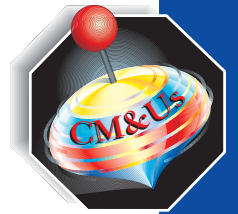


MONITORING PISTON ROD OR PLUNGER RUNOUT



RECIPROCATING COMPRESSORS

INTRODUCTION

Reciprocating compressors which reach high discharge pressures or handle highly inflammable or toxic gases require special design features, application of advanced technologies and monitoring systems of varying degrees of sophistication factors for reliable and safe operation. These make it possible to keep the process under control, increase the life of critical components and program maintenance, thus achieving reliability and availability reaching 99.5 % and higher.

The function of monitoring systems, including systems for measurement of plunger or conventional piston rod oscillation (commonly called runout), is primarily to provide information for early identification of potentially dangerous operating conditions or of machinery problems.

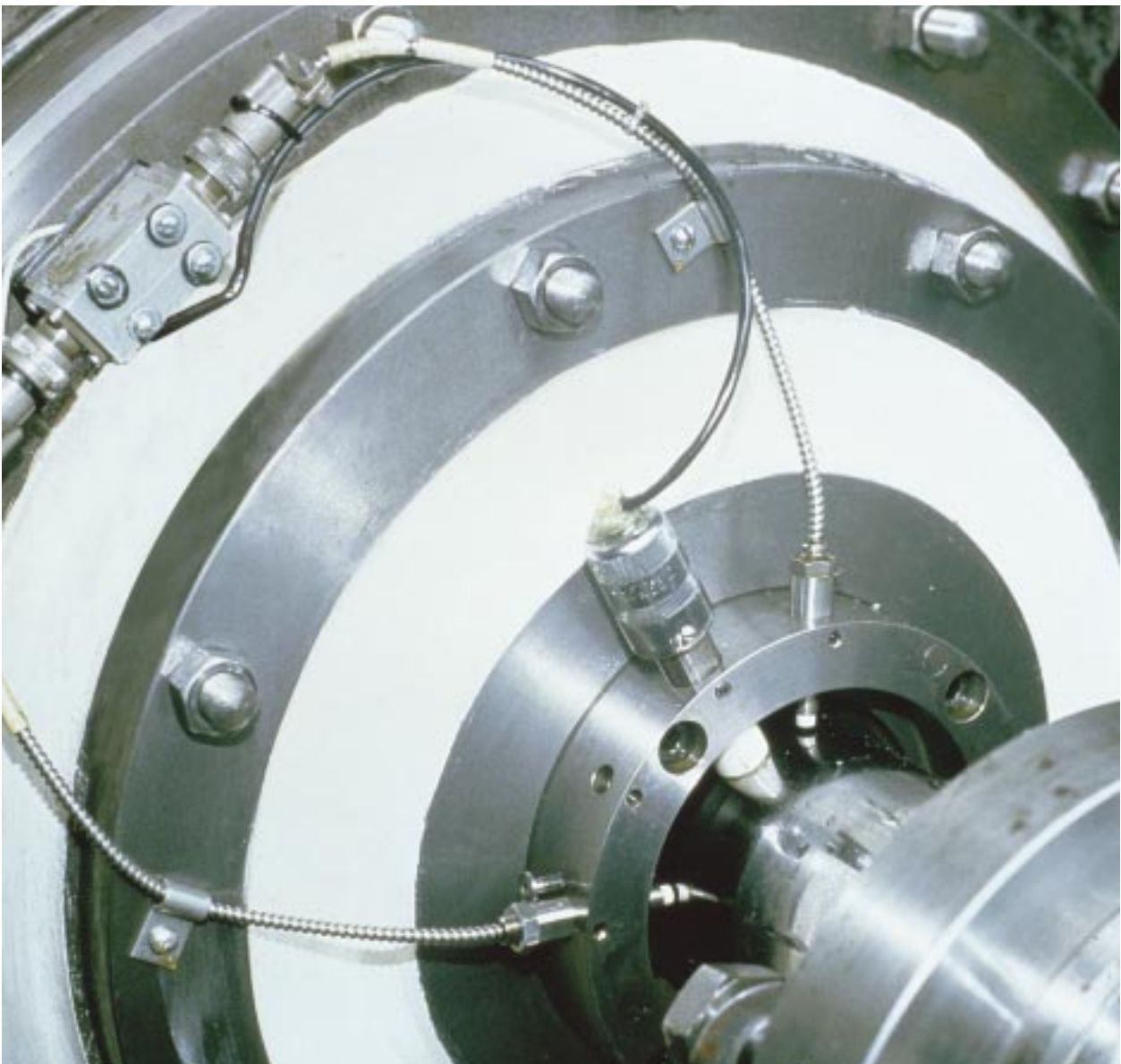
MEASUREMENT OF RUNOUT

Plunger or piston rod oscillation is an indicator of the operating condition of a compressor.

It can be caused by:

- liquids/solids in the cylinders
- undue wear of crosshead shoes
- undue wear of piston rider bands
- misalignment of cylinders
- slackening of the plunger or piston rod in the crosshead connection
- packing seal wear

Running a machine outside acceptable operating conditions can lead to serious damage. For this reason, a monitoring system is essential.



MONITORING SYSTEM

Two non-contact probes are mounted offset by 90° on the partition cover as shown in Figure 1.

A third probe is installed near the flywheel functioning as a key-phasor to trigger the peak-peak value of runout at **every revolution** (a pulse is sent to the monitor every time a notch made on the flywheel passes under the probe).

The probe arrangement is illustrated in Figure 3.

The probe signals are sent to a control room monitor which:

- displays the runout peak-peak value
- gives an alarm and trip for each runout probe
- provides the power supply for field probes

The instruments used in the monitoring system are shown in Figure 2.

The installation is Eex-i intrinsic safety type, where necessary. With this system the peak-peak runout value can be moni-

tored for each plunger or rod in two perpendicular directions each with set alarm and shutdown thresholds.

OTHER DIAGNOSTIC INFORMATION

1. Analysis of the vibration probe signal on an oscilloscope provides additional information on the running condition of machinery.

Two runout wave shapes taken on the same rod at different times are compared in Figure 4.

Figure 4.A shows rod oscillation in normal running condition immediately after an overhaul.

Figure 4.B shows oscillation disturbed by peaks which always occur in the same zone of the arc of rotation; broken cylinder seal rings were identified as the cause of these deformations. By combining the vertical and horizontal signals

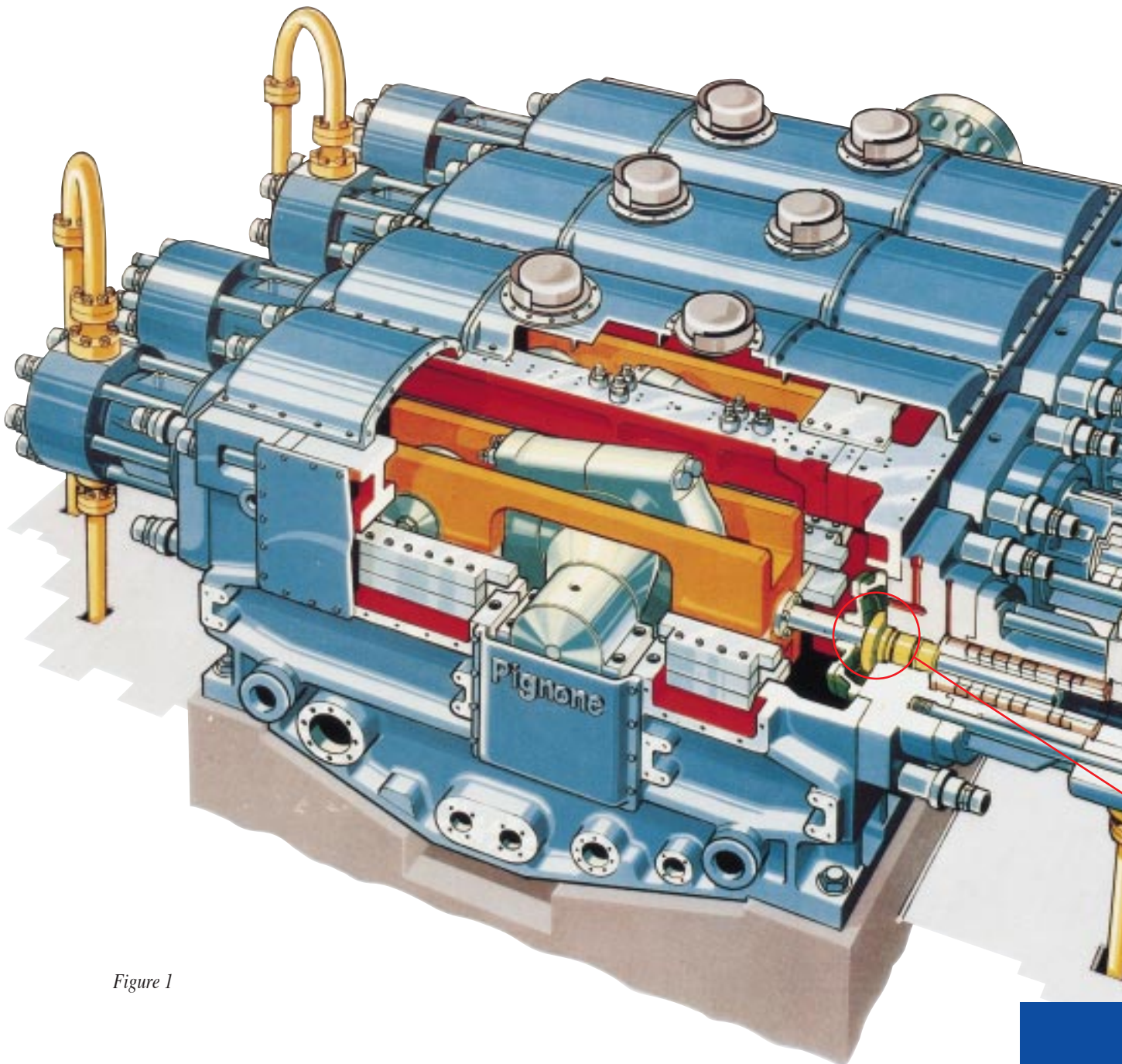


Figure 1

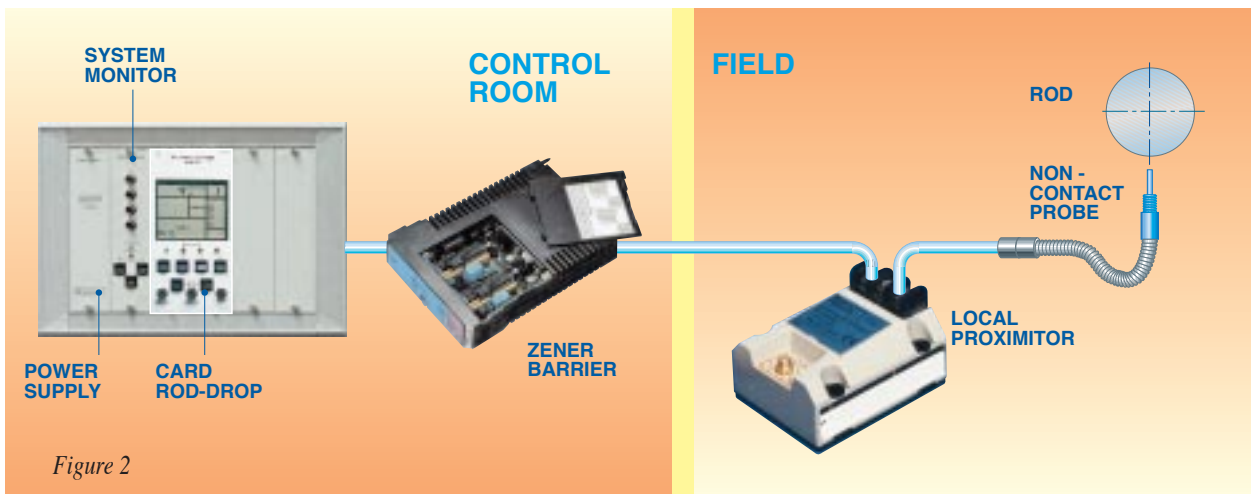


Figure 2

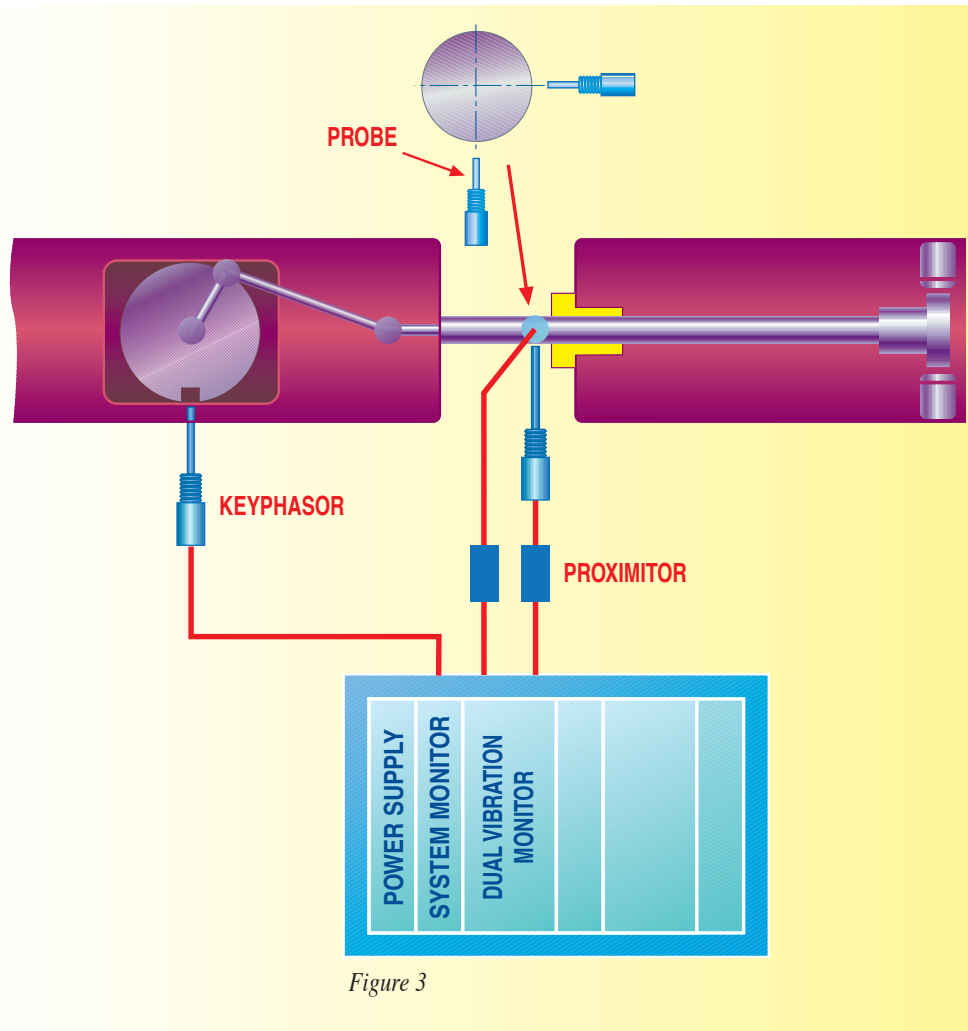
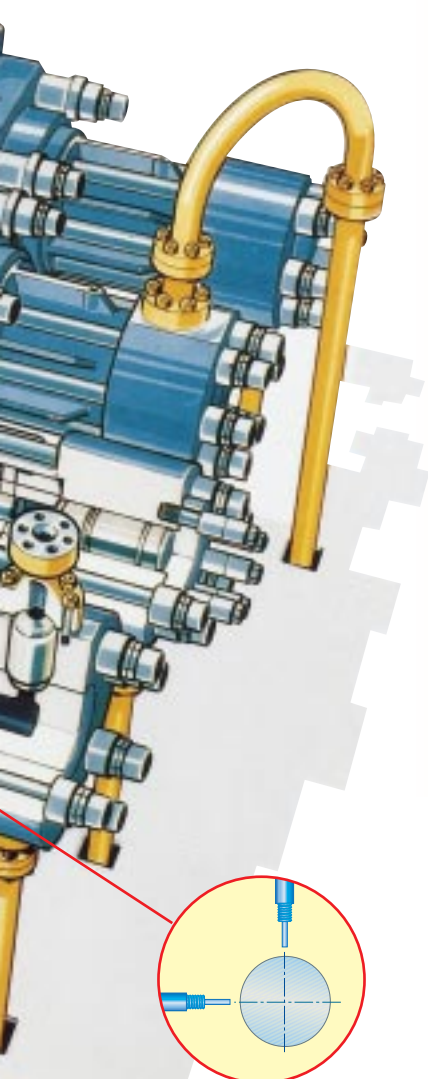


Figure 3



MONITORING PISTON ROD OR PLUNGER RUNOUT

from two proximity probes on a dual-channel oscilloscope the piston rod orbit trend is obtained.

The orbits of a high pressure compressor plunger in normal, acceptable and faulty running conditions are compared in Figure 5.

2. Rod drop can be monitored together with runout (for pistons with plastic rider bands) by one of the two 90° probes. A monitor is simply added to the control room monitor rack and a proximity probe mounted vertically under the piston rod. Refer to the rod drop monitoring system description for more information.

APPLICATIONS

Runout monitoring is particularly recommended for reciprocating compressors handling high pressure, highly inflammable or toxic gases, for example:

- ¥ compressors for polyethylene production with final discharge pressures as high as 3500 Bar and plungers made of tungsten carbide, which is very hard and brittle meaning that they could break if subjected to abnormal bending stresses; plunger movement must be monitored to check that the crosshead maintains coaxial alignment with the cylinder.
- ¥ hydrogen compressors
- ¥ compressors for natural gas re-injection
- ¥ compressors which handle particularly hazardous gases containing H₂S.

SCOPE OF SUPPLY

The conversion kit for installing the runout monitoring system includes:

- ¥ 2 non-contact probes per cylinder including mountings
- ¥ 1 key-phasor probe with mounting
- ¥ Extension cables and proximitors for all probes
- ¥ Local junction box for proximitors

- ¥ Cable sheathing up to the junction box
- ¥ Control room monitor to suit the number of probes
- ¥ Zener barriers for each probe (if necessary)
- ¥ Probe installation modification drawings and wiring diagram

Interconnecting cables between the local junction box, barrier and monitors can be supplied on request.

Figure 4

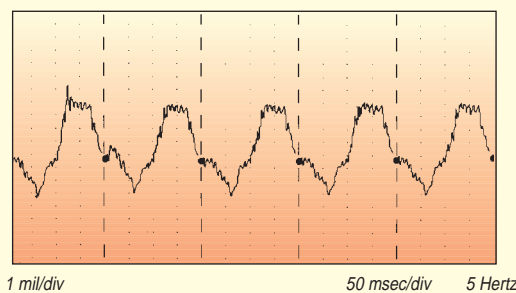


Figure 4A

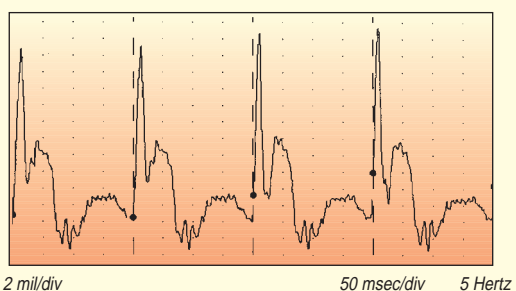


Figure 4B

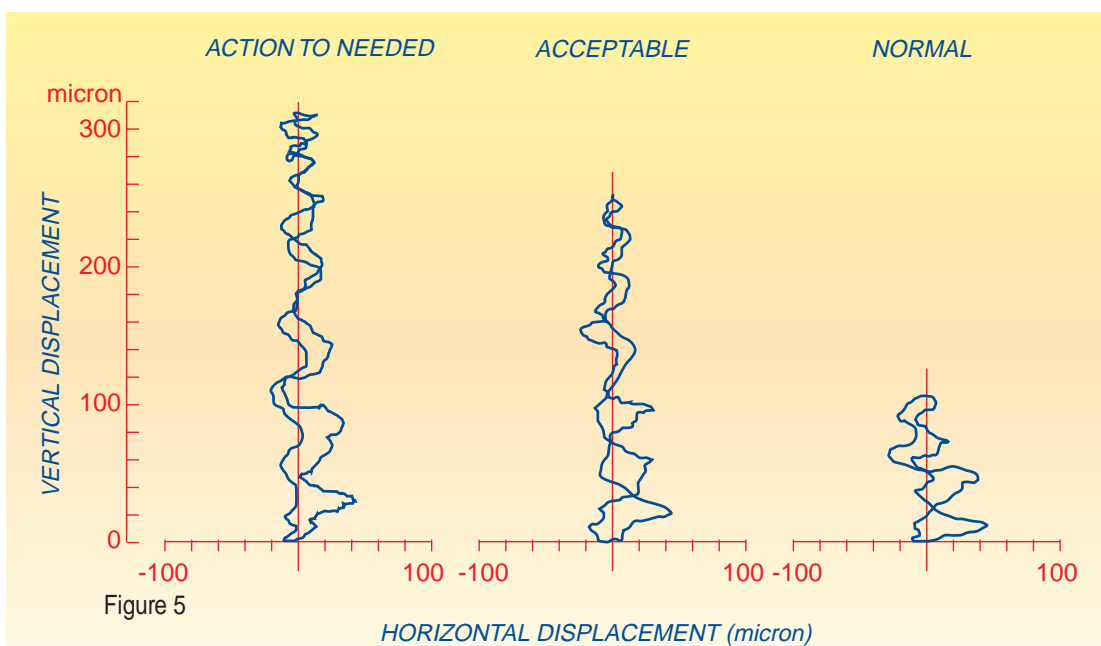


Figure 5

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