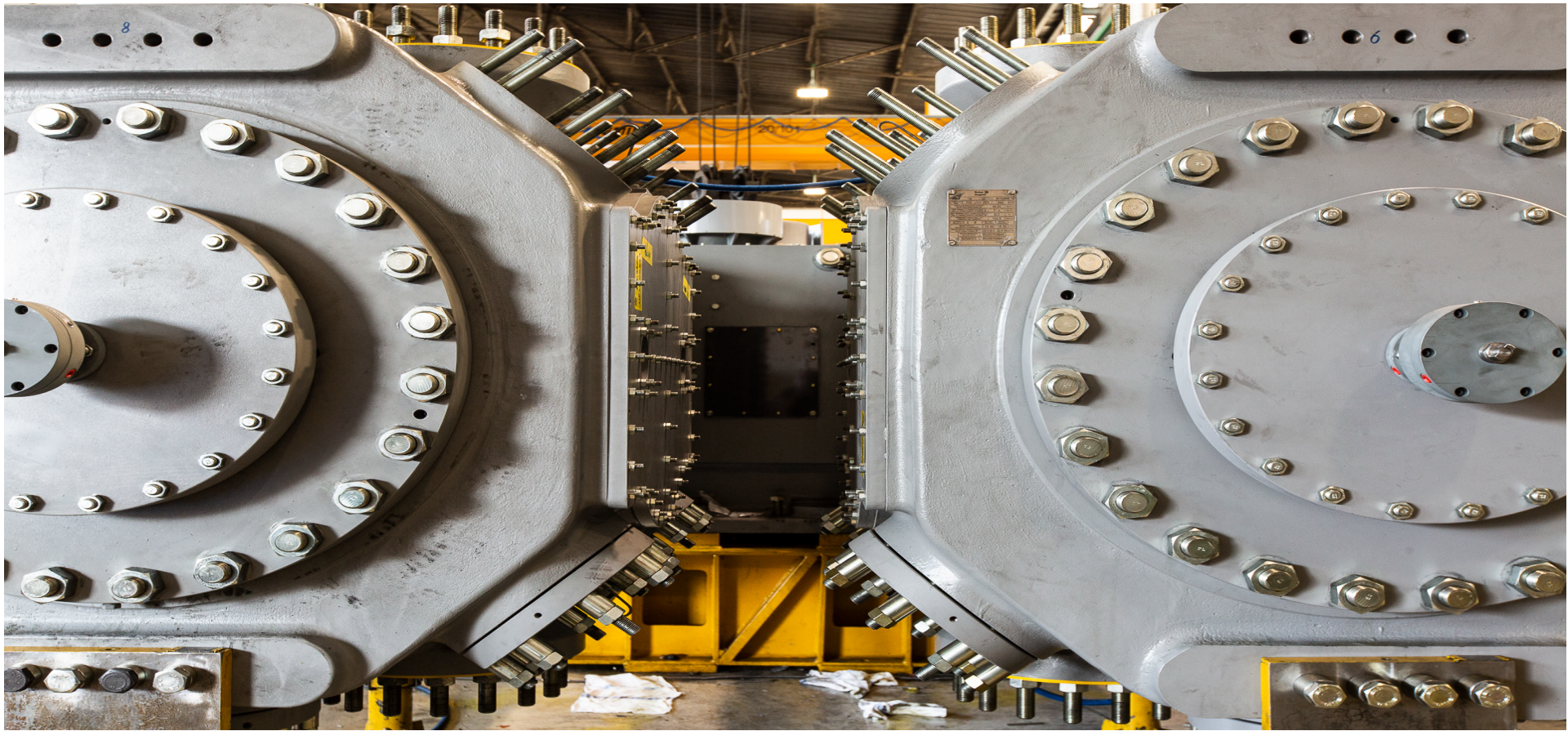
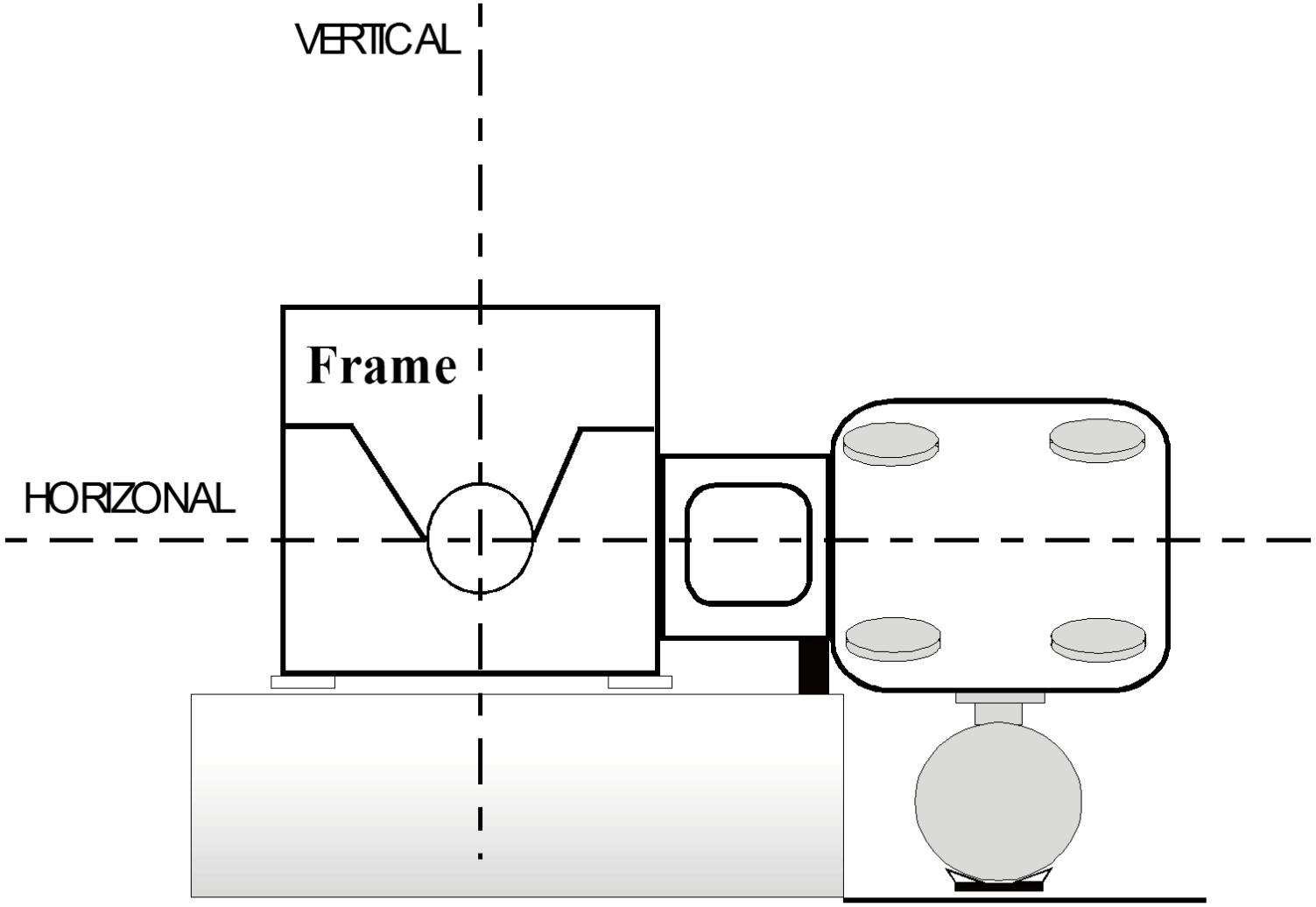
PISTON ROD RUNOUT

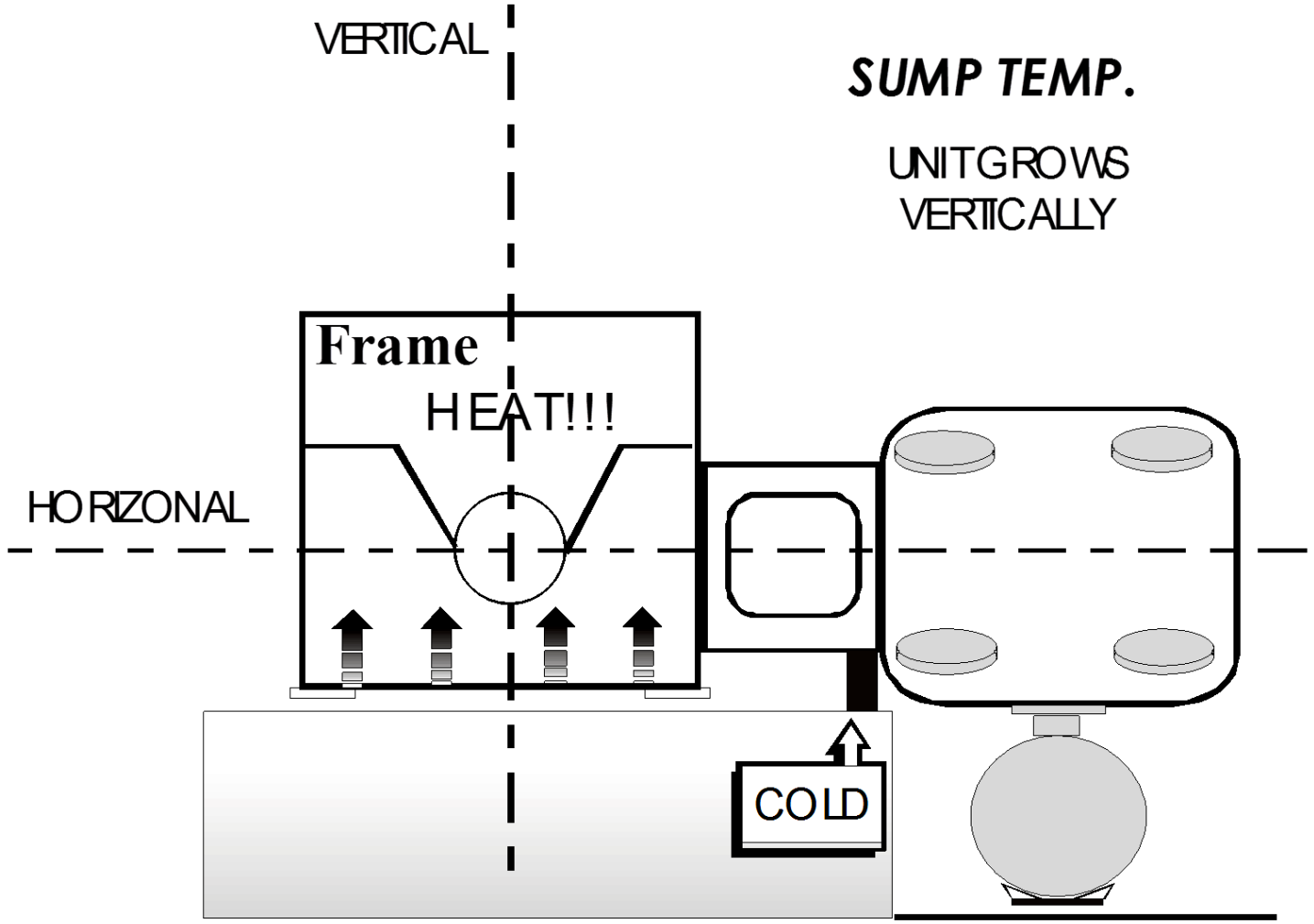
Reciprocating Compressor Cylinders



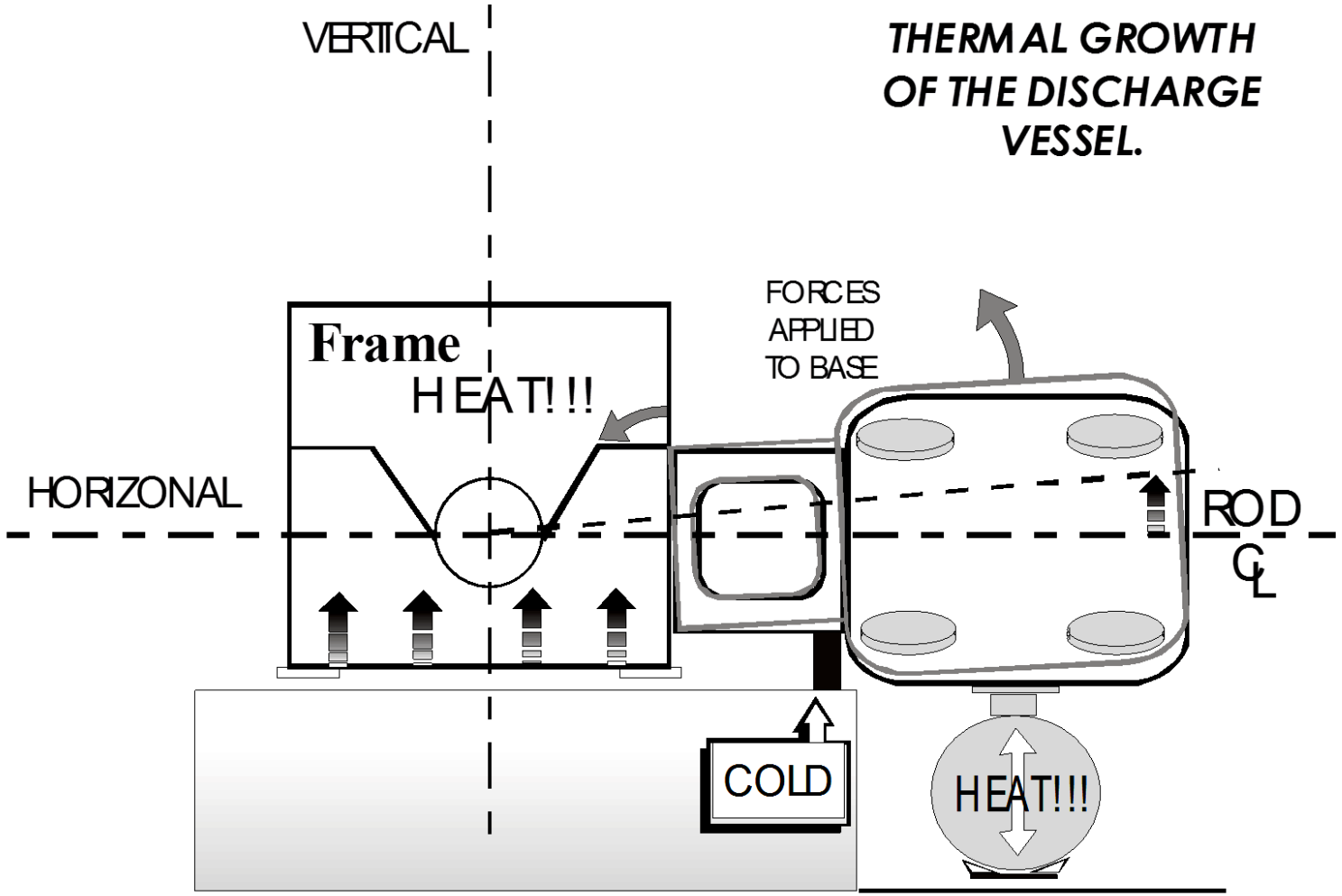
Compressor Frame & Cylinder Alignment



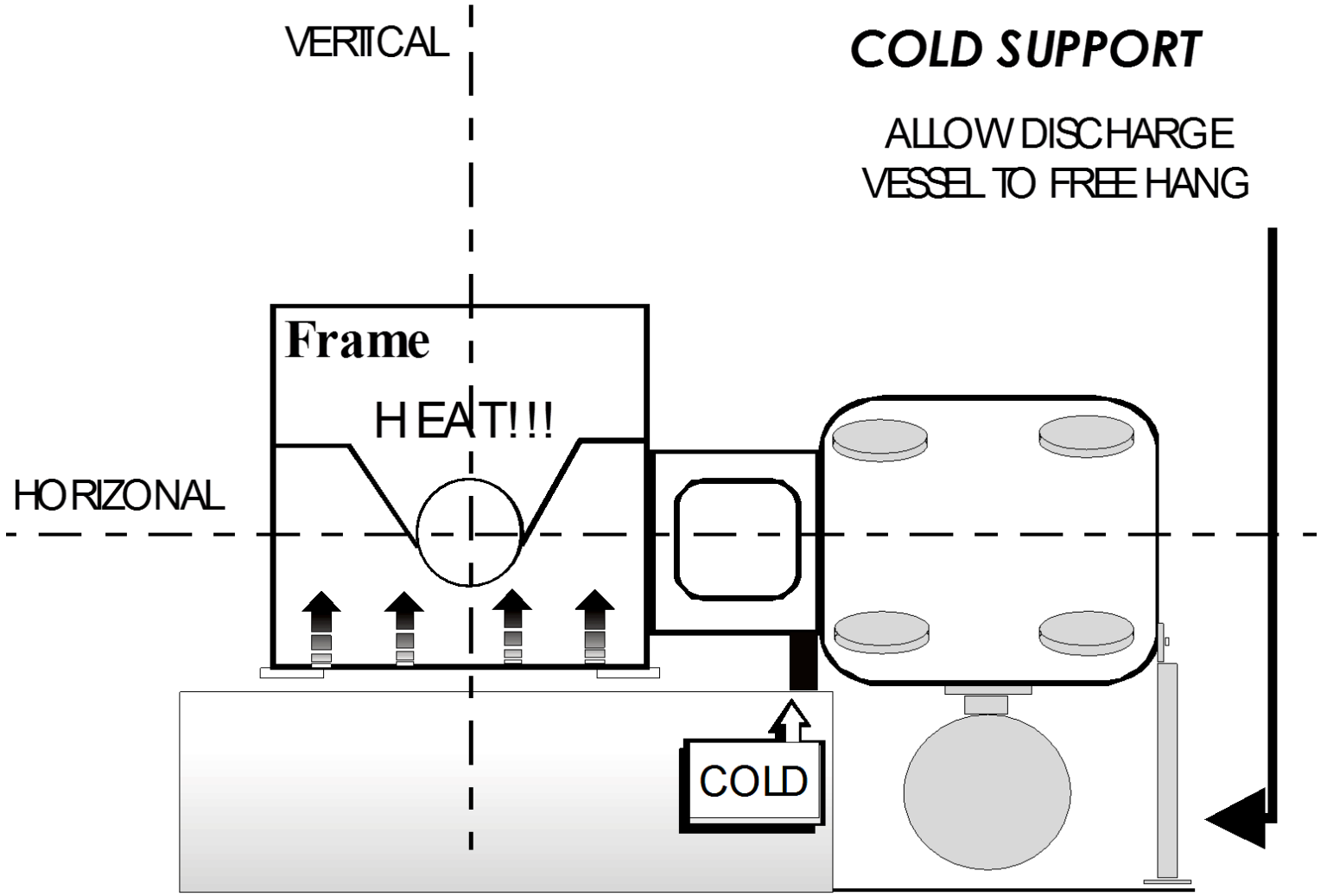
Compressor Frame & Cylinder Alignment



Compressor Frame & Cylinder Alignment

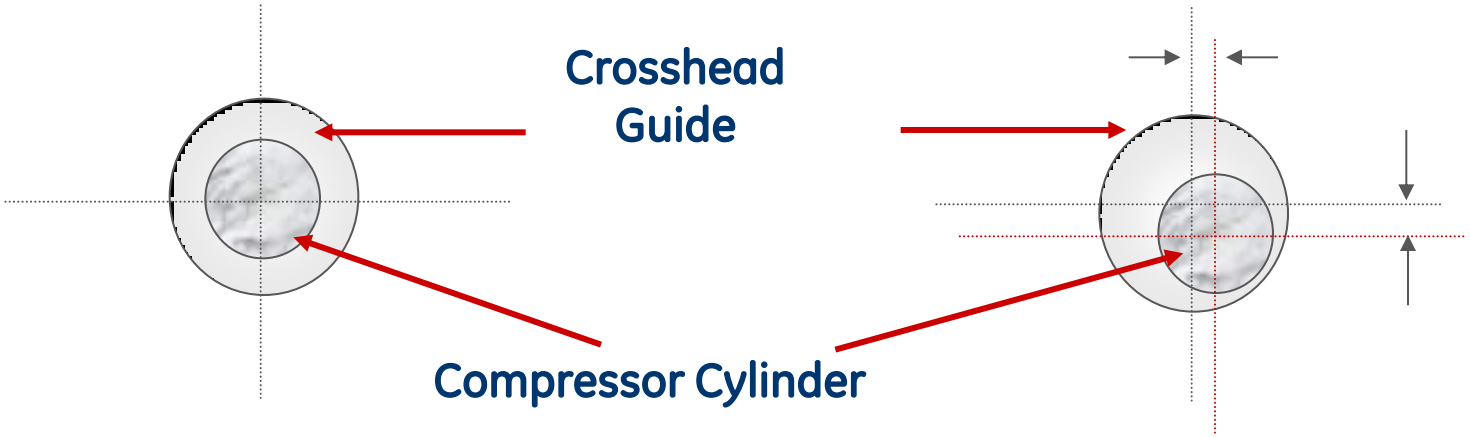


Compressor Frame & Cylinder Alignment



What is it ?

It is a **criterion** used to determine piston rod running alignment variations relative to the alignment of the cylinder body and the crosshead guide.



Simply,

It is a **means** of assuring that the

cylinder body is aligned with the crosshead guide.

Why is alignment so important?

If properly aligned, cylinder body and crosshead guide share common centerline.

Proper alignment assures maximum life of components.

How is proper alignment accomplished?

New compressor assembly:

As components are assembled, the cylinder bore is aligned with the guide bore.

Methods of assuring proper alignment:

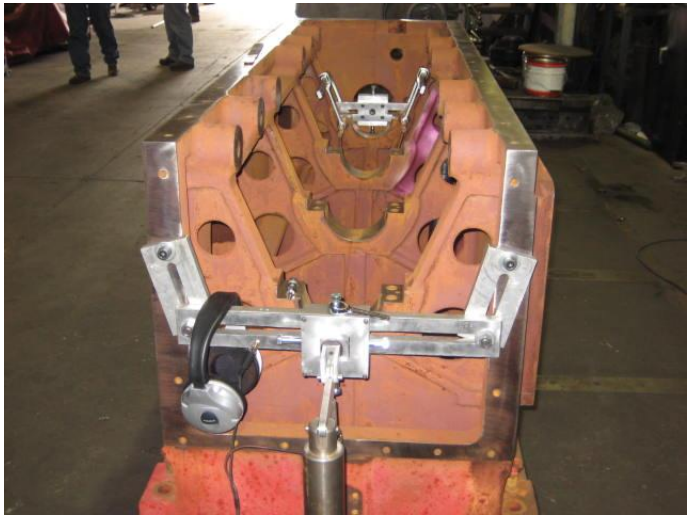
Optics Wire line Laser Run-out

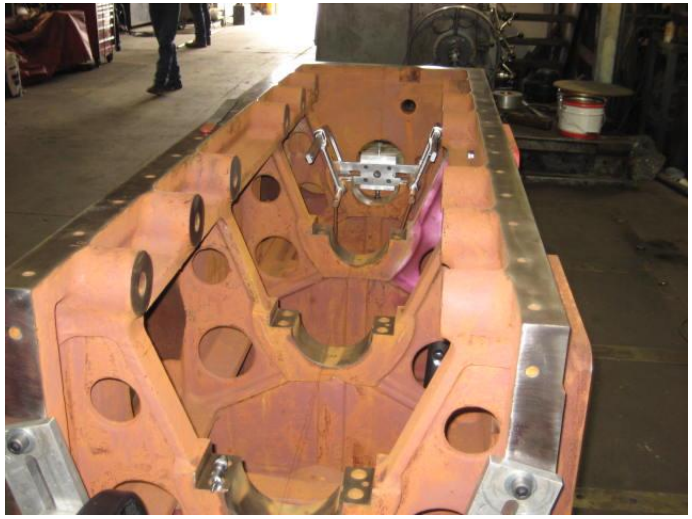
Run-out requires some "special tools".

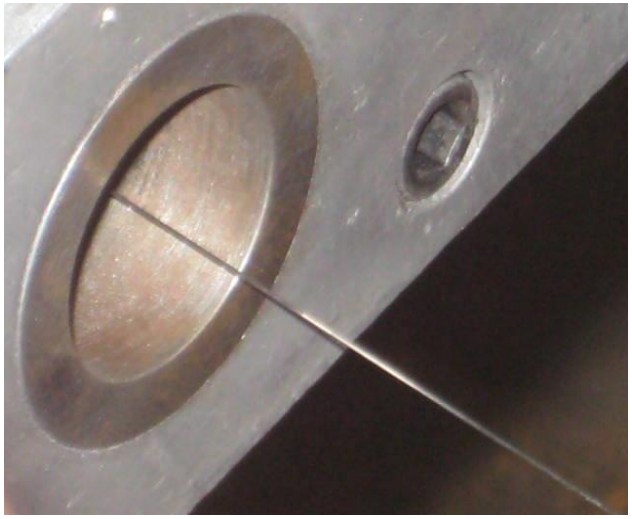
The first tool is the "Piston Rod" with one end connected to the piston and running in the cylinder bore, and the other end connected to the crosshead and running in the guide bore.

The tool is slid across the cylinder bore, and the crosshead guide bore.

The second tool is the "Dial Indicators", and is placed above and beside the central portion of the piston rod, revealing angular travel of the piston rod.

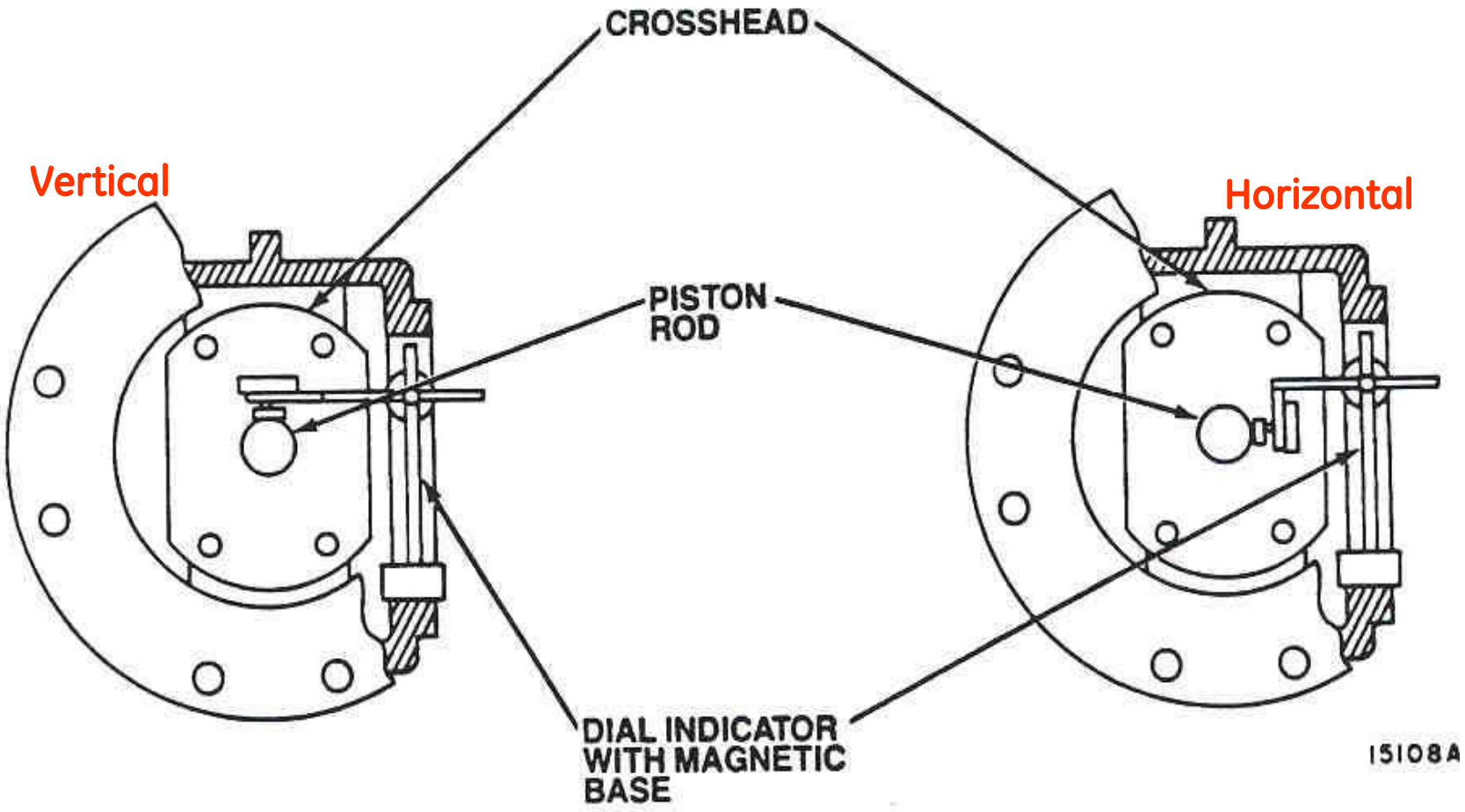






Wire Line

Dial Indicator Setup



Field service man's "special tools"

Dial indicator readings are provided to the customer, and are available to the service man.

Alignment at the site must match the alignment set at factory.

This is done by...

1. Using the same "special tools" as the factory assembler.
2. To get the same "readings" as the factory assembler.

Before you begin

Review your procedures for conducting rod run-out.

Check level - cylinder bore - crosshead guide - equally level.

Check clearance - piston rod to packing case.

Check runout - nut tight and nut loose.

If the two checks differ, then the face of the nut is not ⊥.

Some Points of Attention

During the rod run-out inspection, measure the running clearance of the crosshead to crosshead guide.

- Check clearance at several locations.
- Clearance should be uniform - zero on bottom.

Before taking rod run-out readings, measure the piston rod diameter to determine if any under-sizing has occurred due to packing wear.

- This will effect run-out readings

When taking horizontal rod run-out readings:

- check clearance between cross-head pin and bushings at two (2) points on each side of the cross-head, to determine if connecting rod is running on center line.

Some Points of Attention

Vertical rod run-out is not always an indication of misalignment.

- It may be the result of the difference between the piston to cylinder and crosshead running clearances.

To avoid confusion & provide a standard practice it is suggested that both vertical & horizontal run-out readings be taken on a forward stroke with dial indicator set at zero when the rod is all way back with the piston at the crank end of the cylinder.

- Vertical run-out should always be checked with the dial indicator placed on top of the rod whenever possible.

  Note: If it can not be placed on top of the rod & must be taken from under the rod, do not forget to invert the reading!

Some Points of Attention

Positive Vs. Negative Vertical Rod Run-out

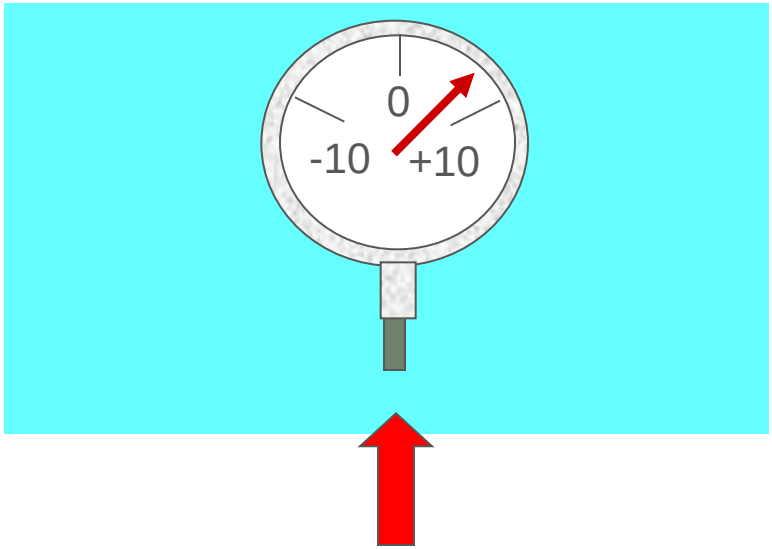
- It is positive when the piston end of the rod is lower than the crosshead end.
- It is negative when the piston end of the rod is higher than the crosshead end.

What can influence run-out?

- Excessive run-out can be corrected by realignment of some or all of the following:
- Cylinder, heads, distance pieces, cross-head guides, cross-heads, pistons, piston rods, cross-head nut.
- Threads of cross-head nut or threads in the cross-head may be out of square.
- A bent connecting rod and/or piston rod can cause excessive run-out.

Some Points of Attention

A standard Dial Indicator will read positive (+)when stem or plunger of the gauge is depressed.



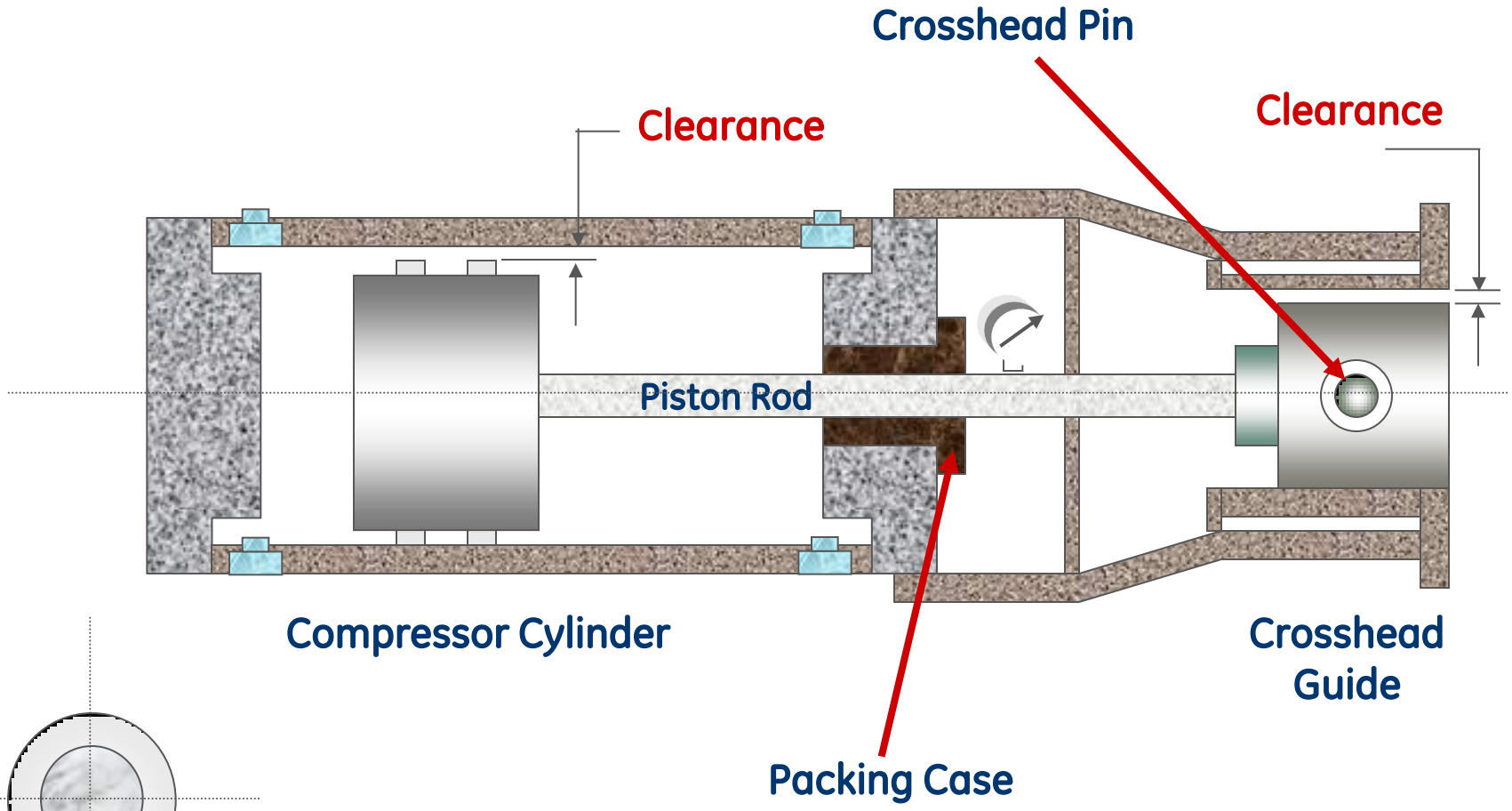
Some interesting axioms relative to vertical rod run-out

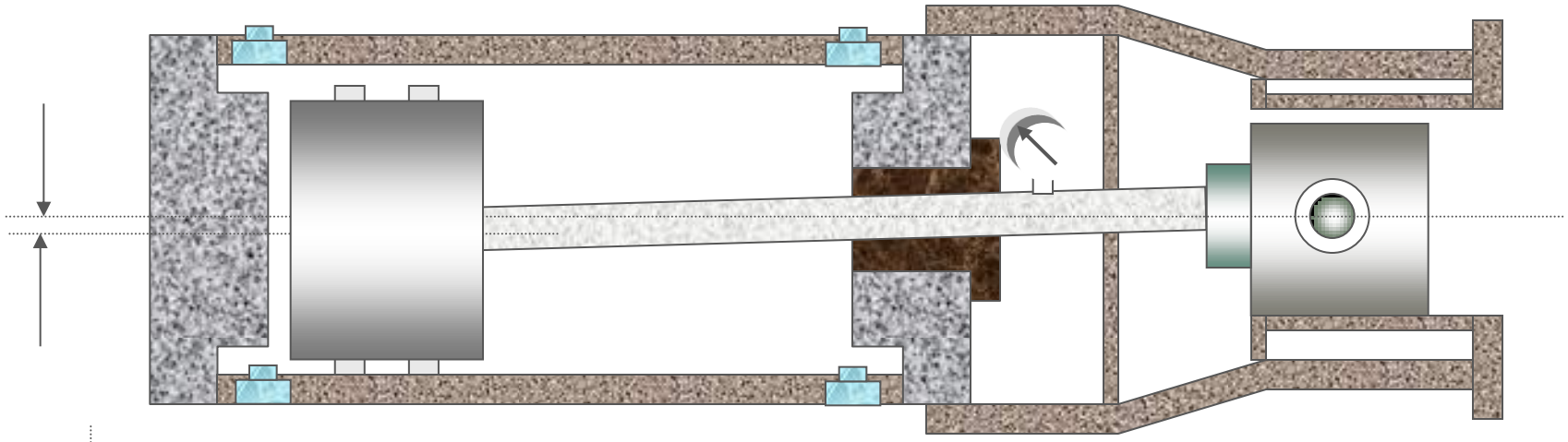
- The larger the bore, the greater the piston running clearance.
- The smaller the bore, the less the piston running clearance.
- Large bore = more running clearance = more run-out
- Small bore = less running clearance = less run-out
- Long stroke = more run-out
- Long rod = less run-out
- Short rod + long stroke = greater run-out
- Long rod + short stroke = less run-out
- Small cylinder + short stroke + long rod = less run-out

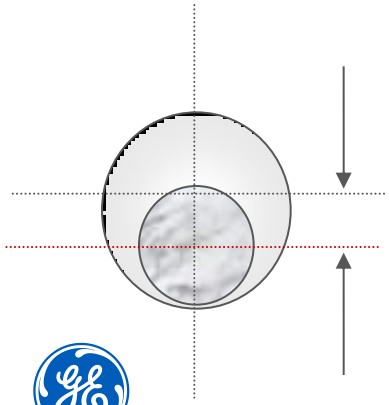
*What **NOT** to do!*

Vertical runout should never be adjusted or corrected by forcing the cylinder and/or distance pieces up or down by use of the support adjusting screws.

This can put excessive forces and stresses on the components involved


Crosshead Pin
Clearance
Clearance
Piston Rod
Compressor Cylinder
Crosshead Guide
Packing Case





Vertical Runout

Measuring Vertical Runout:

Dial indicator above rod close to packing case

Pick up ⊥ to rod

Piston at crank end

Set dial indicator to zero

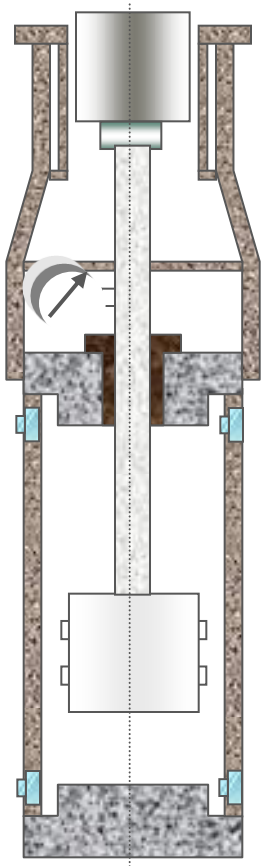
Bar unit

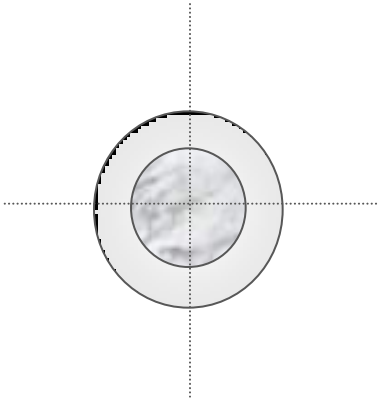
Observe dial indicator

Record reading

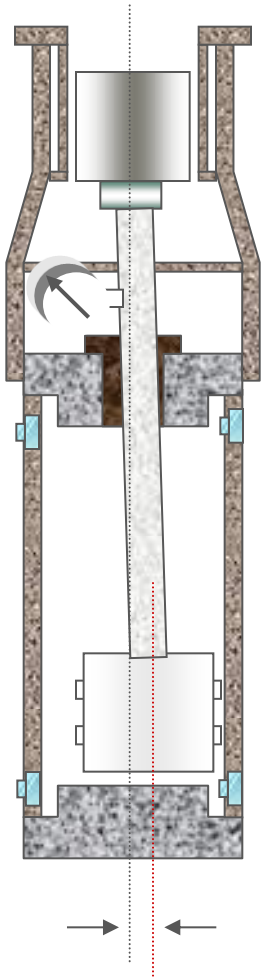
This is the vertical piston rod "runout".

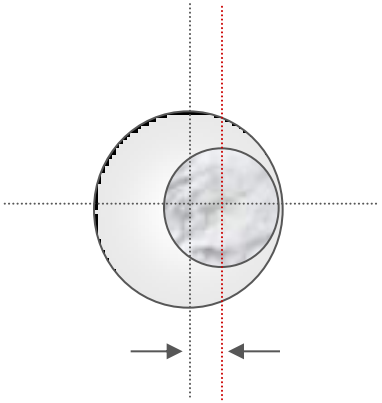
Measuring Horizontal Runout





Top view of cylinder and crosshead guide.





Horizontal Runout

Measuring Horizontal Runout

Dial indicator at driver side of rod close to packing case

Pick up ⊥ to rod

Piston at crank end

Set dial indicator to zero

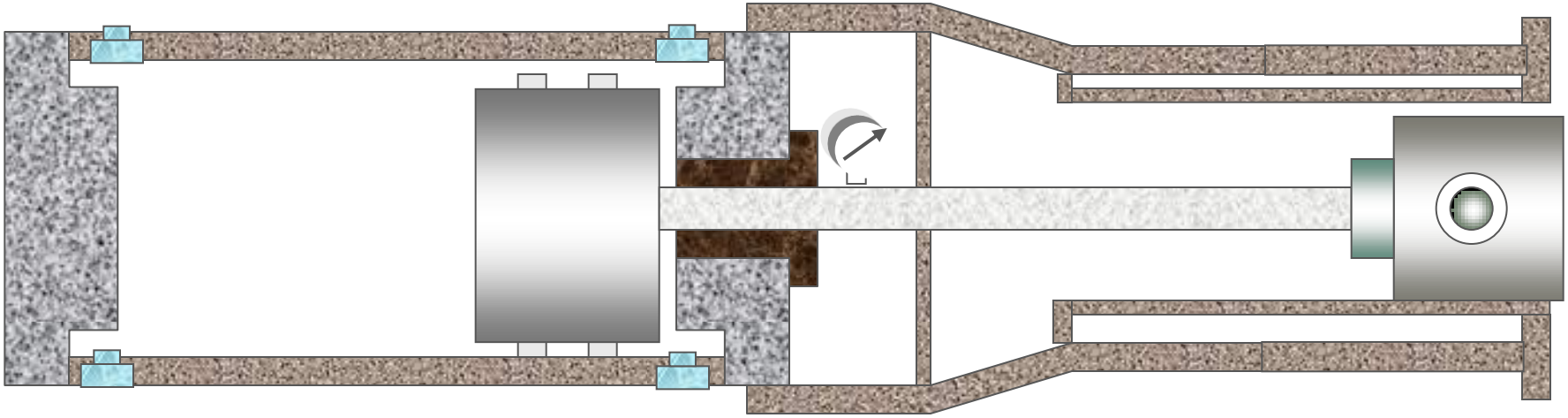
Bar unit

Observe dial indicator

Record reading

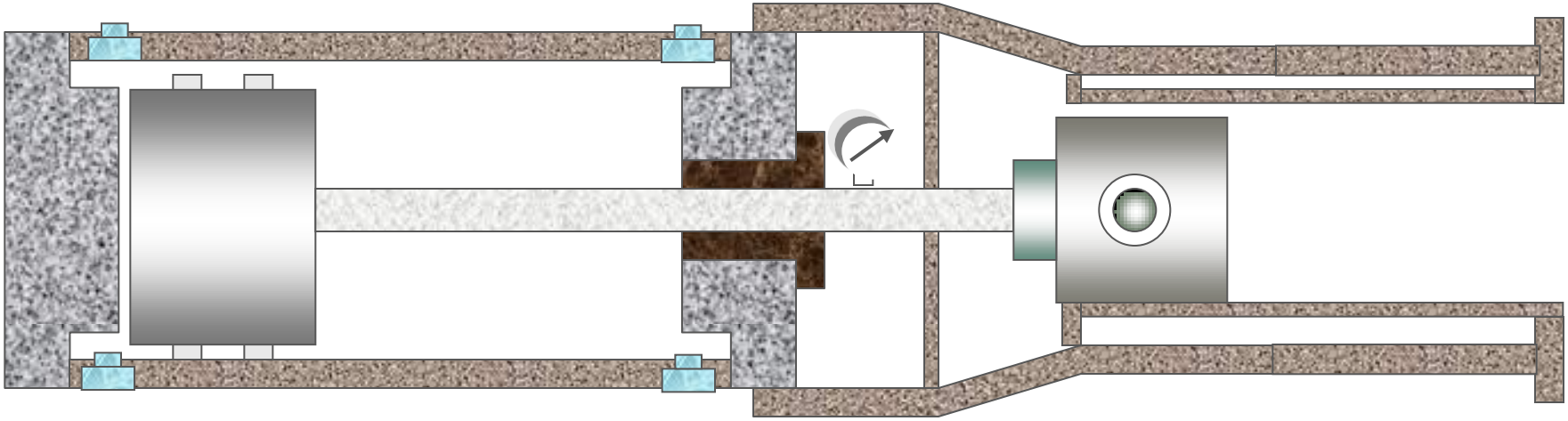
This is the horizontal piston rod “runout”.

No Vertical Rod Runout

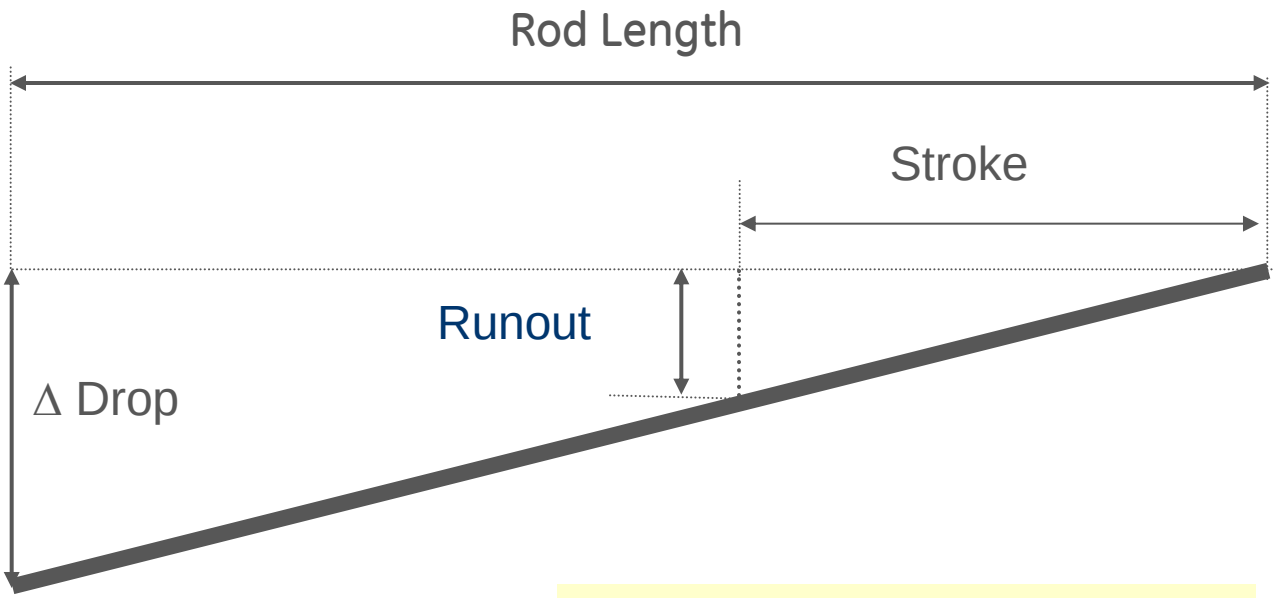


Notice no movement at Dial Indicator

No Vertical Rod Runout



Notice no movement at Dial Indicator



$$\frac{\text{Stroke}}{\text{Rod Length}} = \frac{\text{Runout}}{\Delta\ \text{Drop}}$$

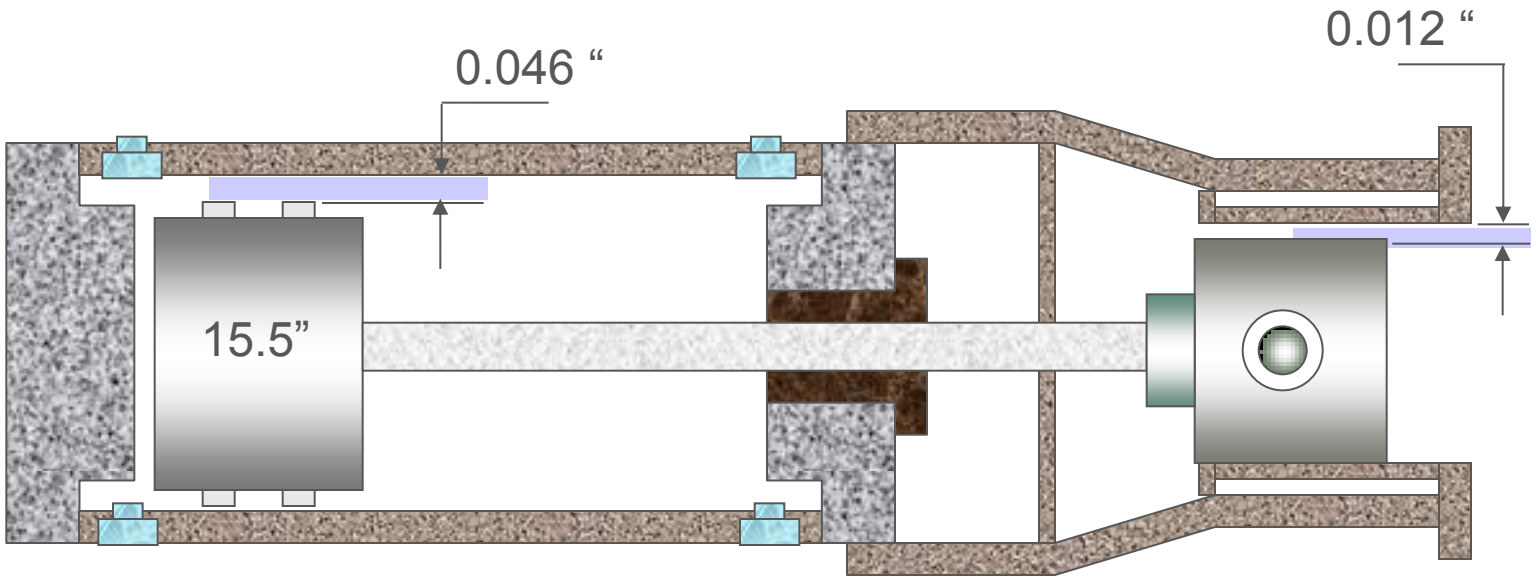
$$\text{Runout} = \frac{\Delta \text{ Drop}}{\text{Rod Length}} \times \text{Stroke}$$

$$\Delta \text{ Drop} = \frac{\text{Cylinder Running Clearance - Crosshead Running Clearance}}{2}$$

	C/I	Aluminum
CB-with Rider Rings(Teflon)		
Thru 40”	Dia. X .002 + .005	Dia. X .003 +.005
Without Riders < 14”	Dia. X .0015 + .005	
> 14”	Dia. X .0015 + .005	
< 20”		Dia. X .0025 + .010
20” - 30”		Dia. X .0025 + .005
Ajax	Dia. X .0015 + .010	Dia. X .003 + .010
Superior	Dia. X .002	Dia. X .003

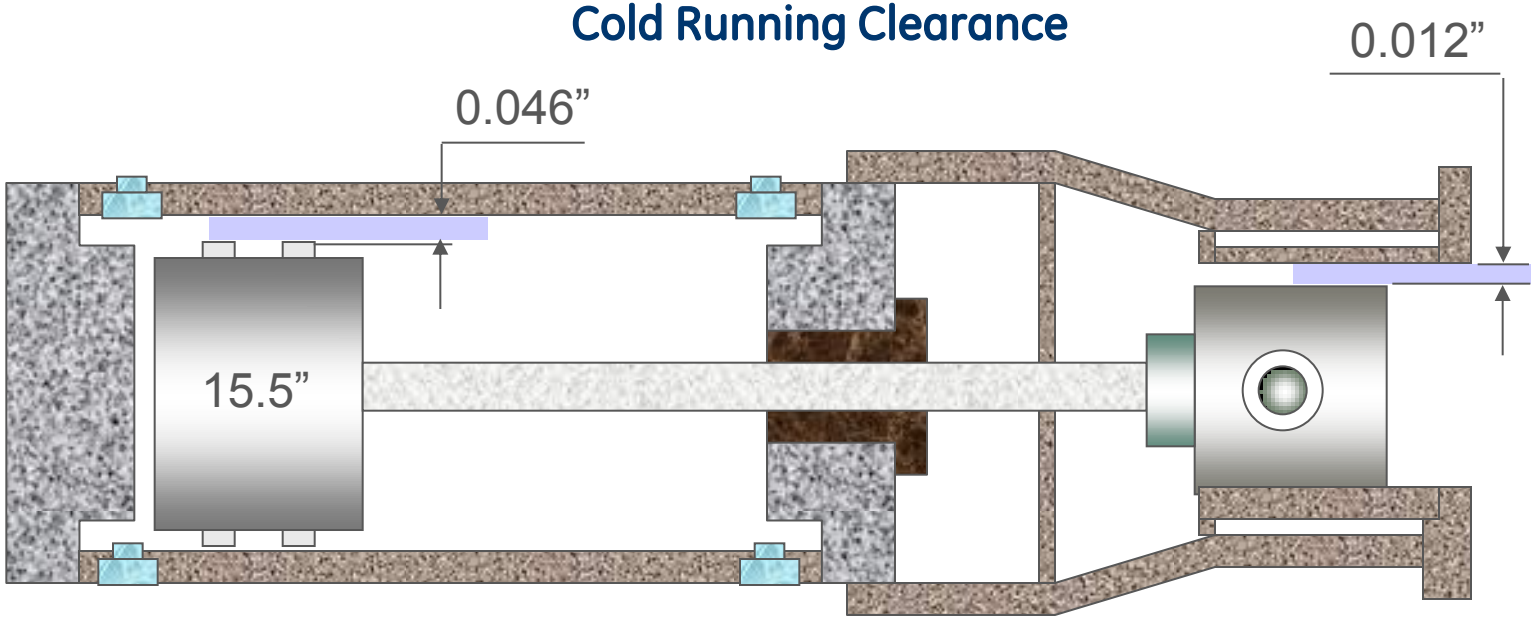
Examples	6”	26”
CB	6 X .002 + .005 = .017	26 X .003 + .005 = .083
Ajax	6 X .0015 + .010 = .019	26 X .003 + .010 = .088
Superior	6 X .002 = .012	26 X .003 = .078

Checking Cold Running Clearance



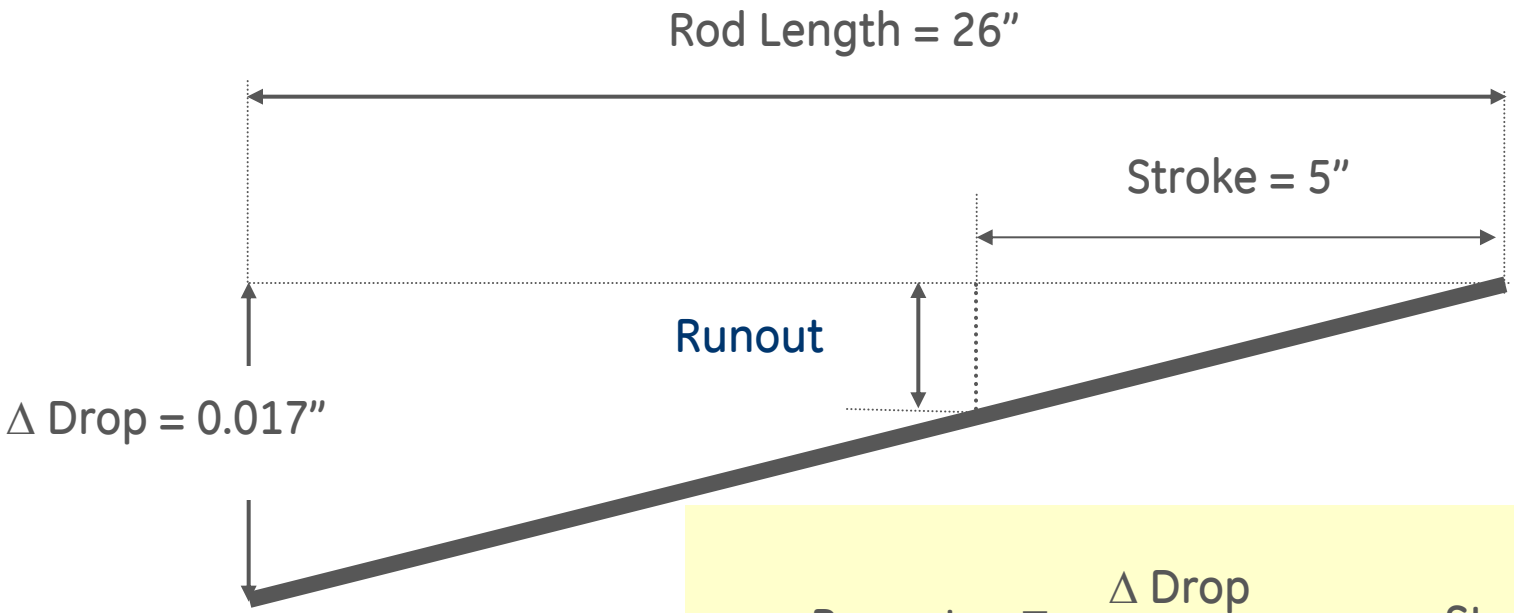
Cast Iron .002” x Cylinder Diameter
Aluminum .003” x Cylinder Diameter

Cold Running Clearance



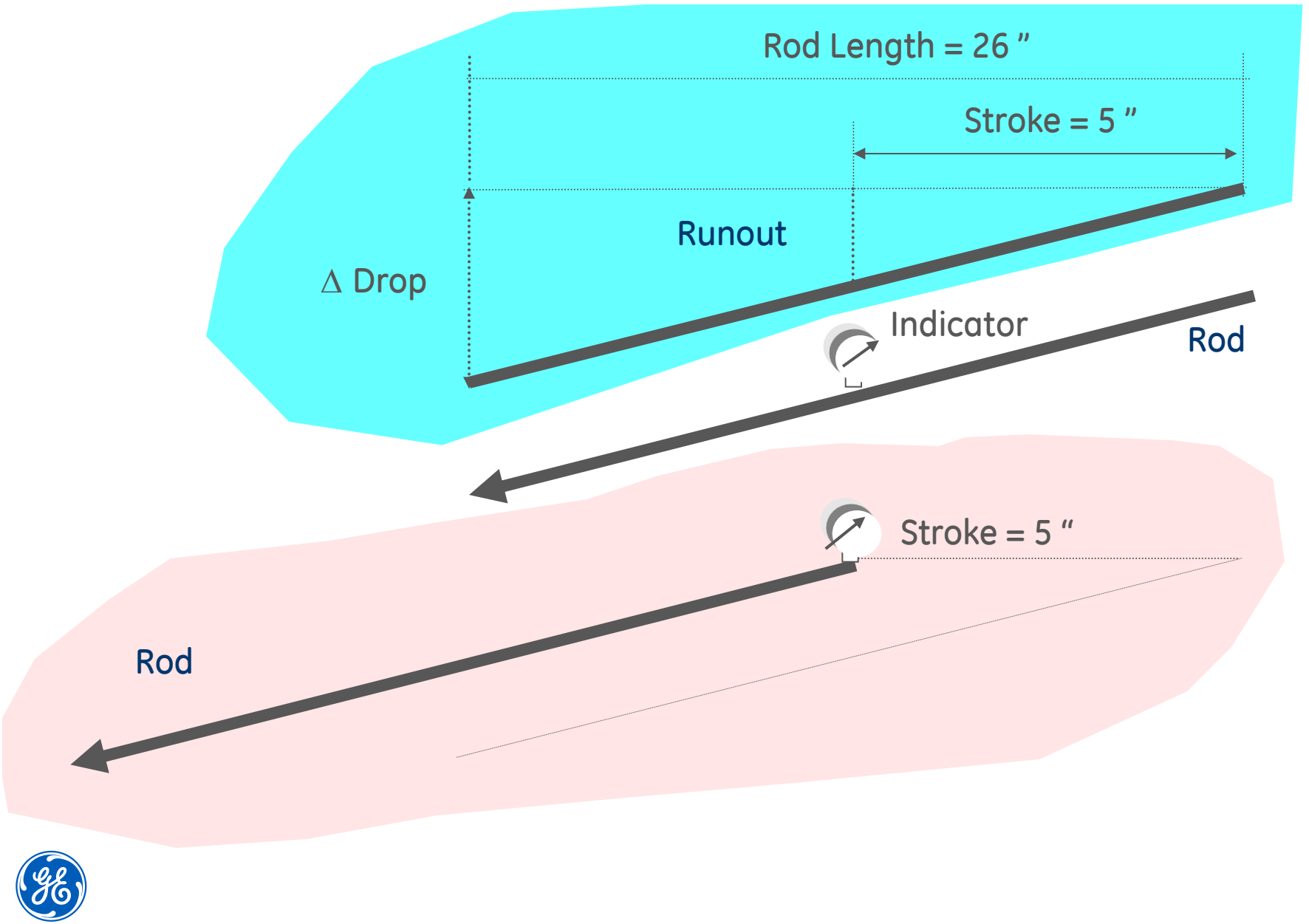
Rod Diameter = 2.00 “
Rod Length = 26 “
Stroke = 5 “

Typical value

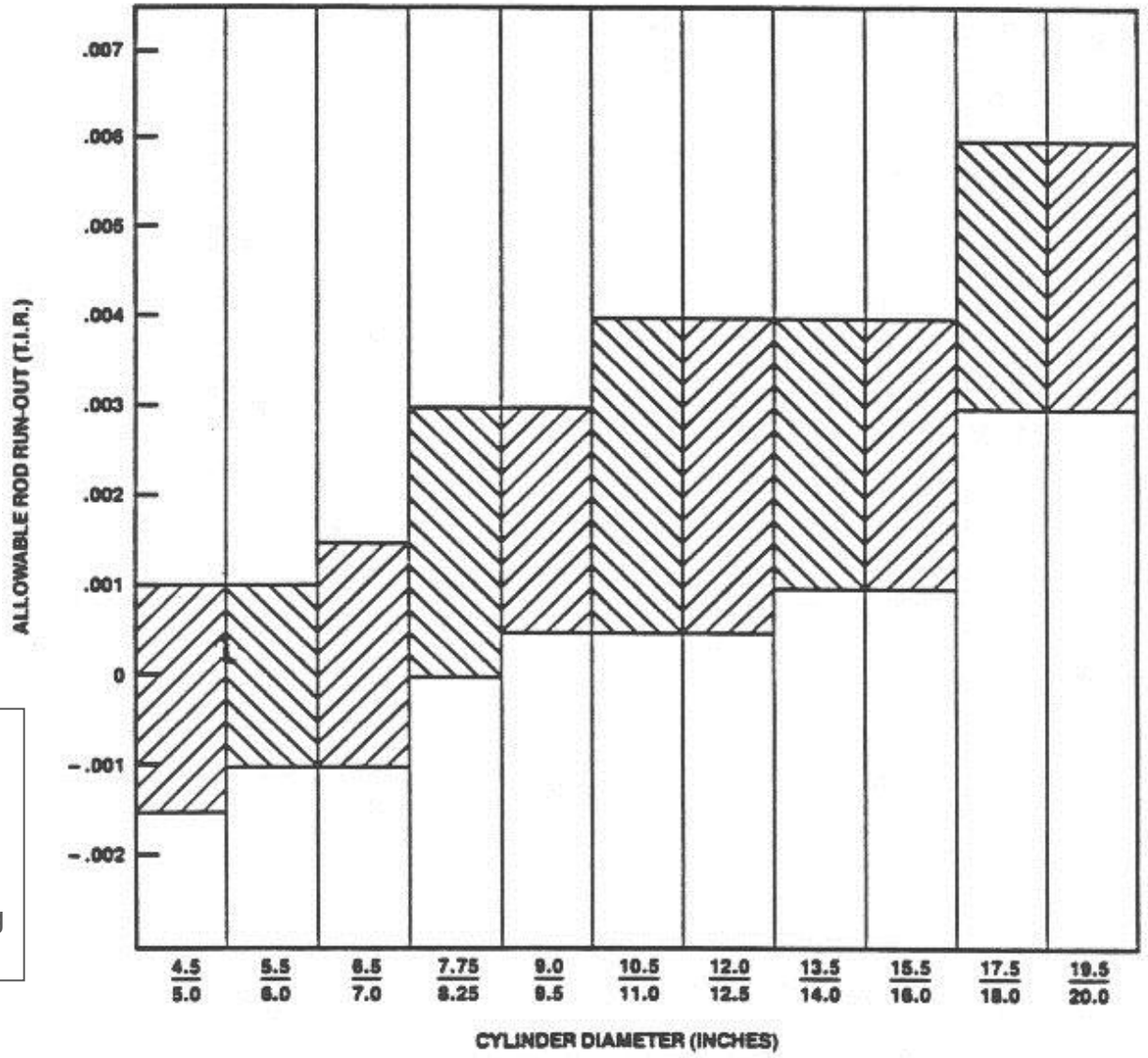


$$\text{Runout} = \frac{\Delta\ \text{Drop}}{\text{Rod Length}} \times \text{Stroke}$$

$$\text{Runout} = \frac{0.017”}{26”} \times 5” = \underline{0.0033”}$$


Rod Length = 26 ”
Stroke = 5 ”
Runout
Δ Drop
Indicator
Rod
Stroke = 5 “
Rod

RAM



Note: Vertical runout should fall within the indicated tolerances for the given cylinder diameter.

Horizontal runout is +/- 0.001. If not within this spec check cylinder/packing alignment.

Superior Rod Runout Limits

ROD RUNOUT LIMITS
6" and 7" stroke cylinders

6" stroke - Vertical reading

Bore range	Max + runout	Max - runout
Smaller than 6"	0.004	-0.0017
6" and larger	0.006	-0.0017

6" stroke max horizontal reading = .001"

7" stroke - Vertical reading

Bore range	Max + runout	Max - runout
Smaller than 6"	0.0047	-0.002
6" and larger	0.007	-0.002

7" stroke max horizontal reading = .0012"

ALLOWABLE PISTON ROD RUNOUT

0.046 ” Cylinder Running Clearance → 0.001 - 0.004 “

Calculate Rod Runout Value = 0.0033 ”

Any Questions?