MINING APPLICATIONS

TECHNICAL HANDBOOK

FP®

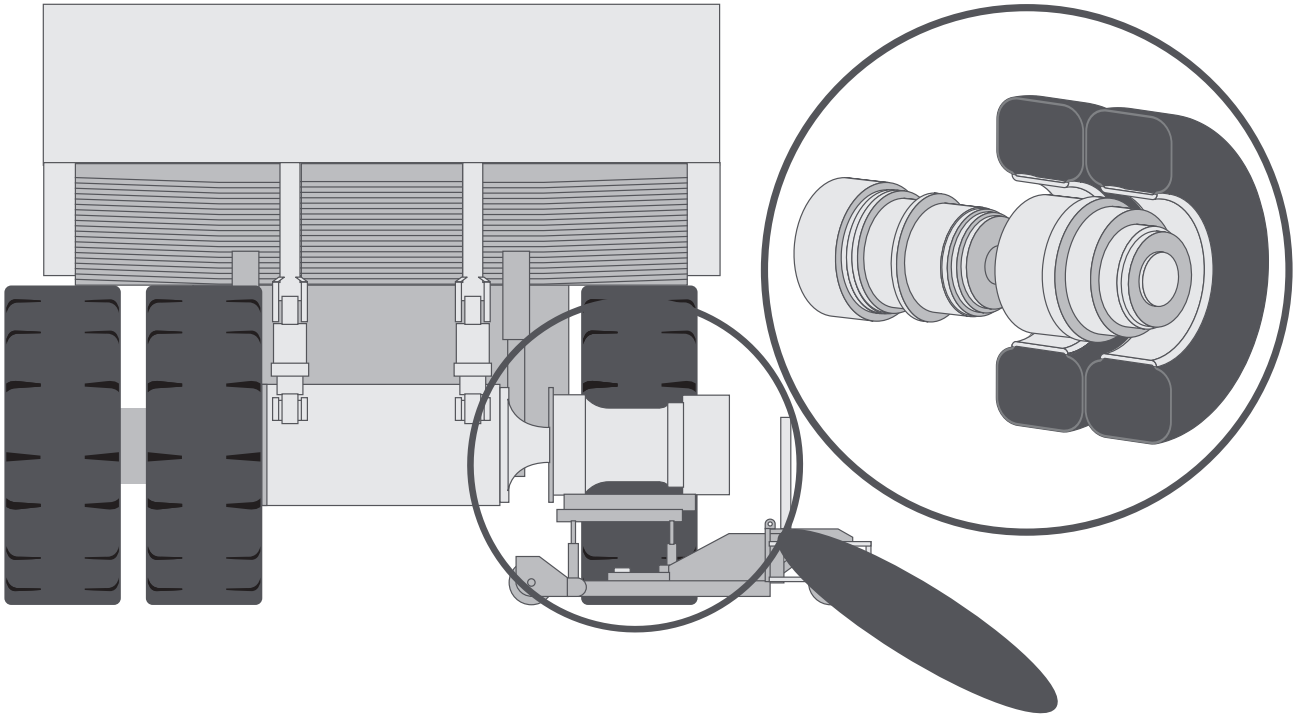
ATS® SPECIAL OIL SEALS

OIL SEALS FOR MINING TRUCKS

In order to optimize the efficency of the heavy-duty truck in the mining field, the industry has developed extremely powerful and performing electric wheel engines, engineerd for the new mining trucks electric drive system providing a best-in-class mix of payload, top-end speed and retarding speed for the 200-ton mining truck class. Since the beginning of this technology engineering, F.lli Paris S.r.l. assisted the development supplying high-performance seals made by ATS Special Oil Seals S.r.l. known to the market as L2M® seals, with specific definition REMM for this industry. Our oil seals for the electric drive system for heavy-haul surface mining trucks are designed for optimal durability and performance even in the harshest environment. Or course, we don't only supply L2M® seals but even all the other oil seals and hydraulic seals (in various profiles and materials including high compression-set O-Rings), required in the whole drive system.

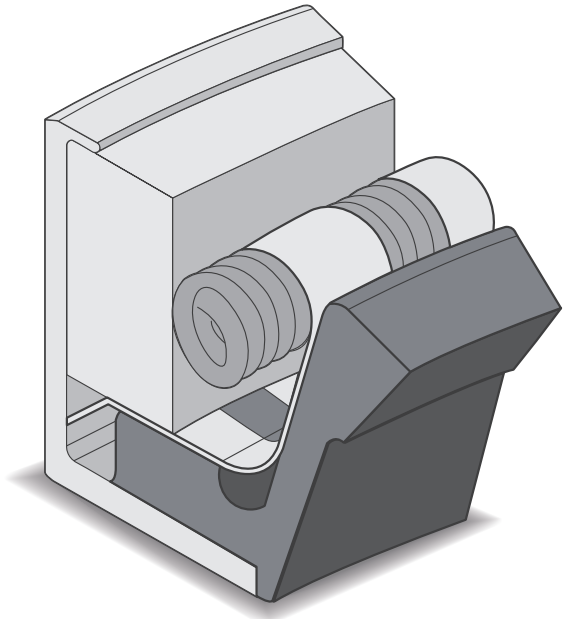
Heavy-Duty truck – rear view

Wheel hub – Electric wheel engine



OIL SEALS TYPE L2M® - REMM

L2M® is the main and most important oil seals used in the electric drive system for heavy-duty mining trucks, and the REMM models are specifically designed for this application.

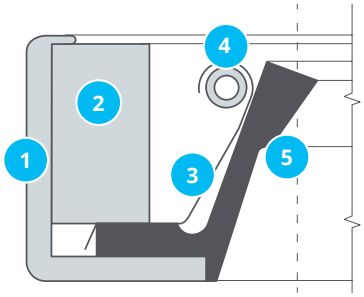


- Developed specifically for severe operating conditions with great misalignments and high speeds where rigidity and strength are necessary.
- Recovery of misalignment up to 5 mm (radial up to 2,5 mm).
- A groove on the external diameter allows the operator to center the oil seal in the housing bore, easing the assembly.
- The outer metal case of the oil seal is conceived in one single piece without welding points.
- Available on demand with rubber or iron spacers.
- The sealing lip is vulcanized onto the metal casing.

Applications:
Paper mill industry, Primary metals industry, Wind mill industry, Mining industry, Power generation and supply, General industry

Dimensions: Minimum I.D. 180 mm; Maximum O.D. 2.000 mm
Working speed: up to 40 m/s
Pressure: up to 0.5 BAR
Operating temperature range: - 40°C / + 220°C
Remarks: All working parameters vary, considering the different type of materials and elastomer used.

L2M®



Technical features

1. Metal outer casing with ground surface
2. Stiffening ring
3. Finger spring
4. Garter spring
5. Rubber sealing ring vulcanized on the metal case

Materials

1. Metal body: **Fe-DC04**
2. Stiffening ring: **Fe 37**
3. Finger spring: **AISI 301**
4. Garter spring: **AISI 316**
5. Elastomer: **NBR; HNBR; FKM; VMQ**

For further information on all our seals, please check our web page or contact our offices.

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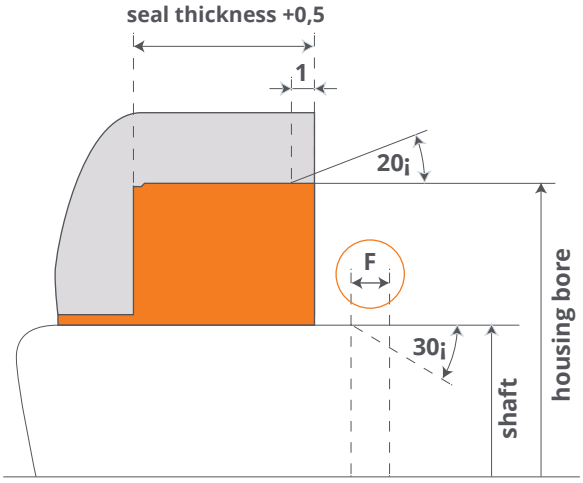
TECHNICAL FEATURES FOR L2M®

Tolerances on shaft and housing for metric (mm) and imperial (inch.)

Shaft size Ø (mm)	<= 100	± 0.080
	101 ÷ 150	± 0.100
	151 ÷ 250	± 0.130
	>= 250	± 0.250
Housing Ø (mm)	<= 76	± 0.025
	77 ÷ 150	± 0.040
	151 ÷ 255	± 0.050
	256 ÷ 510	+ 0.05 /-0.10
	511 ÷ 1015	+ 0.05 /-0.15
	>= 1015	+ 0.05 /-0.15

Maximum misalignment allowed 2,5 mm

Shaft Ø (mm)	Chamfer "F" (mm)
<= 250	7.00
> 250	12.00



"We recommend the use of a conical mounting tool for the installation of the seal"

Finishing of the shaft

A surface finishing of the cylinders done with chromium carbide has shown excellent results. Finishes made with chromium oxides have the disadvantage of reducing the heat dissipation capacity through the cylinder and should not be used with high-speed installations (<10 m/s). It is recommended to apply sleeves on the cylinders in the sealing areas of the ring and finished with hardness 58-62 HRC.

Shaft hardness and surface finishing

Speed	Maximum roughness		Hardness
(m/s)	Ra (mm)	Rmax (mm)	HRC
<= 10	0.5-0.6	2.0-3.0	30
11 ÷ 16	0.3-0.5	1.0-2.0	40
> 16	0.2-0.3	0.8-1.0	50

Selecting the sealing elastomers

Elastomers	Applications
Nitrile NBR	Lubricating oils, hydraulic oils and mineral fats, water, HFA and HFB fluids, caustic cleaners.
Hydrogenated Nitrile HNBR	Lubricating oils, hydraulic oils and mineral fats, water, HFA and HFB fluids, caustic cleaners. It guarantees an excellent resistance to abrasion and a good thermal behavior.
Fluoroelastomer FKM	Mineral based liquids and fats, HFA, HFB, HFC and HFD fluids, water, chemicals and solutions. Not applicable with highly flammable liquids based on phosphoric acid. Recommended for use with flammable oils.
Silicon VQM	Organic oils and oils with high aniline content. Engine and gearbox oil. Excellent characteristics for mineral oils and fats. It can be used with aliphatic and aromatic hydrocarbons. This material is resistant to high and low temperatures.

Description		NBR	FKM	VQM	HNBR
Working temperature	C (± 2)	-20 ÷ +100	-20 ÷ +220	-60 ÷ +180	-40+150
Standard Hardness	Shore A (±5)	70	70	70	70
Maximum working speed	m/s	12	25 ÷ 35	25	15

The above data has been obtained through tests that •FP• considers to be reliable. •FP• does not guarantee that the same results with be replicated in other laboratories with different preparation conditions and laboratory sample evaluation. For more details, please contact our technical office.

SEAL INSTALLATION, HEAVY INDUSTRIAL APPLICATIONS

How to install a metal-cased seal

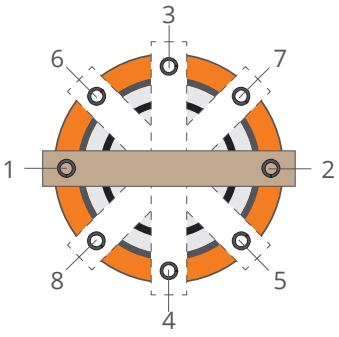
If the preliminary check has the proper conditions matching the quality specification for the shaft and the housing bore, then:

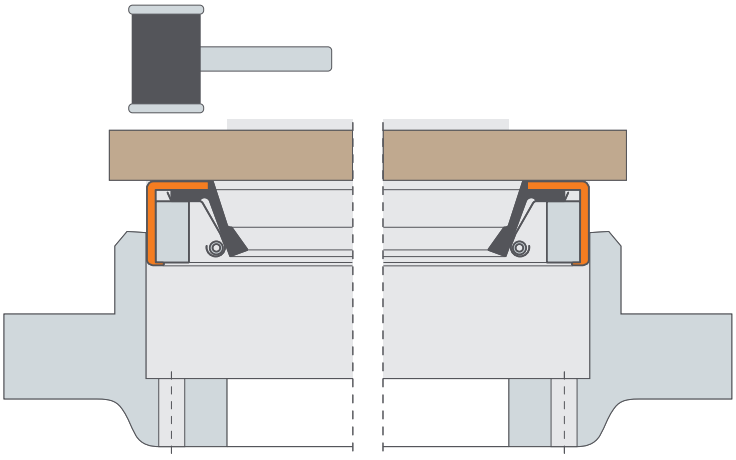
- Coat both the seal and bore lightly with a lubricant;
- The coating shall be done preferably with the same lubricant that will be used to lubricate the application.

installation

- The diameter or contact area of all the installation tooling must not be more than 0.010" (0.254mm) smaller than the bore diameter;
- If the size of the seal prohibits the use of such tool, as for large diameter seals a special installation tool may not be practical, then use a wooden block (or PU or hard-rubber block, or similar) long enough to span the seal's outside diameter;
- Hammer lightly the seal into position (it is recommended the use of a "dead blow" hammer, avoiding to hit it directly, as you may damage it;
- Follow a clock pattern while tapping the seal into position so to fit it straight and correctly aligned, making sure to hammer-hit the seal evenly and sequentially around the seal circumference, as described here underneath:
  - Place the ends of the align hammering block at positions 1 and 2;
  - Strike the center of the board with the dead blow hammer.
  - Rotate the board to the appropriate positions (3 and 4, 5 and 6, 7 and 8) and repeat the procedure until the seal is fully seated in the housing bore;
  - When the seal is fully seated, the
  - The distance from the seal's top surface of the controlled surface of the housing must be equal to or less than 0.010" (0.254mm).

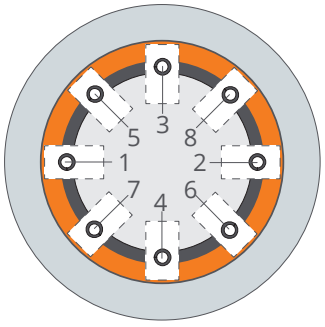
Installation with a dead blow hammer and/or mallet, with an aligning block

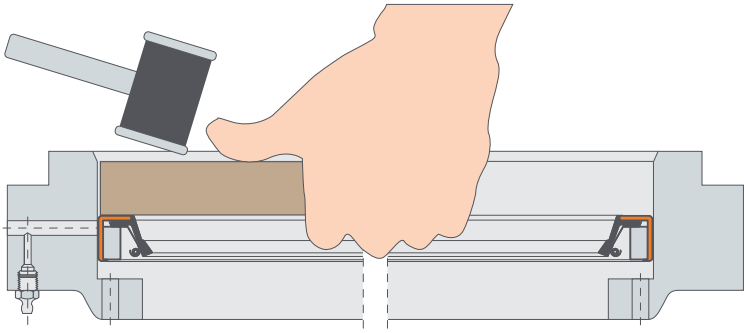




Installation in a deeper bore

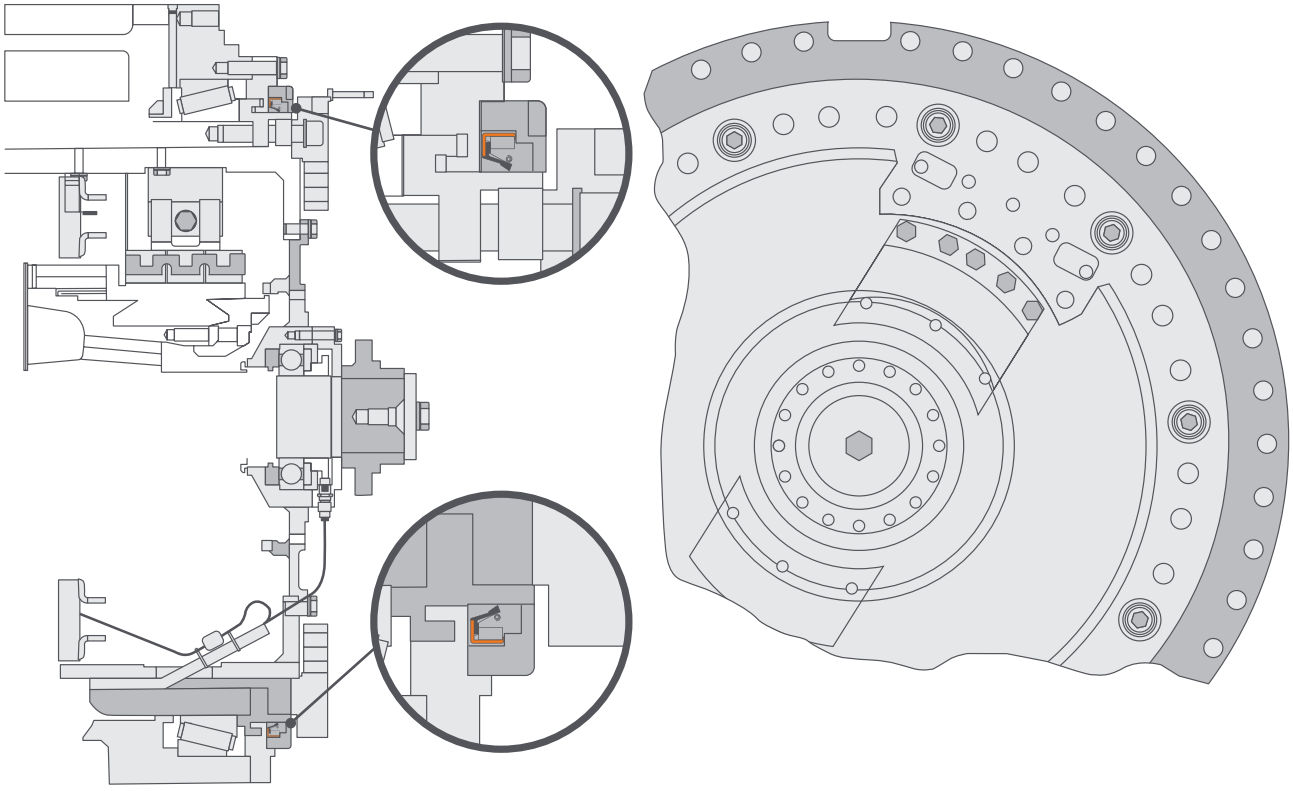
In some applications, the housing is designed for two or more seals to be applied in tandem (in various set-up like face-to-face, back-to-back, face-to-back and in some cases even with spacers), or a seal might have to be pressed further down into a deeper bore housing. In those cases, first set the seal alignment in position with the housing using the method described above. Then, use a shorter piece of wood or PU or hard-rubber block, to drive the seal deeper into the bore utilizing a sequential pattern, lightly hammering it in position with the dead blow hammer or a mallet.



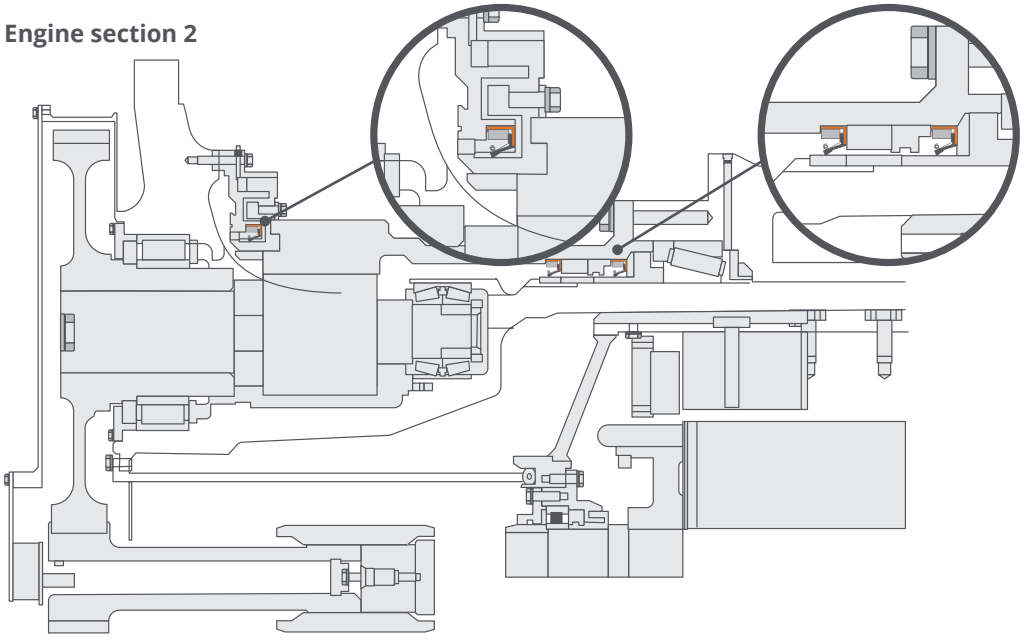


MINING TRUCKS ELECTRIC DRIVE SYSTEM

Engine section 1

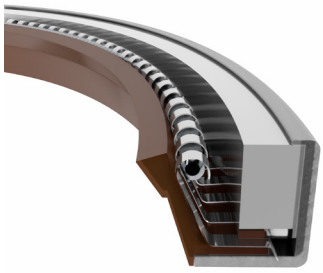


Engine section 2



INFORMATION ON THE SEALS

Most popular seals used in the mining trucks electric drive system, and also in the hydraulic system for smaller vehicles.



L2M®

- L2M® stands for a 2 springs system. One finger spring holding a garter spring. Developed with the double spring system specifically for severe operating conditions with great misalignments up to 5 mm (radial up to 2,5 mm) and hight speeds, where rigidity and strength are necessary
- The L2M® outer metal cases are manufactured in one single piece without any welding point and a groove on the external diameter is made to allows the operator to center the oil seal in the housing bore, easing the assembly.
- The sealing lip is vulcanized onto the metal case, to avoid internal leakages.
- Available on demand with rubber or iron spacers.

GM

- All-rubber oil seal with a vulcanized stainless steel finger spring, recommended for difficult assembly conditions and on-site seal replacements, which avoid opening the cylinder.
- Mostly used in its "split" (open) shape and supplied with the requested length to fit the application housing.
- In its "endless" (closed) shape, the GM type is suitable as a wiper for hydraulic applications.
- Preferably used in applications with grease lubrication and in dusty environments.

G

- Rotary shaft oil seals in rubber-to-metal produced according to DIN 3760 norm.
- The O.D. is totally covered by rubber.
- The sealing lip is obtained by cutting process to avoid imperfection, and energize with a garter spring.
- Available elastomer: NBR; FKM; VMQ; HNBR; EPDM
- Available metals for the metal body: DC04; AISI 304; AISI 316
- Available metals for the garter spring: AISI 302; AISI 316; C72 phosphate.

GP

- Rotary shaft oil seals in rubber-to-metal produced according to DIN 3760 norm and with a dust lip.
- The O.D. is totally covered by rubber.
- The sealing lip is obtained by cutting process to avoid imperfection, and energize with a garter spring.
- Available elastomer: NBR; FKM; VMQ; HNBR; EPDM
- Available metals for the metal body: DC04; AISI 304; AISI 316
- Available metals for the garter spring: AISI 302; AISI 316; C72 phosphate.

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