

Specifications

Lovat RME148SE / Series 27400

Basic Dimensions

Cut Diameter	3,780	mm
Bore Diameter	3,755	mm
Shield Diameter	3,742	mm
Length of TBM	13	m
Length of Back-Up	99	m
Weight of TBM	159	tonne
Weight of Back-Up	127	tonne

Tunnel Lining

Type	Segment
Configuration	No.
Outside Diameter	mm
Inside Diameter	mm
Length	mm

Cuttinghead

Structural

Cantilever Type

Cuttinghead Face opening(approximately): 30 %

Grizzly Bars across openings

Cuttinghead and Chamber Features

Abrasion Resistant Plating on Cuttinghead Face and Rim

Face Injection Port Assemblies (independent operation) 4 No.

Caliper Doors for sealing Chamber when Screw Conveyor is retracted

Scraper Tools 32 No.

Cutting Tools – Soft Ground Configuration

Ripper Teeth (incl. 5 no. with oil pressure type wear indicator) 27 No.

Centre Nose Cone 1 No.

Copy Cutter Ripper Teeth - Manual Operation 1 No.

Wear Indicator Ripper Teeth - Oil Pressurized type 5 No.

Cutting Tools – Hard Rock Configuration

Twin Disc Cutters - Face 15 No.

Twin Disc Cutters - Gauge 8 No.

Single Disc Cutters - Centre 4 No.

Quad Disc Cutter - Centre 1 No.

Main Drive – Variable Frequency Electric Drive

General

Clockwise and Counter-Clockwise Rotation

Variable speed

Inching function for maintenance

Planetary Gear Boxes

Quantity: 4 No.

Water Cooled

Electric Motors

Quantity 4 No.

Water Cooled

Individual Capacity 125 kW

Total Available Power to Cuttinghead 500 kW

Operating Voltage 600 V

Torque Limiters

Quantity 4 No.

Mechanical type

Main Bearing

Triple Roller Bearing

Lubricated by an independent pressurized oil lubrication system

Sampling Points for monitoring of lubrication oil quality

Cuttinghead Drive Speed / Torque After Efficiencies

Maximum Torque:	2,129	kN•m
Speed at Maximum Torque:	2.1	rpm
Nominal Torque:	1,172	kN•m
Speed at Nominal Torque:	3.68	rpm
Peak Start-Up Torque	2,661	kN•m

MAIN DRIVE OIL SEALING SYSTEM

Seals – Oil

Maximum working pressure	4.5	bar
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Multi stage type

Internal Sealing System

Outer Sealing System

Single Lip type Seals

Sealing System “Fail-Safe”, malfunction initiates shutdown of Main Drive

Positively Pressurized Automatic Sealing System controlled by the PLC w/input from Earth Pressure Sensors

Forward Shell

Earth Pressure Sensors in Cuttinghead Chamber	4	No.
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Injection Ports in Cuttinghead Chamber	2	No.
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Injection Ports on Forward Shell Periphery	4 No.
Personnel Access Hatch into Cuttinghead Chamber	1 No.
Material Access Hatch into Cuttinghead Chamber	1 No.

ROTARY FLUID JOINT

Fluid transfer to the Cuttinghead Chamber and Face
 Penetrations through Pressure Bulkhead for Utilities

Active Articulation System

Connection between Forward Shell and Stationary Shell

Articulation Cylinders	8 No.
Individual Cylinder Capacity	127 tonne
Combined Capacity	1016 tonne
Articulation Angle	1.5 – 2 °
Articulation Cylinder Stroke	150 mm
LDTs – One for each Quadrant	4 No.
Articulation Seal – Dynamic (replaceable from within the tunnel)	1 No.

Stationary Shell

Rear Support	
Forward facing Probe Drill / Consolidation Ports (Upper 180°)	No.
Stabilizer fins	2 No.

Automatic Tilt Control

Electric Level Switches

Trip point adjustment range between 0.5 to 6 °

Propulsion

Quantity of Cylinders	16 No.
Maximum Capacity of Cylinder	83 tonne
Total Maximum Thrust	1328 tonne
Operating Pressure at Maximum Thrust	340 bar
Nominal Operating Pressure	240 bar
Propulsion Stroke	mm
Maximum Retraction Speed – Group of 4 no. cylinders	1,000 mm/min
Maximum Extension Speed – All Cylinders	100 mm/min
Soft Mode for Segment Erection	
Self Aligning Shoes	

Operators Station

Located in the Stationary Shell

Controls for TBM mining functions

Programmable Logic Controller (PLC)

The TBM is equipped with a PLC (Programmable Logic Controller). The PLC is used to control the machine and record information from sensors. Any information in the PLC is sent to and displayed with HMI software (Human Machine Interface). The HMI software, which is run on an Industrial PC

located in the TBM or Operators Cabin, can also record the information.

Laptop Computer for PLC System Interface and Diagnostics

A Laptop Computer (Software include) will be supplied for interfacing with the TBM PLC System for diagnostics and troubleshooting.

Industrial Work Station (Located in the TBM)

LCD Color Display

Windows HMI Program for information display and recording

Industrial Work Station (Located on the Surface)

LCD Colour Display

Windows HMI Program for information display and recording

CCTV Monitoring System

Colour Camera, c/w: Sealed Housing 1 No.

High Resolution Colour Monitor 1 No.

Monitoring Point at Trailing Conveyor Discharge

Communication System

Intercom Phones 6 No.

Phone Locations:

- Operators Console (1 No.)
- TBM (1 No.)
- Segment Erector (1 No.)

- Trailing Gantry (3 No.)

TRAILING SHIELD

Injection Ports, fitted with valves 4 No.

Tail Seals

Rows of Wire Brush Tail Seals 3 No.

Invert Grout Flap on Last Row 1 No.

First two rows come factory installed – last row installed on site

First two rows replaceable from within tunnel

Inflatable Emergency Seal (Located ahead of the wire brushes) 1 No.

Grout Lines

Grout Lines – Active 4 No.

Grout Lines – Passive 4 No.

Grout Line Area 1,126 mm²

Grout Type A/B

Replaceable from within the TBM

MUCK REMOVAL SYSTEMS

Screw Conveyor

Nominal Diameter 610 mm

Overall Length 12 m

Tube Wear Protection – Entire Length, Invert only

Auger Wear Protection – Entire Length, Flight OD only

Auger Wear Protection – first 1.5 m, Pulling Side only

Available Power 126 kW

Maximum Speed 24 rpm

Bi-Directional Operation

Replaceable Auger Tip

Capacity at 100% Filling 204 m³/hr

Injection Ports 4 No.

Earth Pressure Sensors 4 No.

Retractable from Cuttinghead Chamber

Inspection Ports – located at Auger Joints

Emergency Closure System for Guillotine

Rear Discharge, c/w: cowling/hopper to control muck flow

Guillotine Doors over Rear Discharge

Trailing Belt Conveyor

Nominal Width 610 mm

Length 47 m

Capacity 232 m³/hr

Belt Speed 0 to 100 m/min

Front & Rear Drive Roller

Available Power kW

Rubber Lagging

Limber Rollers

Rigid Rollers

Belt Scrapers

Frame Mesh Guard on Bottom of Conveyor

Cowling/Hopper to control muck flow

Emergency Stop Pull Cord along entire length of conveyor – both sides

Mechanical Belt Weigh Scales

2

No.

Segment Handling and Erection Systems

Segment Unloader

Single Segment Ring Capacity

Hydraulic Operation

Controls located at First Gantry Section

Unloading Arms

Segment Transport Beam

Single Segment Lift Operation

Delivers Segment to Erector

Hydraulic Operation and Controls

Vacuum Type Pick Up System

Segment Erector – Bulkhead Type

Vacuum Type Pick Up System

190 ° Operation in Each Direction

Rotational Speed – Fully variable

0-2 rpm

Inching Function

Hydraulic Powered

Hydraulic Control of all Functions

Warning Lights and Sirens for Operation

Safety Guards

Fixed Operator Station in TBM

Pendant Operator Station

Lock Out to prevent operation from multiple stations

Controls based on Dead Man system – automatically locks in place in case of power loss or release of controls

Powered Degrees of Freedom 5 No.

Non-powered Degrees of Freedom 1 No.

Fail Safe Brake in case of power loss

TRAILING GANTRY

Structural Steel, c/w: welded and bolted connections

Railing Up

Gantry Sections: 12 No.

Structure Type: Open

Support Type: Bogie
Wheel

Support of TBM Ancillary Equipment

Walkways

Workshop

Note: The Buyer is to provide details of the Rolling Stock

ELECTRICAL

Estimated Installed Power		kW
Transformer:		kVA
Non-Explosion Proof		
Primary Voltage	13.8	kV
Secondary Voltage etc.	600	V

Gas Monitoring System

Gas monitoring system for the following gases:

- Oxygen (O₂)
- Hydrogen Sulfide (H₂S)
- Sulfur Dioxide (SO₂)
- Methane (CH₄)
- Nitrous Oxide (NO)
- Nitrogen Dioxide (NO₂)
- Carbon Monoxide (CO)
- Carbon Dioxide (CO₂)

Monitoring points at the Screw Conveyor Discharge and in the TBM working area

Lighting System

Heavy Duty Waterproof Fluorescent Lighting

Walkways	30	lux
Work Areas	300	lux
2 Hr. Emergency Back-Up	15	lux

TACS Automatic Tunnel Guidance System

Industrial PC

Video Target

Motorized Totalization

'acs' Software and DTA Calculation

Segmental Ring Module

Video Target Software

Theodolite Communicator

PLC Communicator

Data Communication Software

Ground Conditioning System

Foam Injection Rate (Measured @ Atmospheric Pressure) 1,000 l/min

Polymer Injection Rate 100 l/min

Includes: Flow Meter for main water

Pressure Meters for main water and air line

Local Analog Control of Injection Pumps

Foam dosing pump, Polymer dosing pump 5 No.

TWO-COMPONENT GROUT INJECTION SYSTEM

A Component Injection Capacity 15 m³/hr

B Component Injection Capacity 1.5 m³/hr

A Component Tank c/w agitator and level sensor 4 m³

B Component Tank c/w level sensor 1 m³

Total Injection Points 4 No.

Includes Local Controls and Pressure Sensors

Transfer Pump (from Buyer supplied Grout Car to TBM mounted tank)

VENTALATION

Auxiliary Ventilation

Capacity

150 m³/min

Electric Fan, uni-directional, single speed,

Silencer

Ventilation Cassette Lifting System

For Main Ventilation System

Cassette Lifting Mechanism

FIRE SUPRESSION

ANSUL Fire Suppression System for Hydraulic Power Packs

Checkfire MP Electric Detection System Components

Gas Motor Actuator

Dry Chemical Extinguishing Agent

Nitrogen Filled Cartridge

Remote Actuator – manual

Manual Fire Extiguishers (Class A,B,C Fires)

8 No.

Fire Trace Suppression System for TBM Substation and Electrical Panels

Dry Chemical Extinguishing Agent

Remote Actuator - manual

EMERGENCY GENERATOR

Installed Power	30 kW
Output Voltage	600 V
Electrical Frequency	60 Hz
Run Time	8 hrs

Systems Powered:

- Auxiliary Ventilation
- Dewatering Pumps
- Lighting
- Fire Suppression

(Not all systems can operate at 100% capacity)

BENTONITE INJECTION SYSTEM

Injection Ports on TBM Shield	4 No.
Injection Ports to Cuttinghead Chamber	4 No.
Pump Capacity	10 m ³ /min
Agitator Tank Capacity	1.5 m ³

DEWATERING SYSTEM

Settling Tank – Capacity:	2.5 liter
Discharge Pump	200 liter/min
Suction Pump	100 liter/min
Water piping on gantry from suction pump to tank	

AIR COMPRESSOR FOR GCS AND TOOLS

Power	33 kW
Maximum FAD	4.7 m ³ /min
Maximum Pressure	7.5 bar
Air Receiver	1,000 liter

HIGH VOLTAGE CABLE REEL

Capacity	150 m
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WATER HOSE REEL

Capacity	150 m
Hydraulic Rewinding & Automatic Tensioning	

COOLING WATER INLET REQUIREMENT

Required Inlet Flow	386 liter/min
Maximum Inlet Temperature	10 °C
Minimum Inlet Pressure	4 bar
Maximum Inlet Pressure	7 bar