



شرکت مهندسين مشاور کاوشگران

**250 KTPY Iron Ore Concentrate
Plant**



راهبران فولاد اصفهان

**Tender Document
For
Tailing Thickener and
Floculant Package
(REV 02)**

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Date	Rev	Prepared by	Checked By	Approved



Rahbaran Foolad Isfahan



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Plant of Rahbaran Foolad Isfahan

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(TS)

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1. General Characteristics and Site conditions

1- Location	Latitude	Longitude	Elevation (m)	
	N 30°48' 14.7"	E 53°33' 42"	1495	
	Abarkooh city in Yazd province in central part of Iran			
2-Temperature	Max. Recorded in Summer (°C)	Max. Considered for design (°C)	Min. Recorded in Winter (°C)	Min. Considered for design (°C)
	43	43	-10	-7 to -10
3-Rainfall			4-Snow	
Average yearly/Max daily (mm)		60/36	Snow Load (KN/m ²)	----)0.5-1(
5- Humidity		6- Pressure		
Ave. Relative (%)	Max. Relative (%)	Barometric Pressure (mbar)		---
10-50	69			
7- Wind	Design wind velocity (m/sec)		26-40 (100)	

2. General Process Data

Material type	Iron Ore Magnetite Tailing
Dry Solids Feed (t/h)	50-60
Solids Specific Gravity	2.9
Slurry Flow (m ³ /h)	542-660
Solids in Feed (%)	7.5- 8.6
Solid in Under Flow (%)	40-45
Slurry Density (t/m ³)	1.05
Size Distribution (µm)	D80 = 45~90
Overflow clarity	<150 ppm



3. Tailing Thickener

3.1. Concept

The objective of this document is to present required information, specification and tender document for Thickener and Flocculant package.

3.2. Scope of supply

Each thickener will be delivered with all components necessary for its operation, which includes the items described below:

Tank, Tank support, Bridge, Feeding device, Central drive pipe, Feeding pipe, Centre hydraulic drive, Rake (include cone scraper), Hydraulic system power including Cooling medium, Hydraulic rake lift, Flocculant transport pipe, Drive device, Walkway and handrail, gearbox, hydro motor, Feed Hopper, Make-up Tank Agitator, Flocculent Feed Pump, Drive main oil pump motor, Lifting oil pump motor, Spiral feeding motor, mixing motor, Feed pump motor and etc.

3.3. Main Equipment Data

Type	HRT Thickener
Settling Rate	..... m/h
Rise Rate	..... m/h
Area required	..... m ²
Diameter	14 m
Wall	3 m (thickness : 8*10)
Qty.	2

3.4. Flocculant system

Design dosage rate	20 g/t (assumed)
Tailing feed rate	2*25 tph
Dry flocculant dosing rate	1 kg/hr
Flocculant mixing strength	0.3 %
Flocculant Dosing strength	0.05 %
Flocculant needed l/hr (thickness:0.3 %)



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Pipeline dilution rate (dilute ratio)
Dosing pump m ³ /hr (adjustable)
Water consumption m ³ /hr

3.5. High-rate tailing thickener general technical data

Tailing Thickener type	High-rate central drive
Tank diameter	.... m
subsidence area	..... m ²
Bottom slope	.....degrees
Wall height	.....m
Drive method	.....
Rake speed	.....r/min
Rake lift height	.....
Rake lift speed	.....mm/min
Hydraulic system power	.....Kw
Hydraulic drive system work pressure	.....Mpa
Hydraulic rake lift system work pressure	.....Mpa
Feeding slurry solid content (by weight)%
Under flow solid content (by weight)%
Weight (Bridge and complete rake system)	.....kg
Overall Dimension	

3.6. Tailing thickener main technical data

Tank	
Tank support	H beam type
Bridge	Galvanized grating type
Feeding device	
Central drive pipe	
Feeding pipe	



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Rake (include cone scraper)	2 long rake + 2 short rake
Flocculant transport pipe	
Control cabinet	
Drive device	
Bridge	
Bridge type	Galvanized grating
Walkway	Galvanized grating
handrail	pipe type
Bridge width	
Rake Drive Details	
Drive method	
Over torque protection	
Drive Type	
Installed power	
Absorbed power	
Drive reducer	
Type/Qty	
Manufacturer/Model	
Ratio	
Lubrication system details	
Gearbox size	
reducer output speed	
Momentary Peak Torque	
Maximum Operating Torque	
Standard Operating Torque	
Average Output Speed	
Drive pinion	
Material	Mo 40
Quantity	
Thickness (Pinion Depth)	
Tooth number	



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Slewing gear	
Quantity	
Design life	
Pressure angle	
Tooth number	
Material	
Thickness	
Module	
Hydraulics	
Supplier	
Cooling medium	
Water consumption & pressure	
Electric Motor	
Supplier	WEG – SIEMENS – SEW - Gamak
Power	
Speed	
Hydraulic Pump	
Type	Gear pump
Capacity	
Hydraulic Motor	
Qty of motors	
Rake Mechanism	
Cone blade	
Number	
Detachable	
Rake	
No. of long arms	
No. of short arms	
Total (see notes)	



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<p>Notes:</p> <p><i>(a) Angle of attachment is 45° in all cases</i></p> <p><i>(b) All rake blades are detachable and therefore replaceable.</i></p>	
Torque Indication	
Torque Sensing	
Method	
Type of Device	
Control Panel	
Location	
Operations	

3.7. Torque Specification

Design operating torque (30%) (determined by process conditions)	.....
Maximum operating torque	.....
Mechanism design (150%)	.....
High torque Alarm set point (50%)	.....
Rake drive trip set point (100%)	.....

3.8. Flocculant system technical data:

Feed Hopper	made with section and profiles
Quantity	.....
Hopper Capacity (Volume)	
Hopper Capacity (Mass)	
Material of Construction	
Level Measurement System	
Screw Feeder	
Quantity	
Rated	



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Motor	
Make-up Tank	
Quantity	
Dimension	
Material of Construction	
Live Volume	
Make-up Tank Agitator	
Quantity	
Motor	
Agitator	
Material of Construction	SS304
Level Measurement System	
Flocculent Feed Pump	
Quantity	
Type/Make	Mono pump / Bohlul - Shirani
Capacity	
Motor Size	
Process Data	
Design Capacity	
Make-up Construction	
Equivalent Liquid Capacity	
Control system	

4. Flocculant system

Flocculant system is a very important part during working with tailing thickener with high rate; It mainly includes dry powder feeding device, tank (flocculant preparation tank, digestion tank, storage tank) and control system; The process of making dry powder to liquid is realized step by step through each liquor tanks, tanks are kept certain space to ensure best reaction time and constant thickness. Avoid any direct path between preparation tank and storage tank; Auto control

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system is connected with level controller of storage tank, when level reaches LOW, valve will be opened, and dry power feeding device starts, water dosing is designed to get accurate thickness. When liquid level reaches HIGH, water and powder dosage will stop, while mixer continues to work till set working time finishes.

Technical features:

- fully automatic operation can save labour.
- flocculant dosage can be adjusted sensitively to ensure nice flocculation mixing effect to avoid wasting.
- stainless steel body, components are imported with high quality and good anti-corrosion performance.
- It is with idle run and overflow protection and preparation process can be designed as customer needs.
- This system does not need base or fixing. It is convenient to maintain and it looks nice.

5. Equipment technical advantages and features

Centre drive adopts planetary gear reducer slewing support driving method, structure is novel, drive torque is large, use life is long.

Centre deep feeding , advection subside to reduce sedimentation height and motive energy of solid grain.

Reasonable rake structure reduces interference of grain sedimentation and quicken concentration & sedimentation. After adding flocculant, processing capacity is 6-8 times higher than common tailing thickener.

Rake is automatically controlled by hydraulic pressure. Rake lifting is stable and reliable.

Centre drive device adopts hydraulic variable motor, speed is adjustable to meet need of any condition.

- Adopts PLC control. It is designed with overload alarm indicator, auto rake lifting and falling; Use PLC control system, and it can realize local operation and remote control (combined with DCS); It realizes overload alarm, rake auto lift/ fall, and automatic, manual and remote centralized control.

All electrical and control cell and system for tailing thickener and Flocculant system including feeders, starter, frequency convertors and like these.



- It is designed with concentrated phase sensor. It can adjust the speed of underflow pump to control the This tailing thickener should designed with mud thickness - underflow thickness. sensor.

All flanges are in standard: ASME B16.5/Class 150/Welding neck/ Rise face -

Protection class criteria: -

- a. Low voltage motors IP 55
b. Medium voltage motors IP 55
c. Control cabinets in electrical rooms IP 41
d. Control cabinets outside of electrical rooms IP 54
e. Cabinets with power electronics in electrical rooms IP 21

6. High-rate Tailing Thickener and Flocculant System Motor list:

Table with 2 columns: Motor Name, Power (Kw). Rows include High-rate Thickener (Drive main oil pump motor, Lifting oil pump motor) and Flocculant System (Spiral feeding motor, mixing motor, Feed pump motor).

- The automation system is completely designed and implemented based on the process, and all the required data is displayed in the monitoring and can be adjusted and changed by the operator.

Information and errors can be recorded and tracked as separate files.



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7. The obligations that the seller is responsible for are:

- Supplying all mechanical and electrical equipment and accessories and equipment for control and automation panels.
- Construction of industrial equipment with safe and appropriate materials.

Working liner of all the parts exposed to the passage of slurry with a 6 mm thick liner and sure of A60.



Providing a load list of the required electricity of the device/equipment weight/required amount and type of water/required volume of compressed air, instrumentation.

Table with 2 columns: Description and Value. Rows include: Equipment delivery time, Conditions of loading, transportation, delivery of the device and insurance, The building of the plant, high according to the initial plan and all works of buildings, such as, caving, etc.

- Providing document for driving and repairs and maintenance.
- All required piping between equipment's
- Delivery of slurry at the entry point of the system.
- Delivery of solid materials from the exit point of the device according to the provided drawings.
- All required cabling between equipment's such as:
- Electrical cabling and instruments along with cable trays and working conduits from the panel to all equipment's.
- Crane to install the equipment
- Transportation and insurance costs from the purchasing factory to the installation site

8. Documents

- The manufacturing company must send the following documents and mechanical and electrical drawings along with the equipment:
- Equipment assembly drawing with part list(PDF file and physics drawing in four copies).

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–Equipment foundation drawing with part list(PDF and physics drawing in four copies).

Equipment installation and maintenance manual (four copies).

Equipment spare parts list.

Specify the list of Sub – Vendor.

Drawing of P & ID and PFD.

Technical specifications related to electric motors and gearboxes.

Preparing the final book (four copies).

All documents shall cover feeding material from Flocculent Unit to Thickener.

9. Design, Operation

9.1 The minimum technical requirements for the design, material, inspection, and commissioning of the purchased Clarifier are contained in this specification. The equipment shall include at least, but not be limited to the following:

- Drive device
- Drive shaft, rake arms
- Tank Body
- Planetary gearbox
- Bridge plate walkway handrails
- Feed well
- Vane Feed well, deflector cone and feedpipe
- Raking mechanism
- Underflow cone
- Bridge monorail (If required)
- Hydraulic power pack
- Rake drive system with torque transmission
- Instrumentation
- Bed level detector and remote analogue control signal
- Rake torque measurement and remote signal



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- High torque pressure switch
- Bed pressure measurement and remote signal
- IP65 Control panel housing instrument interfaces and providing local controls and remote interfaces
- automatic control system

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

9.3 The equipment supplied by the seller should be fully functional, advanced technology, and can satisfy the personal safety and labour protection conditions.

9.4 Design and manufacture of Thickener shall comply with regulations of basic standard such as machinery drawing, limits and fits, form and location tolerance and etc.

9.5 Design and manufacture of Thickener shall be carried out according to actual conditions such as usage, requirement, materials property and etc; parameter and structure shall comply with advanced, reliable, economy and reasonable requirement.

9.6 Materials selection of each component for Thickener shall be reasonable, pay attention to workload reduction of manufacturer and installation as well and corrosion resistant and wear resistant requirement.

9.7 For same specification, quick-wear part, standby part, and outsourced part, etc, shall be interchangeable and comply with regulations of related standard or drawing.

9.8 Thickener structure shall comply with following requirements:

- a) No oil leakage in Clarifier tank ;
- b) Ease of installation, maintenance and lubrication;



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- c) Overload alarm shall be provided;
- d) Rake lifting mechanism.
- e) To be connected with central lubrication system

9.9 Steel structural member welding seam shall be flat without defects such as burn through, crack, slag inclusion, undercut and etc.

9.10 Driving arm and trough lead to Thickener center shall be provided with walking board and handrail.

9.11 Temperature rises of centre driving type Thickener bearing shall be not exceed 40°C, maximum temperature shall be not exceeding 70°C.

9.12 Centre drive type current collecting equipment for automatic rake shall be safe and reliable.

9.13 Drive device of centre drive type Thickener shall be with light safe hood or enclosure.

9.14 Large size spare parts shall be provided with rings for hoisting.

9.15 Equipment used for maintenance (such as platform and etc.) shall ensure service safe.

9.16 Quality of welding joints that exposed to the heavy impact and vibration should be inspected visually & UT / PT (general comment). UT is used to penetration welding and PT is used to fillet welding.



9.17 The service factor of reducers shall be more than 1.5 according to AGMA standard.

9.18 Vendor shall furnish all appliances, special tools, and accessories that are necessary or incidental to the proper installation and operation of the equipment.

9.19 Feed well

9.19.1 Steel feed well, equipment supplier shall provide detailed configuration of this mechanism. Feed well is supported by upper structure. Feed well shall be provided with feeding distribution function and suitable liner to reduce wear on the well.

9.20 Rake arm

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9.20.1 Rake arm shall be steel and linear configuration with Thickener drive device. Rake arm shall be easily for maintenance and suitable wear proof shall be done to extend its service life in pulp. Rake arm is inclined downward, directly insert Thickener bottom. The service life of rake arm is minimum 10 years, the service life of scraper is minimum 10 years.

9.21 Rake arm drive mechanism

9.21.1 Rake arm drive mechanism design shall consider rake arm without oversize shifting or overload under maximum torque and eccentric force.

9.21.2 The pressure on drive device is monitored by pressure sensor, which can initiate the automatic lifting/descending function of rake; it can monitor hydraulic pressure, start alarm and electric tripping at the relatively high voltage setting point; it can ensure the drive device not beyond designed rated torque through the relief valve on hydraulic circuit.

9.22 Rake Lifting

9.22.1 Supplier shall provide one set hydraulic rake lifting device. Rake lifting device shall be controlled by measure torque. Rake can realize automatic lifting/ descending based on the pressure sensor monitoring on drive device.



9.23 Feed pipe

9.23.1 Supplier is responsible for dimension design and supply of feed pipe, and design of support component. External joint of feed pipe shall be located above Thickener tank wall, inlet end of walkway, and flange connection is adopted.

9.24 Bridge structure

9.24.1 Supplier shall design and provide steel structure frame works upper layer structure, which provide support under live load & dead load running and maintenance. In addition, this steel structure shall also provide support for walkway and feed pipeline.

9.25 Platform and passageway

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9.25.1 Platform shall be constructed around all components to be repaired and reserved with at least 1 square meter works space. At least 1-meter net passageway shall be provided above all passageway. All grating shall be fastened to super structure. Exit and entry of platform on vertical access staircase shall be installed with safe door or floor fence gate.

9.26 Bearing

9.26.1 Supplier shall adopt wear-proof bearing. All bearing shall be with at least 100000 hours of service life. Bearing shall adopt reliable product of domestic famous make.

9.27 Gear

9.27.1 All gears shall at least comply with minimum quality requirement of AGMA, and pass 100% X ray and ultrasonic inspection. Working factor shall be greater than 1.5 times of design torque. Except for worm gear, machine finishing and polishing shall be done for gear tooth after harden. Hardness against 4 Nos of uniformly-spaced position on each face of gear shall be checked. In any case, thermal ratings of gear box shall be not lower than mechanical ratings of motor.

9.27.2 Design of gear drive device and case shall fully consider ease of equipment disassemble during maintenance and necessary dust proof and water proof treatment shall be done. Oil level meter shall be provided above it for ease of observation as well as oil drain and oil fill facility. Necessary inspection cover shall be provided according to requirement. External bearing sealing shall be provided.

9.27.3 Gear box shall adopt reliable product of international famous make.

9.28 Coupler

9.28.1 Coupler between drive motor and gear box shall be designed according to flexible brake connection.

Coupler's design shall be with sufficient hardness to ensure torque stabilization.

9.29 Lubrication



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9.29.1 Necessary lubrication shall be provided to ensure fully lubricate to gear component and bearing under continuous running. Lubrication oil shall be with sufficient viscosity and suitable for local weather conditions. The viscosity will be specified in data sheet by vendor.

9.29.2 Hand lubrication has to be indicated where used. Lubrication lines shall be tread and stubble-proof. Standard gear oils and grease shall be used throughout. At critical Points the lubrication nipples shall be sunk. All grease points shall be marked in red.

9.29.3 It shall be mentioned number of standby drives for whole systems.

9.30 Thickener support

9.30.1 Thickener adopts bridge frame support.

9.31 Thickener underflow

9.31.1 Supplier shall provide assemble drawing of Thickener underflow cone or pipe manifold.

9.32 discharge cone bottom

9.32.1 The discharge cone bottom of the tanks should be designed with suitable slope for discharge.



9.33 Thickener over-flow pipe and flange

9.33.1 Thickener is set up with over-flow pipeline, with companion flange.

9.34 Manufacture process and processing

9.34.1 Finishing and polishing shall be done for all main and auxiliary equipment, all exposed metal components shall be without burr and crater. Casting process shall be meet qualified standard without sand hole, cold shut or tool scratch. It is not recommended to use gas cutting for chambering, puncher only can be used for alignment, not for chambering or hole finishing.

9.34.2 Repaired, peeling or gap filled surface cannot pass acceptance. All bolt hole shall be repaired to hole opening surface. Exposed shaft extension part shall be covered or provided with safety protection. Safe protective hood shall be provided for unused shaft extension part and all rotating parts, which might result in danger to operators or other personal.

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9.34.3 Unless otherwise stated, tolerances on straightness, fit-up and overall dimensions shall be strictly in accordance with the relevant Standards. Notwithstanding, the VENDOR shall ensure that all completed components shall be free of sharp edges, burrs, tacks, and weld spatter.

9.34.4 Bolt holes in all flanges shall straddle the normal casing centreline.

9.34.5 Painting requirement: Provided by the vendor's painting requirements and spray-painting process for the owner after approval, shall be executed.

9.35 Safety requirement

9.35.1 Safety regulations should be followed at least BS and VDE regulations or equivalent and all necessary safety devices for all open gearing parts, couplings, brakes, pulleys, etc. shall be Provided in accordance with the relevant regulations

9.35.2 Safe operating labels shall be fixed at obvious location of Thickener.

9.35.3 Lubrication points shall be clearly identified and ease of access without danger.



9.35.4 Electrical equipment of Thickener shall comply with ICE regulation.

9.36 Loading Data

9.36.1 Loads of equipment etc. shall be provided according to below classification:

- Static load, include equipment free load weight, all related internal and external accessories, platform and others weight.
- Operating loads which shall be included all loads in operating condition. This includes all dead loads in previous items.
- Operating loads together with impact loads for equipment similar to feeders
- Test and maintenance load
- Other special load is to be provided by supplier such as Dynamic loads
- Earthquake loads
- Wind load

9.36.2 Supplier shall be responsible for integrity and accuracy of foundation load data provided by them, and clarifies value of load.

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9.37 Control System

9.37.1 Thickener control system will be controlled by Plant PLC. Programming and configuration of the process control equipment shall be carried out by others. Flocculent plant (If any) shall be controlled by dedicated PLCs provided with those packages. Safety interlocks where applicable shall be interfaced by hardwired discrete I/O.

10. Main parts technical description

10.1 Main drive and rake lift device

Drive frame and base are designed according to standard for heavy-duty gear to get enough strength and stability, so that the drive device and lift device can work stably.

Drive device is planetary gear box from Italian Bonfiglioli company. They are fixed on a base which can lift and fall, and the base is connected with the base of centre supporting tube. planetary gear box is driven by low speed high-torque hydraulic motor; maximum operating torque is 350,000Nm.

Full-automatic and hydraulic lift rake device is driven by hydraulic cylinder fixed on bridge. Hydraulic lifting device and hydraulic drive device share one modular hydraulic power unit . Hydraulic control elements are imported and quality is stable and reliable.

Drive device design torque:

- High torque alarm: 50% of design torque.
- Rake lift: 60% of design torque.

- Rake fall: 40% of design torque.
- Operation torque: 30% of design torque.
- Mechanical device design torque: 150% of design torque.

The super heavy drive and mechanical device design can keep thickener working even under extreme conditions, see Figure 1.

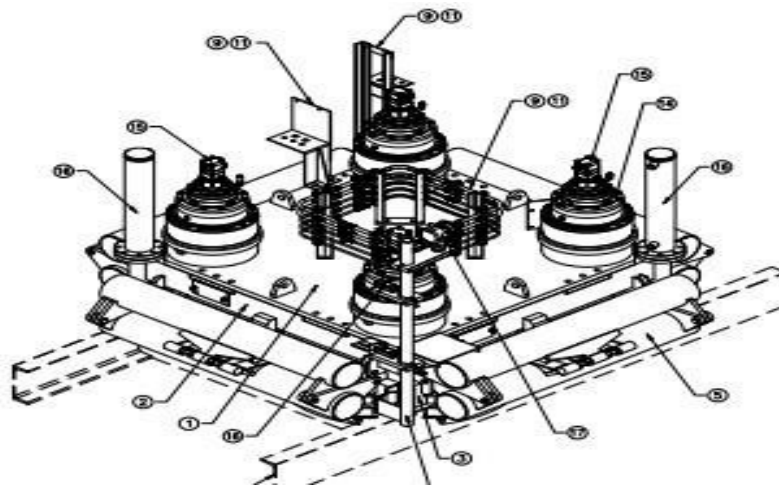




Figure 1 : drive device and rake lift device

11. Control System

Thickener control system is designed with combination of site and remote control, equipment provides necessary control point for site control and customer DCS remote control.

The control system including following sensors:

- Bed level detection transmitter
- Rake torque measurement transmitter
- Bed pressure measurement transmitter
- Limitation switch for rake's high and low level

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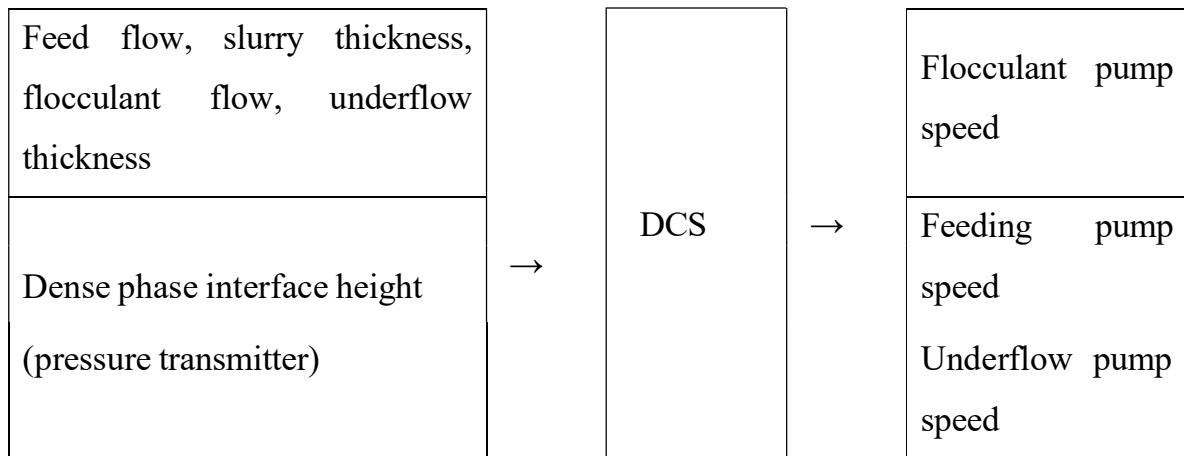
- Transmitter for rake position

Confirmed that control panel of thickener include:

- Start/stop push buttons and running lamps
- Rake raise/lower push buttons and rake position indication
- High torque trip lamp, high torque alarm lamp
- Low level oil alarm
- Lamp test facility
- Client I/O for plant control system logic control
- Local rake torque indication with 4-20 mA signal for remote use
- Local bed pressure indication with 4-20 mA signal for remote use
- Local bed level indication with 4-20 mA signal for remote use

System control is in accordance with the following

Figure:



Equipment itself control :





Hydraulic pressure transmitter (current 4-20mA)	→PLC	→ rake frame location show	→rake frame lift/fall or alarm,stop
Rake location ultrasonic level instrument(current 4-20mA)			

Interfaces Signals between control system (PLC) and client system (DCS) are dry contact type as follows

Thickener Minimum Signals to DCS

1. Thickener Ready (DI) include: Power On + Control voltage available + No Faults + No stop switches activated
+ Remote mode
2. Thickener Fault (DI): Overload + emergency trip + protective switch + etc.
3. Thickener Running (DI): The running signal indicates that the Thickener is in normal operation
4. Thickener Torque (AI)
5. Thickener Bed level interface Level (AI)
6. Thickener Bed mass pressure (AI)
7. Thickener Rake Position (AI)

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Thickener Minimum Signals From DCS

1. Flocculants Fundamental Interlock (DO): A contact open means that the Flocculants shall not start in local control mode.
2. Dosing pump Drive command (DO): A contact close starts the Dosing pumps in the correct sequence. A contact open stops the Dosing pumps Do in the correct sequence.
3. Flocculants pump Speed Set point (AI)

*** Consider in Local mode Flocculants Dosing pump shall start/stop through the PLC system locally but in Remote can start/stop from DCS .

Rake frame drive hydraulic and hoist cylinder are controlled by site and remote DCS.

Motor will be supplied according to industry standard: 4 pole (1500 rpm), IP55, Temperater rise B, insulation class F, air-cooled motor. Local voltage:3 Phase/400 V/50 Hz.

12. High-rate feeder (steady flow tube)

Slurry goes to Energy dissipation area through pipe; slurry without kinetic energy goes to steady flow tube through overflow port. Combining with water channel and baffle, this can further improve sedimentation efficiency.

Effective flocculation is key step to concentration process. this feeder can realize this key element through control mix and contact condition in reactor. Analysis has shows that our feeding system is the most advanced system in world.

Key element:

- a. degas for slurry

- b. control mixing
- c. control feeding speed
- d. depth changeable flocculant eductor
- e. narrow bottom to Short
- f. best

feeder
eliminate
circuit
thickness

Refer to Figure 3

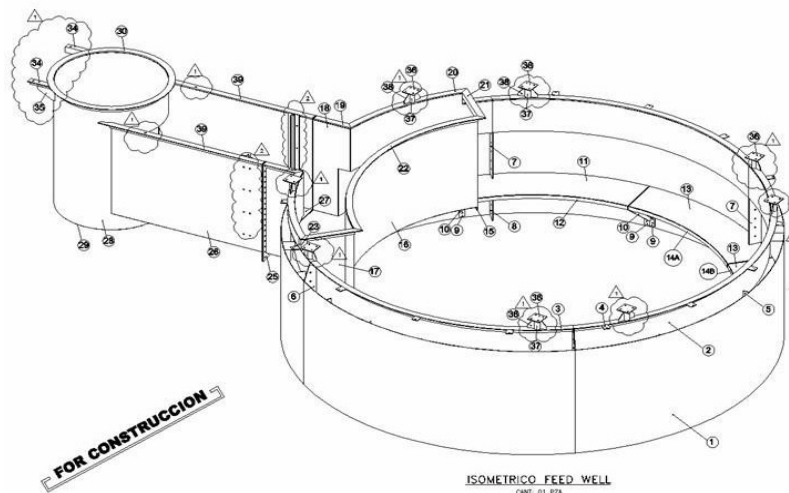




Figure 2 : high rate feeder (steady flow tube) structure

13. Other components

The bridge are in frame structure, with liftinglug, which is full span, reasonable width, height and length and walkway with handrail can reduce the snow and ice in winter.

Meanwhile the bridge is used for feeding pipes, flocculant pipes and all the necessary parts for normal operation, so we adopts H type steel and other steel for bridge bottom, Which of the structure are in arch shape so as to keep good loading and stable.

The flocculant pipes and the feeding pipe, pass though the tank outside to tank center with the support of bridge.

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And the bridge center supports the rake drive system and the rake lift system.

High grade feeding box (stable box) with automatic dilute components, the feeding slurry feed into tank in tangent direction, combines with launder and baffle, which can increase deposit rate more.

Two long rake frame and two short rake frame adopts triangle section, in the center of the rake arm with scalable scrapers, all the rakes scrapers can be detachable (see figure 4). All of rake frame connect with center drive axis, the raw material are in strength pipe, and in the bottom of the drive axis installs blades for discharging the slurry effectively. The rake and mechanical device operation torque is 150% of design torque.

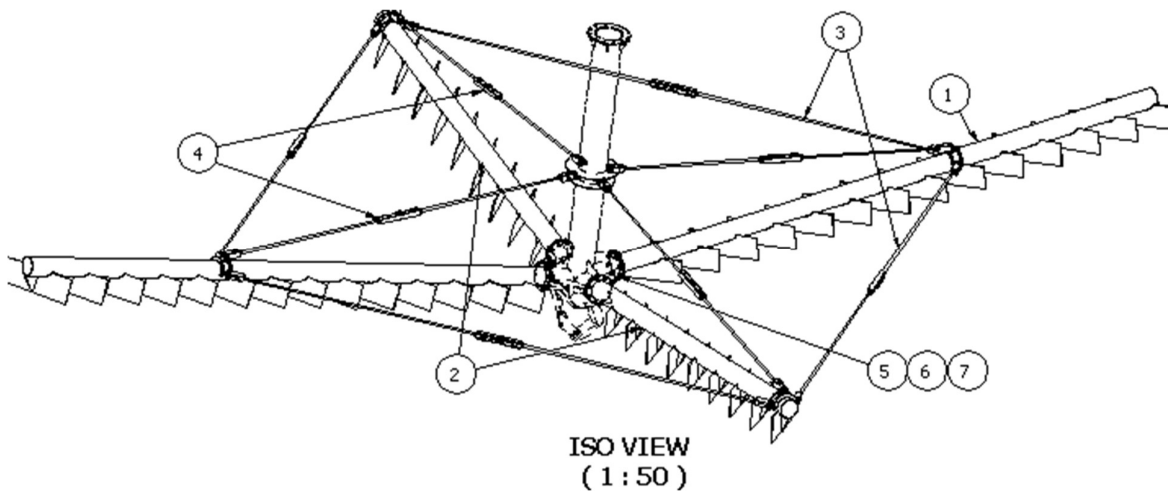


Figure 3 : Less than 30M thickener drive shaft and rake structure

14. System Guaranty:

...12..... months from the date of installation or 24 .months from the date of delivery thickener devices, excluding electrical items, whichever occurs first, except for shocks and external forces, It is under Guaranty.

15. Manufacturer's Technical & Financial Proposal



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Item	Unit	Technical Specification
Price	Rials	
Paymen Methode	-	
Equipment Delivery Time	-	
Technical Offer		Yes / No

- The Manufacturer can attach its technical proposals to this document as a separate file.