be with suitable hoisting point. All lifting lug shall have certificate issued by related organization.

2.3.7 Protective device

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Platform and aisle shall be provided with handrail, knee stop and foot stop. All exposed part, rotating part, high temperature part without insulated layer shall be provide with mesh protective plate. Equipment is provided with locking device for maintenance. Locking device can totally avoid equipment start during maintenance.

To shift all safe protective device without interfere other components of equipment. While safe protective device clashes lubrication point, oil pipe and fixed remote oil nozzle shall be provided; so lubrication can be done without dismantling protective device. Protective device shall be provided with sufficient space for ease of drive component adjustment.

2.4 Mark, package, transportation and storage

2.4.1 Identification

Each cyclone shall be fixed with product tag at visible location, indicated with following content:

- Product name and model
- Main technical parameter
- Manufacturer name and address
- Manufacturer date
- Factory No.



2.4.2 Package

Packing should follow ASTM D3951 standard.

- 1) Hydro cyclone fastener must be painted with rust proof oil with rust proof period not less than 1 year.

Outer wall of package box shall have obvious mark, content includes:

- Manufacturer
- Product name and model

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- Consignee and address
- Net weight, gross weight, overall dimension, box No;
- Hoisting line and transportation mark.

2) Equipment parts for binding transportation shall be tied with signs at visible location.

2.4.3 Storage

Runner liner shall be avoided contact with acid, alkali, oil and organic solvent and other materials affecting rubber quality during transportation and storage, and required to be 3 meters away from hot source.

2.4.4 Transportation

Equipment package shall comply with land and waterway transportation requirement.

2.4.5 Technical documents along with equipment

- Product manual;
- Product quality certificate
- Product general layout and installation drawing
- Packing list

3. Technical Specification

3.1 Basic Process Data

Feed material	Grinded Iron Ore (magnetite / Hematite)
Specific Weight (Fresh Feed)	4 t/m ³
Feed rate (solid)	148.2 t/h (with circulation load)
Feed capacity (slurry)	260-400 m ³ /h (with circulation load and related to feed solid percent)
Over flow rate	55.1 t/h
Circulation Load	200-300 %
Feed Solid concentration	40-50%
Over flow concentration	20-30%



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Under flow concentration	60-70%
Cut size	47 μm
Feed size	K80 < 120 μm
Process type	Overflow of primary hydrocyclone, secondary ball mill product and tailing of cleaner separators are feed for secondary hydrocyclone

4. Inspection and Test

4.1 Feed port pressure shall use 0~0.6MPa of pressure gauge with precision not lower than 4 grade for measurement.

4.2 Inspection type shall be according to the ITP & QCP documents. ITP & QCP will be prepare be supplier and sent to client approval.

4.3 Test data shall be provided by rubber liner manufacturer.

4.4 Each set of hydro cyclones must pass inspection of manufacturer test department and satisfied, and attached with product quality certificate before delivery.



4.5 Hydro cyclone shall have one set sampling every 3 years at site for regular test.

5. Noise

Noise level during operation should be less than 85dB@1m.

6. Quality Guarantee and assurance

The Supplier should guarantee that the equipment can be run normally as per the stated process requirements. The supplied equipment should not have the defects caused by improper engineering, material or structure, and can be safe and reliable run in the scope of maximum load capacity; the manufacturer should guarantee to adopt the high quality materials and advanced technology, and the performance can accord with the requirements of this technical specification and annex. For performance guarantees it should be mentioned

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that capacity performance in full 24 hours operation in 5 consecutive days (based on the main contract) should be realized and guaranteed.

6.1 Warranty

“Warranty Period” means 12 months of regular, reliable working of the Contract Plant commencing from the date of issue of Provisional Acceptance Certificate (PAC).