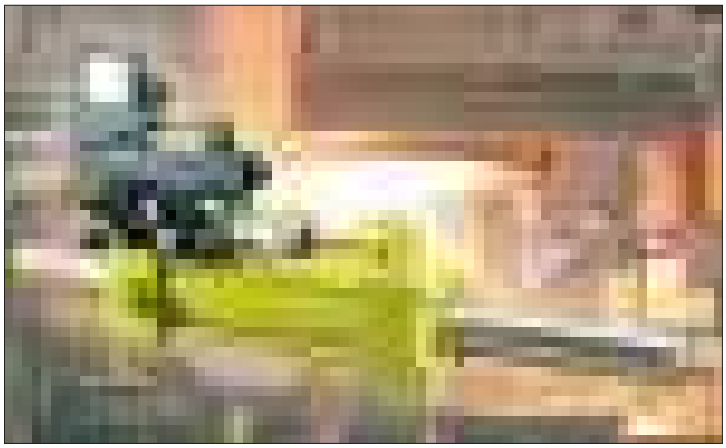
Cylinders troubleshooting



The following sections provide guidelines for the common cylinders failures with a simple scheme driving through the analysis of causes and preventive actions to avoid premature breakdowns. The last section gives useful information about the main spare parts codes necessary to proceed with a complete cylinder's mechanical overhaul.

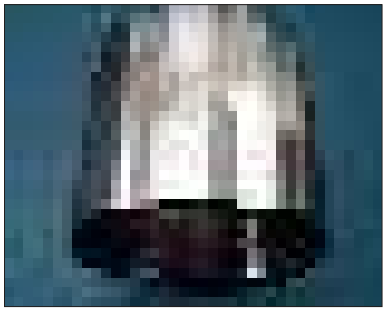
For the best understanding we recommend to consult the complete technical tables at **Atos catalog on-line**.

1 EXTREME TEMPERATURES

Trouble description: very high or low temperatures may cause the seals overheating or freezing, thus the loss of elastic properties and oil leakages. High temperatures make the seals dark and flaked, low temperatures make the seals brittle with heavy damages and may cause breaks in the most stressed and exposed components.

Action & prevention: standard sealing systems satisfy a wide temperature range from -20°C to 120°C, it is mandatory to respect the temperatures reported in the technical tables. Max admitted temperature for Poliurethane **G1** and PTFE seals **G4** is 85°C, for higher temperatures up to 120°C PTFE seals **G2** must be selected. Lower or higher temperatures impose a cylinder design review, contact Atos technical office.

2 FLUID CONTAMINANTS



Trouble description: contaminated fluid is one of the main causes of seal leakages. Abrasive particle contamination is evidenced by scratch and score marks on the seals, rod bearing and cushioning piston with consequent leakages and loss of cushioning effect which place the cylinder out of service.

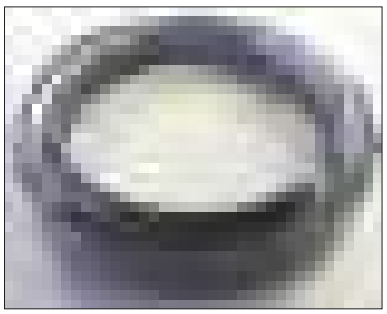
Action & prevention: hydraulic circuit must be provided with appropriate filters (at least 25 µm) to grant a contamination class lower than ISO 19/18/15 according to ISO 4406. Take care to grant adequate recirculation of the oil flow.

3 OVERPRESSURE

Trouble description: excessive flow restriction in the hydraulic circuit or mechanical rod shocks could involve peaks of pressure which stress rod seals and give rise to rapid seal wear and leakages. The seals appears with abnormal wear and, in the worst cases, extruded.

Action & prevention: hydraulic circuit must be designed to avoid flow restrictions which could involve dangerous peaks of pressure. A PTFE sealing system **G2**-**G4**-**G8** should be preferred if the peaks of pressure cannot be reduced, contact Atos technical office.

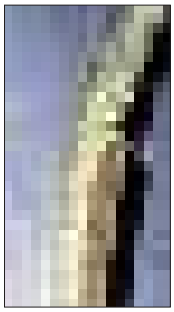
4 UNSUITABLE FLUID

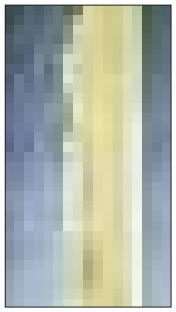


Trouble description: presence of aggressive additives in the fluid is one of the main causes of seals compound deterioration that causing heavy leakages. Seals may appear sticky or dry depending to the chemical reaction.

Action & prevention: the correct choice of sealing system according to the fluids is the main prevention. Atos technical tables provides the seals compatibility with the most common fluids, for water based fluids (HFA, HFB, HFC) or synthetic HFD-U PTFE seals **G2**-**G4** are mandatory, in particular for phosphate esters HFD-R PTFE seals **G2** must be selected. In case of special fluids not indicated in Cylinder's technical table please contact Atos technical office to receive suggestions on the most suitable seals for your application.

5 HIGH ROD SPEED FREQUENCY

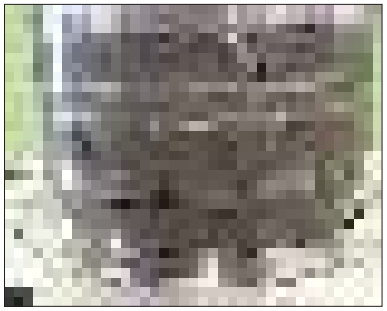




Trouble description: high rod speeds and frequencies reduce the lubricant capacity of the seals and involve the increasing of friction and surface temperature which may cause a premature wear of the sealing system. The seals appear burned and damaged on both sides. This failure is primarily related to polyurethane sealing system **G1** that tolerate max speed up to only 0,5 m/s.

Action & prevention: the respect of rod speed limits, specifically indicated in the cylinder's technical tables for each sealing system model, is mandatory. For high speed applications it is required to adopt seals with high sliding/low friction properties, particularly for rod speed over than 0,5 m/s PTFE seals **G2**-**G4** are strongly recommended. For high frequencies (> 5 hz) selflubricated **G0** PTFE seals mineral fiber filled should be selected, see tech table **TB020** for details.

6 DIESEL EFFECT



Trouble description: the pressurization of the mixture air/mineral oil may involve a self-combustion dangerous for the seals and components (Diesel effect). The presence of air inside the cylinder may be caused by a poor bleed off procedure of the hydraulic circuit or when the inertia of the connected load forces the cylinder at higher speed than the flow provided by the pump flow (cavitation). Other causes of air presence in the oil can be due to the incorrect positioning of the return pipe inside the power unit tank. The piston/bushing surface appears dark and pitted, seals and guide rings are heavily worn.

Action & prevention: no seals are available to withstand fluid ignition, thus it is mandatory to completely bleed off the air inside the circuit. We also suggest to check the absence of turbulence inside the circuit and tank. Any operation which involve a negative pressure inside the cylinder must be avoided.

7 HIGH LATERAL LOADS

Trouble description: cylinders are designed to provide axial force and motion to a guided load, the result of a poor alignment is the excessive side loading of the rod, which involves a premature wear of the bronze bushing, seals and wear rings. Bronze bushing presents a glossy area on one side, seals and guide rings are heavily worn.

Action & prevention: the perfect alignment cylinder-machine should be ensured, pivoted mounting style, such as **C**, **D**, **S**, **G**, **H** and **L** must be preferred to rigid coupling. Particularly the **S** mounting style is equipped with spherical bearings to grant best reliability also in front of small misalignments of the cylinder mounting. For cylinders with long strokes (> 1000 mm) in horizontal applications and not guided loads, the use of well sized spacers (options **2**-**4**-**6**-**8**) is mandatory to decrease the specific pressure on the guide rings.

8 HIGH PRESSURE / LOADS

Trouble description: overpressures/overloads respect to cylinders limits or high loads/pressures coupled to high frequency applications or long life expectations may involve mechanical failures of the rod thread, that is the most critical part of any hydraulic cylinder. In the first case a ductile failure may result, the rod end presents a necking area followed by a tear break zone; in the second one a fatigue failure may occur, the breaking of the rod thread is featured by an early progression of serious brittle cracks (see red line in the picture) with final plastic yelding.

Action & prevention: in case of ductile failure check the compliance of actual pressures/loads with the cylinder's max operating pressure shown in relevant technical table. In case of fatigue failure check the fatigue life expectation in accordance with the instructions given in tech. table **B015**. If above checks highlight conforming application data please contact Atos technical office.

9 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads, see section 7	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**, see section 7
	Fluid contaminants, see section 2	Check the fluid contamination class is < 19/18/15
	Chemical attack, see section 4	Check seals compatibility with operating fluid, see section 4
	High temperatures (fluid/ambient), see section 1	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient), see section 1	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed, see section 5	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency, see section 5	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect), see section 6	Bleed off completely the air inside the hydraulic circuit, see section 6
Wiper or seal extrusion	Overpressure, see section 3	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace “fast” cushionings **1**-**2**-**3** , with “slow” cushionings **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants, see section 2	Check the fluid contamination class is < 19/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking, see section 3	a) Replace “fixed” cushionings **7**-**9** with “adjustable” cushionings **1**-**3** b) For adjustable cushionings, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances, see section 2	Check the fluid contamination class is < 19/18/15
Rod failure	Overload/overpressure, see section 8	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation, see section 8	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 19/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

10 SERVOCYLINDERS TROUBLESHOOTING

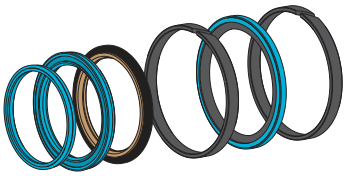
TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 9

11 SPARE PARTS

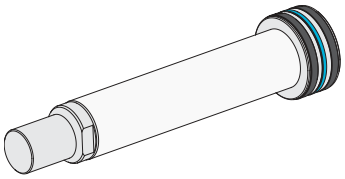
Atos spare parts allow to proceed with a fast replacement of damaged components to recondition the cylinder, the following table give references to **SP** tech.tables to define the suitable spare part codes according to the cylinder type. See **B600** and **SP-B600** for maintenance guidelines and tools.

Seals kit



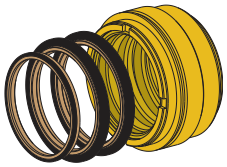
Example code
G1 - CK - 50 / 22 / 22

Pistons + rods



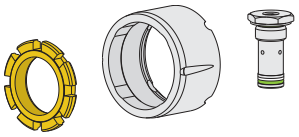
Example code
U - CK - 50 / 22 / 22 x 500....

Rod bearings



Example code
B1 - CK - 50 / 22 - 32

Cushionings



Example code
F1 - CK - 50 / 22 - 32

SP TECH.TABLES REFERENCE FOR SPARE PARTS CODES

	CK CKA	CH	CH - big bore size	CN	CC	CK*	CKS
Seals kit	SP-B137 Sect. 5.1	SP-B140 Sect. 5.1	SP-B160 Sect. 3.1	SP-B180 Sect. 3.1	SP-B241 Sect. 5.1	SP-B310 Sect. 9.3	SP-B450 Sect. 5.1
Rod bearings **(assembled with seals)**	SP-B137 Sect. 5.2	SP-B140 Sect. 5.2	SP-B160 Sect. 3.2		SP-B241 Sect. 5.2	SP-B310 Sect. 9.4	SP-B450 Sect. 5.2
Pistons + rods **(assembled with seals)**	SP-B137 Sect. 5.3	SP-B140 Sect. 5.3	SP-B160 Sect. 3.3	SP-B180 Sect. 3.2	SP-B241 Sect. 5.3	SP-B310 Sect. 9.5	SP-B450 Sect. 5.3
Cushionings	SP-B137 Sect. 5.4	SP-B140 Sect. 5.4	SP-B160 Sect. 3.4	SP-B180 Sect. 3.3	SP-B241 Sect. 5.4	SP-B310 Sect. 9.6	SP-B450 Sect. 5.4
Proximity sensors	SP-B137 Sect. 5.5	SP-B140 Sect. 5.5					SP-B450 Sect. 5.5
Connectors for position transducers						SP-B310 Sect. 9.1	
Position transducers						SP-B310 Sect. 9.2	

Note: SP tech.tables are available at Atos catalog on-line