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△ MANUFACTURING
~~QUOTATION~~ SPECIFICATION

FOR

JSW △
CMP305X ~~JSW~~

CERTIFIED FINAL

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JSW

EQUIPMENT SPECIFICATIONS

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EQUIPMENT SPECIFICATION FOR CMP 305X-~~9SW~~^{12SW}④

I. GENERAL

This specification covers the furnishing of all labor, materials and services in connection with design, fabrication and delivery of the Continuous Mixer Gear Pump System Model CMP 305X-~~9SW~~^{12SW}④

CMP 305X-~~9SW~~^{12SW}④ is designed and fabricated to receive and mix powder and additives, and pelletize the extruded strands through die plate in hot water chamber. Pellets are then conveyed to drying and classifying equipment, where conveying hot water is removed from pellets and pellets are dried and classified.

II. SCOPE OF SUPPLY

- A. Starting Unit 1 Set
- B. Mixer 1 Set
1. Mixer gear reducer
 2. Mixer screws
 3. Hopper cylinder
 4. Mixing cylinder
 5. Discharge cylinder
 6. Hydraulic oil unit for slot clearance adjustment
 7. Mixer cylinder supports
 8. Cylinder cooling water unit (CCW unit)
 9. Valve stand
 10. Vacuum system
- C. Diverter Valve 1 Set
1. Diverter valve
- D. Gear pump 1 Set
1. Gear reducer
 2. Separate drive gear
 3. Couplings
 4. Gear pump
- E. Screen Changer 1 Set
1. Screen changer
 2. Hydraulic oil unit for screen changer and diverter valve with interconnecting pipe
 3. Adaptor
- F. Underwater Cutter 1 Set
1. Die holder
 2. Die plate
 3. Water chamber
 4. Cutter unit
 5. Hot oil unit

G. Carriages 1 Set

H. Drying System 1 Set

- ⑤ OFF
- 1. ~~Pre~~dewatering screen
- 2. Dewatering screen
- 3. Centrifugal dryer ⑤
- 4. Vibrating classifier ~~classifier~~ SCREEN
- 5. Exhaust fan
- 6. Damper

I. Pellet Conveying Water System (PCW) 1 Set

- 1. PCW tank
- 2. PCW pump
- 3. PCW cooler
- 4. PCW screen
- 5. PCW 3 way valve

J. Electric equipment and instrumentation 1 Set

- 1. Mixer Motor, Gear Pump Motor and Cutter Motor
- 2. Auxiliary Motors
- 3. Control Panels
 - 1) Hot oil control panel
 - ~~2) Local start up panel~~ ⑤
- 4. Instruments
- 5. Unit Wiring

K. Accessories 1 Set

- 1. Safety guards for rotating parts
- 2. Anchor bolts and liners
- 3. Special tools for maintenance
- 4. Flexible hose
- 5. Rails for carriages
- ~~⑤ 6. Spool piece when gear pump failure (Option)~~
- ⑤ 6. Bellows for hopper

L. Start-up spare parts 1 Set

- 1. Cutter blades : 2 sets (32 pcs.)
- 2. Screen pack : 4 sets (8 pcs.) ⑤ 12 x 50 x 12 MESH
- 3. Rupture disk : 5 pcs per each

III. OUT OF VENDOR'S SCOPE OF SUPPLY

The following equipment and work are out of scope.

1. Foundation and civil work
2. Installation, erection and test operation at job site.
3. Standard tools for assembly and disassembly of equipment and instrument.
4. Lubricant and hydraulic oil, and hot oil
5. Insulation
6. PCW piping, duct piping and the following interconnecting piping
(Refer to P&I DWG.)
 - 1) Interconnecting piping between CCW unit and valve stand
 - 2) Interconnecting piping between valve stand and mixer
 - 3) Hot oil piping between hot oil unit and pelletizer
7. Operation and maintenance stage
8. Switch gear device and power supply equipment
 - a) H.V. panel for large motor
 - b) L.V. panel for auxiliary motors
9. Power transformer for gear pump drive system
10. Distributed control system
11. Control panel including PLC system in control room
- △ 12. Local start up panel

IV. OPERATING AND DESIGN CONDITIONS

A. PROPERTIES OF FEED MATERIALS

Table 1-1 Properties of Feed Material

Description	Powder	Pellet
Components	Polypropylene	Polypropylene / Polyethylene
Shape	Power	Pellet
Particle size Ave.	800-900 micron	0.126-0.177in (3.2-4.5mm)Dia. x 0.0787-0.118in (2.0-3.0mm)t
	Min. 40 micron	
	Max. 2000 micron	
Melt index	0.5 - 90	0.5 - 90
Melting point	338 °F (170 °C)	338 °F (170 °C) / 284 °F (140 °C)
Viscosity	---	---
Specific heat Btu/lb°F(kcal/kg°C)	0.55 (0.55) at 230°F (110°C)	0.55 (0.55) at 230°F (110°C)
True density lb/ft ³ (kg/m ³)	56.2 (900)	56.2 (900)
Bulk Density lb/ft ³ (kg/m ³)	21.8 - 28.1 (350 - 450)	31.2 (500)
Corrosiveness	None	None
Adhesivity	None	None
Angle of repose	35°	36°
Feed temperature	Ambient - 194°F (50°C)	Ambient

Table 1-2 Properties of Feed Material

Description	A-Additives	C-Additives	Liquid - Additives
Components	---	---	---
Shape	Powder	Powder	Liquid
Particle size Ave.	---	---	---
Min.	1.3 micron	40 micron	---
Max.	1000 micron	2000 micron	---
Melt index	---	---	---
Melting point	113 - 266°F (45 - 130°C)	284°F (140 °C)	103 - 176°F (39.5 - 80 °C)
Specific heat Btu/lb°F(kcal/kg°C)	0.5 (0.5)	0.5 (0.5)	1.0 (1.0)
True density lb/ft ³ (kg/m ³)	62.4 (1000)	56.2 (900)	53.1 - 59.3 (850 - 950) [at 212°F (100°C)]
Bulk Density lb/ft ³ (kg/m ³)	18.7 - 31.2 (300 - 500)	22.5 (360)	
Corrosiveness	None	None	None
Adhesivity	Severe	Severe	Mild
Angle of repose	35°	53°	---
Feed temperature	Ambient	Ambient	176 - 212°F (80 - 100°C)

Note : Physical properties of Additives are typical figures.

Table 2 Properties of Feed Materials

(unit : wt%)

Materials	Case 1	Case 2	Case 3	Case 4
Polymer	99.4 - 99.9	98.8 - 99.8	98.3 - 99.7	79.4 - 89.9
A Additives	0.1 - 0.6	0.1 - 0.6	0.1 - 0.6	0.1 - 0.6
C Additives	0	---	0.1 - 0.5	0
Liquid Additives	0	0.1 - 0.6	0.1 - 0.6	0
Pellet	0	0	0	10 - 20

B. PRODUCTS

Pellets are to be cylindrical in shape,

Typical Pellet Dia.	:	0.126 - 0.177 in (3.2 - 4.5mm)
Typical Pellet Length	:	0.0787 - 0.118 in (2.0 - 3.0mm)
True Density	:	56.2 lb/ft ³ (900 kg/m ³)
Bulk Density	:	31.2 lb/ft ³ (500 kg/m ³)
Angle of repose	:	36°
Std. deviation value	:	Diameter \leq 0.23 Thickness \geq 0.29
Ratio of thickness	:	$l_1/l_2 \leq 1.2$
Contents of linked pellets	:	Less than 0.01 wt%
Oversize + Undersize	:	Less than 0.05 wt%
Contents of whisker pellets	:	
Over 0.0197 in (0.5 mm)	:	Less than 5.0 wt%
Over 0.0394 in (1.0 mm)	:	Less than 3.0 wt%
Volatile matter	:	Less than 0.1 wt% (Dry base)

C. MACHINE CAPACITY

1. Guaranteed capacity

$0.5 \leq MI < 1.0$:	33,100 lb/h (15,000 kg/h)	} ↘ Ⓞ Min. (10,000 kg/h)
$1 \leq MI \leq 90$:	44,100 lb/h (20,000 kg/h)	

D. SITE DATA

Location	:	Indoor use
Indoor Ambient Temperature	:	°F to °F
Outdoor Ambient Temperature	:	20 °F to 105 °F
Humidity	:	75 % to 80%
Altitude	:	34 ft (10.4 m)

E. APPLICABLE CODES AND STANDARDS

The Japan Steel Works Design Standards

- JIS : Japanese Industrial Standard
- JEM : Standards of Japan Electric Machine Industry Association
- JEC : Standards of Japanese Electrotechnical Committee.
- IEC : International Electrotechnical Commission
- IEEE, NEAM and NFPA70, NEC are applicable

- Note :
- a. Machine parts and piping materials :
Per JIS materials equivalent to ASTM and AISI
 - b. Piping (at the battery points)
 ⚠ Piping ~~and~~ flanges are ANSI.
 Piping (within the confines of JSW supplied equipment)
 Piping and flanges are designed and fabricated in accordance with the JSW standard based on our experience for the similar service.
 - c. Area electrical classification
 Installation is in a non-hazardous, non-classified location.
 However, all equipment except the discharge gear pump DC motor are to be adequate for installation in a Class II, Division 2, Group G area.

F. LANGUAGE AND MEASURING UNITS

1. All commercial and technical documentation including correspondence, specifications, drawings, instruction manuals and engineering data are in English.
2. All dimension and measuring units are in British units.

Temperature	:	°F
Length	:	inch, ft
Weight	:	lb
Press.	:	psig
Power	:	HP
Time	:	s, min, h

⚠ Note) Each equipment should be manufactured based on ISO metric unit.

G. UTILITIES AVAILABLE

1. Power

Motor more than 201HP	:	4160 VAC,	60 Hz,	3 Phase
Motor less than 200HP	:	460 VAC,	60 Hz,	3 Phase
Instruments	:	110 VAC,	60 Hz,	1 Phase

2. Instrument air

- Operating temperature	:	Amb.
- Design temperature	:	130 °F
- Operating pressure	:	④ Min. 70 psig Nor. 100 psig Max. psig
- Design pressure	:	150 psig
- Dew point temperature	:	°F

3. Cooling water (supply)

- Operating temperature	:	86 °F
- Design temperature	:	130 °F
- Operating pressure	:	② 50 psig
- Design pressure	:	③ 150 psig
- Max. allowable pressure drop	:	④ 15-20 psig
- Fouling factor	:	④ 0.002 Ft ² h F/ BTU.

4. Cooling water (Return)

- Operating temperature	:	101 °F
- Design temperature	:	① 130 °F
- Operating pressure	:	② 25 30 psig
- Design pressure	:	③ 85 150 psig

5. Demineralized water

- Operating temperature	:	⑤ Amb. 100° F
- Design temperature	:	① 130 °F
- Operating pressure	:	② 50 70 psig
- Design pressure	:	③ 110 125 psig

6. Nitrogen (NL)

- Operating temperature : Amb.
- Design temperature : 130 °F
- Operating pressure : Min. psig
Nor. 30 psig
Max. psig
- Design pressure : 36 psig
- Dew point temperature : °F

7. Steam

- MS
- Operating temperature : Min.
: Nor. 575 °F
: Max.
 - Design temperature : 600 °F
 - Operating pressure : Min. psig
: Nor. 300 psig
: Max. psig
 - Design pressure : 420 psig

- SL
- Operating temperature : Min.
: Nor. 286 °F
: Max. °F
 - Design temperature : ^A325 ~~340~~ °F
 - Operating pressure : Min. psig
: Nor. 40 psig
: Max. psig
 - Design pressure : 50 psig

V. DOCUMENT SUBMITTALS

Documents and drawings will be submitted as outlined in Document Schedule Sheets.

VI. INSPECTION AND TEST

Equipment furnished is subject to be inspected and tested per JSW INSPECTION SPECIFICATION FOR CMP 305X-~~95W~~ before shipment.

△ IZSW

VII. PAINTING AND RUST PREVENTION

Rust prevention and painting at JSW/his vendor's shop will be done per JSW Painting Specification and Rust Prevention.

Surface treatment of equipment is SSPC SP-2 or SP-3.

VIII. PACKING

Packing will secure safety of the equipment from damage by sea and overland transportation per MWK standards (L1-4TS-83 and L1-5TS-92) and bear clear marking on the case.

IX. MECHANICAL GUARANTEE

SELLER undertakes to replace or repair at its discretion, on F.O.B. Japanese-port basis, any defects resulting from undesirable material, insufficient design or poor workmanship brought to its notice within ~~eighteen (18)~~ ^{twenty six (26)} months from the date of shipment or within twelve (12) months from start-up, whichever comes earlier.

BUYER must provide SELLER sufficient time and opportunity to inspect and remedy such defects and permit adequate time for shipment of repaired parts or replacements. SELLER's obligation shall be deemed to have been fulfilled when such defective parts are properly repaired or replacements thereof are delivered on F.O.B. Japanese-port basis.

SELLER shall bear no liability concerning abnormal operation, improper or insufficient maintenance, or faulty erection by BUYER, for normal wear and tear, or for indirect or consequential losses, profit detention or damage of any nature.

Repair or replacement of parts or remounting of repaired parts at BUYER's site shall be performed by BUYER and at BUYER's expense.

For guarantee purpose, SELLER will send an erection supervisor and/or operation supervisor only on BUYER request at BUYER's expense.

NOTE

Prices and delivery terms are subject to re-adjustment in the case the technical specifications of the quoted machines are to be modified after receipt of formal Purchase Order.

X. EQUIPMENT SPECIFICATIONS

A. Starting Unit

Starting unit assembly is composed of starting motor and gear reducer with cam clutch to facilitate mixer drive before starting mixer drive motor.

1. Gear reducer part

a. Construction and design

Type	:	Enclosed helical 3-stage speed reducer Center split gear casing
Capacity	:	100 HP (75 kW)
Input/output shaft speed:		1176 rpm / 25 rpm
Gear ratio	:	1 : 47
Gears	:	AGMA service factor ≥ 1.5
Bearing life	:	B-10 > 40,000h
Input/coupling	:	Gear coupling
Lubrication	:	Oil bath

b. Material

Pinions and gears	:	Special alloy steel
Surface treatment of teeth	:	Carburizing
Casing	:	Fabricated steel plate

2. Cam clutch part

One way clutch to transmit torque in one direction of rotation and to overrun in the opposite direction of rotation.

Lubrication	:	Water cooled oil bath
-------------	---	-----------------------

B. Mixer

1. Mixer gear reducer

a. Construction and design

- Type : Enclosed helical gear reducer with 2-stages speed shift Center split gear casing
- Capacity : 6,000 / 4,200 HP (4,474/3,132 kW)
- Input shaft speed : 1176 rpm
- Output shaft speed : Δ 216 / 156 / 245 / 454 rpm
- Gears : AGMA service factor \geq 1.5
- Bearing life : Radial bearing B-10 > 40,000h Main thrust roller bearing B-10 > 100,000h
- Input coupling : Torque limit coupling

b. Material

- Pinions and gears : Special alloy steel
- Surface treatment of teeth : Carburizing
- Gear shafts : Forged steel
- Casing : Δ Cast iron ~~or Fabricated steel plate~~

c. Instrumentation and controls

- Thermometers : For bearing on input shaft
- Limit switches : For charge level of speed shaft
- Bearing conditioning sensor : On bearings
- Δ Thermocouple : Oil bath

d. Lubrication System

Complete forced lubrication system with pump, cooler, filter, oil flow sight, piping and necessary instruments. Main drive motor is to be interlocked to prevent start-up until adequate oil pressure is established in the lubrication system.

Piping material is carbon steel (JSW Standard).
 But piping material after filter is stainless steel.

1) Lube oil pump with stand-by

- Type : Gear pump [Ⓐ] ~~with relief valve~~
- Drive : 20 HP (15 kW) x 6P
- Delivery : [Ⓐ] ~~722~~ [Ⓑ] ~~460~~ 360
[Ⓓ] ~~116~~ 95 GPM (~~440~~ liter / min)
- Pressure : Max. 71 psig

2) Oil cooler (ASME with U-stamp, TEMA-C)

- Type : Shell and tube
- Heat transfer : [Ⓐ] ~~468,224~~ ~~118,000~~
[Ⓑ] ~~458,026~~ Btu/h (~~115,430~~ kcal / h)
- Capacity : [Ⓓ] ~~475522~~ 119.900

3) Filter (ASME with U-stamp)

- Type : Dual oil filter
- Screen : 10 μm

2. Mixer Screws

a. Construction and Design

Model	:	^{12Sw} CMP305X- 9SW , twin screws Co-rotating and Intermeshing type
Feed section	:	12.87 inch (327 mm) dia. } ¹² L/D = 9
Mixing section	:	12.87 inch (327 mm) dia. }
Screw has special oval configuration for effective mixing and melting.		
Discharge section	:	9.72 inch (247 mm) dia. L/D = 5
Screw speed	:	215/151 rpm (2-speed type)
Slot clearance	:	0.31 to 2.76 inch (8 to 70 mm) (Screw axial direction)

Slot clearance permits the optimum operation for polymer mixing.

Screws are composed of screw shafts and replaceable screw segments.

b. Materials : Forged alloy steel

Feed and mixing sections are machined, ground and polished with screw surface nitrided.

Discharge section is machined, ground and polished with screw flight edges hard fusing with wear resistant material, and other outer surfaces chrome plated.

3. Hopper Cylinder

a. Construction and Design

Feed hopper is mounted on inlet port of hopper cylinder.

Two hydraulic cylinders connect hopper cylinder to gear reducer to control mixer cylinder position for slot clearance adjustment.

Polymer design press : 2,143 psig

Cylinder jacket is designed for cooling water circulation only.

Operating pressure : \triangle 50 psig

Design pressure : 429 psig

Hydrostatic test
Pressure : 643 psig

To prevent powder leakage from gap between cylinder bores and rotating screws, sealing device is provided at rear side of hopper section.

One flexible bellows is provided between the bottom of hopper (by customer) and the inlet of hopper cylinder to absorb the slot movement of mixer cylinder.

b. Material

Hopper cylinder is of nitrided steel.

4. Mixing Cylinder

a. Construction and design

Mixing cylinders are composed of ^{△ three}~~two~~ cylinder barrels and supported on either side by cylinder supports.

Polymer design press : 2,143 psig

Each mixing cylinder has drilled jackets for steam heating or water cooling

Operating pressure : ^{△ 300}~~57~~ psig

Design pressure : 429 psig

Hydrostatic test Pressure : 643 psig

Two nozzles for liquid additive injection are provided on the top of mixing barrel with plug.

b. Material

Mixing cylinders are of nitrided steel.

5. Discharge Cylinder

a. Construction and design

Discharge cylinders is composed of one cylinder barrel bolted to mixing cylinder and supported on either side by cylinder support.

Polymer design pressure : 2,143 psig

Discharge cylinder has drilled jackets for steam heating or water cooling

Operating pressure	:	57 ³⁰⁰ psig
Design pressure	:	429 psig
Hydrostatic test Pressure	:	643 psig

Vent port is provided on discharge cylinder.

Two replaceable liners coated with N-aloy are fitted inside discharge cylinder.

b. Materials

Discharge cylinder is of forged steel.

6. Hydraulic Oil Unit for slot clearance Adjustment

Slot clearance (variable orifice to restrict polymer pathway) is automatically adjustable by axially movable mixer cylinder and hydraulic oil unit.

a. Hydraulic oil unit

Pump	:	Axial plunger type
Delivery pressure	:	5,714 psig 714 psig
Delivery volume	:	0.16 GPM (0.6 liter / min) (High) 1.06 GPM (4.0 liter / min) (Low)
Drive	:	1.0 HP (0.75 kW) × 2 P
Oil tank volume	:	6.6 gallon (25 liter)

b. Attachments provided

Solenoid valve
Filters
Valve
Internal piping for hydraulic oil unit and rubber hoses
Other necessary instruments

7. Mixer Cylinder Supports

a. Construction and design

Mixer cylinder supports have sliding faces on their tops to allow slot adjustment and expansion of the cylinders.

b. Material

Welded carbon steel plate fabrication

8. Cylinder Cooling Water Unit (CCW unit)

a. CCW Tank

5 BOX

Type : ~~Cylindrical~~ type
Volume : 316 gallon (400 liter)
Material : Stainless steel

b. CCW Pump

Type : Centrifugal type (Mechanical seal)
Capacity : 119 GPM × 131 ft Aq
(450 liter / min × 40 meter Aq)
Material : Spheroidal graphite cast iron
Drive : 15 HP (11 kW) × 2 P

c. CCW Cooler

Type : Plate
Capacity : 1,011,840 Btu/h (255,000 kcal / hr)
Material : Stainless steel

d. CCW Internal Piping

Size : 3 inch
Material : Carbon steel
(JSW Standard spec.)

9. Valve Stand

a. Construction and design

Valve stand is valve unit for water cooling or steam heating for cylinder.

b. Material

Piping classification shall be designed in accordance with JSW Standard.

10. Vacuum System

Vacuum system consists of polymer catcher drum, vacuum pump and separator.

a. Polymer catcher drum

Volume : \triangle 3.6 0.1
~~36~~ ft³ (~~1~~m³)

Material : Carbon steel

Steam heating jacket is provided.

b. Vacuum pump (Mechanical seal)

Capacity : 283 ft³/min × -13.1 psi
 (8 m³/min × -700 mmHg)

Material : Stainless steel

Drive : ~~29~~ HP (~~22~~ kW) × ~~4~~ P
 25 18.5 6 \triangle

c. Separator

Volume : 3.6 ft³ (0.1 m³)

Material : Carbon steel

C. Diverter Valve

a. Construction and design

Diverter valve is bolted to mixer cylinder end to divert degraded or unflexed polymer to the floor by activation of hydraulic cylinder.

Polymer design pressure : 2,143 psig

Rupture disk (for 2,143 psig) is equipped on diverter valve.

Valve body has jacket for oil heating

Operating pressure : 57 psig

Design pressure : 857 psig

Hydrostatic test pressure : 1,286 psig

Hydraulic oil cylinder

Hydraulic pressure : 8,571 psig

b. Materials

Body : Cast steel

Piston : Carbon steel

All surfaces in contact with polymer is chrome-plated

c. Instrumentation and controls

Limit switch : Diverter valve stroke ends.

D. Gear Pump

1. Gear Reducer

a. Construction and design

Type	:	Enclosed helical gear 3-stage speed reducer. Casing to be split at center line.
Capacity	:	⁵ 750 1,000 HP (746 kW)
Input shaft speed	:	115 to 1150 rpm
Output shaft speed	:	5.0 to 50 rpm
Input coupling	:	Gear coupling
Output	:	⁴ Two ^{One} Universal joints
Gears for G/R	:	AGMA service factor \geq 1.5
Bearing life	:	B-10 \geq 40,000 h

b. Material

Pinions and gears	:	Special steel alloy
Surface treatment of teeth	:	Carburizing ⁵ AND INDUCTION HARDENING
Shafts	:	Forged steel
Casing	:	Fabricated steel plate

c. Instrumentation and controls

Thermometer	:	For a bearing on input shaft
Bearing conditioning Sensor	:	On bearings

2. Separate Drive Gear

a. Construction and design

Type	:	Enclosed one pair of spur driving gear unit to prevent gear teeth contact of gear pump by uniformly distributing gear flank clearances
Capacity (Drive motor)	:	1,000 HP (⁵ 750 746 kW)
Input/output speed	:	5.0 to 50 rpm
Gear	:	AGMA service factor ≥ 1.2
Bearing life	:	B-10 $\geq 40,000$ h
Bearing condition sensor	:	On bearing

b. Material

Pinions and gears	:	Special alloy steel
Surface treatment of teeth of teeth	:	Carburizing
Casing	:	Fabrication steel plate

c. Lubrication System

One complete forced lubrication system for gear reducer and separate gear drive are equipped with pump, cooler, filter, oil flow sight, piping and necessary instruments.

Gear pump drive motor is to be interlocked to prevent start-up until adequate oil pressure is established in the lubrication system.

Piping material is Carbon steel (JSW Standard)
But piping material after filter is stainless steel.

1) Lube oil pump with stand-by

Type : Gear pump
 Drive : 5 HP (3.7 kW) x 6 P
 Delivery : ~~23~~¹⁸ GPM (~~88~~⁶⁹ liter/min)
 Pressure : 71 psig Max.

2) Oil cooler (ASME with U-stamp, TEMA-C)

Type : Shell and tube
 Heat transfer capacity : ~~87,280~~^{91,072} ~~22,500~~^{23,000} Btu/h (~~18,060~~ kcal/h)

3) Filter (ASME with U-stamp)

Type : Dual oil filter
 Screen : 10 μ m

3. Coupling Joint

a. Universal joint connecting Gear Reducer and Separate Drive Gear

Universal joints is equipped with shear pin to protect over-torque to gear pump.

Universal joint absorbs shaft center off-set resulting from mixer cylinder movement by heat expansion and slot adjustment.

b. Special couplings connrcting Separate Drive Gear and Gear Pump

Couplings unifoemly distribute gear flank clearance (black lash) on both sides of gear teeth for gear pump preventing metal to metal contact of gear teeth.

4. Gear Pump

a. Construction and design

Gear pump is directly bolted upstream diverter valve and downstream screen changer in tandem on the same floor level.

Type	:	Spur Gear Pump GP 400T
Polymer press.	:	Suction press is automatically controlled by gear pump speed control
Polymer design press.	:	5,000 psig
Speed	:	5.0 to 50 rpm
Casing has drilled jackets for oil heating		
Operating pressure	:	57 psig
Design pressure	:	857 psig
Hydrostatic test pressure	:	1,286 psig

b. Material

Gears	:	Nitrided steel
Bearings	:	Hardened steel (N-alloy)
Casing	:	Cast steel with chrome plate inside

c. Instrumentation

Pressure transmitter and thermocouple for melt resin on suction side of casing

Pressure transmitter for melt resin and thermometer on discharge side of casing

4-thermocouple for bearing temperature measurement.

E. Screen Changer

1. Screen Changer

Screen changer is connected to the downstream of pump to enhance polymer quality in process by removing impurity contained in polymer. Slide bar shifts by hydraulic cylinder to exchange clogged screen pack.

a. Construction and design

Type : NSC 250DBW dual bar wide type

Actual filter area : 180 in² (1164 cm²)

Two screens are to be changed slowly and safely during mixer operation.

Two screen assemblies are in two slide bars.

Polymer pressure

Body design pressure : 5,000 psig

Differential design pressure : 2,857 psig

Main body has jackets for oil heating

Operating pressure : 57 psig

Design pressure : 857 psig

Hydrostatic test pressure : 1,286 psig

b. Materials

Main body : Nitrided steel Inside surfaces in contact with polymer is chrome-plate

Slide bar : Nitrided steel

Breaker plate : Alloy steel

Screen : Stainless steel

2. Hydraulic oil unit for screen changer and diverter valve

Hydraulic oil unit consists of drive motor, pump, solenoid valve, pressure gauge and oil tank for screen changer and diverter valve.

Pump motor	:	7.5 HP (5.5 kW) × 4 P
Delivery	:	1.19 GPM (4.5 liter/min)
Delivery pressure	:	8,571 psig

3. Adaptor

Adaptor is installed between gear pump and screen changer.

a) Construction and design

Polymer design pressure : 5,000 psig

Rupture disk (for 5,000 psig) is equipped on adaptor.

Adaptor is designed with jacket for oil heating only.

Operating pressure : 57 psig

Design pressure : 857 psig

Hydrostatic test pressure : 1,286 psig

b) Materials

: Forged steel Inside surface in contact with polymer is chrome plated.

F. Underwater Cutter

Underwater cutter is composed of die holder, die plate, water chamber and cutter unit to pelletize polymer strands extruded through die plate into pellets in hot water.

1. Die holder

Die holder is bolted to screen changer and die plate is bolted to the other side.

The hole with blind plug for rheometer (return type) is provided

a. Construction and design

Polymer design press. : 2,857 psig

Rupture disk (for 2,857 psig) is equipped on die holder.

Die holder has jackets for oil heating :

Operating pressure : 57 psig

Design pressure : 857 psig

Hydrostatic test pressure : 1.286 psig

b. Materials : Forged steel Inside surfaces in contact with polymer is chrome-plated

c. Instrumentation and controls

Press. transmitter : For polymer pressure

Thermocouple : For polymer temp.

Thermometer : For steel temp.

2. Die Plate

Heat channel die effectively prevents freezing of die nozzles even at low throughput owing to high heat transfer construction.

a. Construction and design

- Type : Heat channel die
- Number of die holes : 0.098 inch (2.5 mm) dia.
x approx. 944 holes
- Polymer design press : 2,857 psig

Die plate has drilled jackets for oil heating

- Operating pressure : 57 psig
- Design pressure : 857 psig
- Hydrostatic test pressure : 1,286 psig

b. Materials : Stainless steel with titanium carbide plate on cutting surface

c. Instrumentation and controls

- Thermocouple : For die plate steel temp.

3. Water Chamber

Water chamber is clamped to die holder by quick open/close mechanism. Hot water is pumped into water chamber for underwater pelletizing and conveys pellets to dewatering equipment.

a. Construction and design

Two hinged side doors are provided on the both sides. Operator's side has a peep window.

One scope lamp is provided on the opposite side door.

Water chamber design press. : 57 psig

Hot water inlet/outlet size : 8" / 10"

b. Materials : Cast stainless steel

c. Instrumentation and controls

Two limit switches are provided for side doors

One limit switch is provided to ensure the contact of water chamber with die holder.

4. Cutter Unit

Cutter motor is directly connected to cutter shaft by gear coupling covered with safety guard.

Cutter shaft can stroke back and forth by activation of hydraulic cylinder provided inside cutter unit.

The cutter blades can be kept to contact to the cutting surface of die plate automatically by activation of hydraulic cylinder.

Cutter holder is designed for ease of exchange after disconnecting water chamber from die plate by releasing clamp device.

Cutter shaft adjusting handle and a dial gauge are provided at rear end of casing.

a. Construction and design

Type	:	ADC-75
Drive	:	87 HP (65 kW)
Cutter speed	:	115 to 1150 rpm
Number of cutter blades	:	16 blades
Lubrication	:	Oil bath, grease

b. Material

Casing	:	Cast iron
Cutter blade	:	Titanium carbide
Cutter holder	:	Stainless steel
Cutter shaft	:	Stainless steel

c. Instrumentation

Dial gauge

Proximity switch for cutter blade wear alarm.

5. Hot Oil Unit

Hot oil unit is used to heat diverter valve, adaptor, gear pump, screen changer, die holder and die plate.

Hot oil unit consists of oil pump with stand by, expansion tank, electrical heater, instrument, and internal piping, which are mounted on one skid.

Control panel for hot oil unit is installed separately in electrical room.

- | | | | | |
|---|---|--------------------------------------|---|--|
| 1) Operating temperature | : | Normal | : | Δ 500-572°F (260-300°C)
500°F (260°C) |
| | | Design | : | 750 °F (399°C) |
| 2) Electric heating capacity | : | 491 HP (122 kW × 3sets) | | |
| 3) Pump capacity | : | 239 GPM (900 liter/min) × 230 ft TDH | | |
| 4) Pump drive motor | : | 40 HP (30 KW) × 2P | | |
| Δ 5) HEATER SHELL AND EXPANSION TANK | : | ASME WITH U-STAMP | | |

G. Carriages

Two independent carriages support pelletizing components and move on rails in direction of mixer screw axis for quick and accurate line-up.

Carriage for Diverter Valve, Gear Pump, Screen Changer and Die Head.

Carriage for Water chamber and Underwater pelletizer with motor.

a. Construction and design


Support height of carriages are adjustable with adjusting bolts and shims. Carriage wheels can be driven by either a direct ratchet lever (for gear pump, screen changer and die holder) or a handle (for underwater cutter unit and drive motor).

b. Materials : Steel fabrication



H. Drying System Specification

1. ^{OFF} ~~Pre~~-dewatering Screen

- Type : Box type with  ~~cylindrical~~-screen
- Material : Stainless steel for parts in contact with slurry
- Screen : 2 mm dia. punched steel

2. Dewatering Screen

a. Construction and design

Inclined screen which separates agglomerates from the pellets and discharges agglomerates through a swing gate operated pneumatically.

- Type : GALA
- Agglomerate size : More than 1 inch (25 mm)

b. Material : Stainless steel for parts in contact with slurry

3. Centrifugal Dryer

a. Construction and design

- Type : GALA 32.5 DW
- Speed : 410 rpm
- Drive : 20 HP (15 kW) x 4 P

b. Material : Stainless steel for parts in contact with slurry and carbon steel for others

△ SCREEN

4. Vibrating Classifier

a. Construction and design

Type : Mechanically vibrating classifying type
(52A SS/SS)

△ Screen Speed : Top : 0.31 inch (8 mm) dia. punched plate
Bottom : 12 mesh screen

Drive : 7.5 HP (~~5.6~~⁵ kW) × 6 P

b. Material : Stainless steel for parts in contact with pellets
and carbon steel for others
Flexible canvas are provided

5. Exhaust Fan

a. Construction and design

Type : Centrifugal fan

Capacity : 5,297 Nft³/min × 0.082 ftAq
(150 Nm³/min × 25 mmAq)

Drive : △ 5 3.7
~~7.5~~ HP (~~5.5~~ kW) × 4 P

b. Material : Carbon steel with epoxy coating

6. Damper

a. Construction and design

Damper is installed before the exhaust fan.

b. Material : Stainless steel

I. Pellet Conveying Water System (PCW) Specification

1. PCW Tank

a. Construction and design

Type : Box type
Volume : 424 ft³ (12 m³)

b. Material : Stainless steel for parts in contact with liquid

2. PCW Pump ~~with stand-by~~

a. Construction and design

Type : ^{④ Vertical} ~~Centrifugal~~ type (Mechanical seal)
Capacity : ^{⑤ 115} 1,162 GPM × ^{④ 35} ~~98~~ ft ^{④ 30} (4,400 liter/min. × ~~30~~ meter)
Drive : 75 HP (55 kW) × 4 P

b. Material : Stainless steel for parts in contact with liquid

3. PCW Cooler

a. Construction and design

Type : Plate type
Heat Exchanged : Approx. 13,269,000 Btu/h
(3,344,000 kcal/h)
Capacity
Design : PCW side : ^{④ 71} ~~57~~ psig
 CW side : ^{④ 50} ~~50~~ psig
 ^{⑤ 85}
Cooling water : Inlet : ^{④ 86} °F
 Outlet : ^{④ 101} °F
 ΔT : ~~10~~ °F (~~10~~ °C)

b. Material : ^{④ 14.4} ~~14.4~~ 8
^{⑤ 15} Stainless steel for parts in contact with PCW water

4. PCW Screen

a. Construction and design

- Type : Inclined type installed ⁵ ~~near~~ ^{ON} PCW Tank
- Material : Stainless steel for parts in contact with liquid
- Screen : ⁴⁰ ~~30~~ mesh

5. PCW 3 Way Valve

a. Construction and design

- Size : 8 inch (lower line)
12 inch (upper line)

b. Material : Stainless steel