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Distribution list Jenbach, Subsidiaries, Service Providers		
Service Technician Instruction	ST-145	20 April 2016

Engine type

6

Subject

Cylinder pressure sensors
Configuration, handling, wiring, troubleshooting

Service Technician Instruction ST-145 is intended to assist when dealing with cylinder pressure sensors.

AFFECTED ENGINES / SCOPE OF THIS BULLETIN

Type 6 engines for special applications (special gas with SAFI DMR).

SAFI ...Sensor Actuator Functional Interface

DMR ...Pressure-based engine control system PBC (Druckgeführte Motorregelung DMR)

DESCRIPTION OF THE CONTENT

Engines currently in operation equipped with cylinder pressure sensors exhibit different performance according to the versions of the sensors installed (sensor manufacturer, sensor type and associated DIA.NE software and SAFI firmware).

On-site equipment from a particular manufacturer should be retained in order to gather more experience of the different manufacturers.

Cylinder pressure sensors from different manufacturers must NOT be mixed, i.e. do not install them on one and the same engine. However, engines may be operated with different sensor types from the same manufacturer. We recommend updating to the latest designs.

If a change is made on an engine from one manufacturer to another, the sensitivity parameters must be modified in the DIA.NE.

This Service Technician Instruction is intended primarily to describe how to identify the sensor configurations, how to replace the old design of sensors, how to carry out troubleshooting and how to handle defective parts.

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1. Configuration of the cylinder pressure sensors

PIEZOCRYST and KISTLER are the names of the manufacturers of sensors currently fitted to engines in the field. The following designs must be distinguished:

- PIEZOCRYST cylinder pressure sensors

Type	Part number	Remarks
G031J	548302	Old design
G031J	1214717	New design

- KISTLER cylinder pressure sensors

Type	Part number	Remarks
6615AQ04	581263	Old design
6615AQ06	1216761	Old design
6615AQ07	1230921	New design
6615AQ08	1230049	New design



Figure 01: PIEZOCRYST cylinder pressure sensor, Type G031J



Figure 02: KISTLER cylinder pressure sensor, Type 6615AQ04



Figure 03: KISTLER cylinder pressure sensor, Types 6615AQ06, 6615AQ07, 6615AQ08

Distinguishing features

All the sensors are marked at the end (connector outlet) with at least the manufacturer's identification, type and serial number. The plug connector types and pin assignments are identical for both manufacturers.

The Type G031J manufactured by PIEZOCRYST is distinguished by its serial number. The first two or three figures of the consecutive serial number (e.g. 100082) give the production date and therefore the development status (90 – 2009, 100 – 2010, 110 – 2011, 120 – 2012, 130 – 2013). All the sensor types are of the same design and length.

The sensor type (e.g. 6615AQ06) and serial number (e.g. SN4367546) are given separately on KISTLER sensors. The actual used sensor types are AQ07 und AQ08.



The sensors from the two manufacturers differ in their sensitivity as follows:

Manufacturer	Sensitivity
PIEZOCRYST	13mV/bar
KISTLER	10mV/bar

We recommend checking the parameter and sensitivity settings on DIA.NE and modifying if required according above shown table. The parameter can be found pending on generation (XT, XT3, XT4) and application (special gas) under PBC or SAFI-PBC.

The sensor assembly at cylinder head requires a clean sealing cone (1) and a free pressure channel (2).



Figure 04: Clean sealing cone (1) and free pressure channel (2) required

The assembly should be performed at same temperature level of sensor and cylinder head. A pre-warming of sensor by applying it at cylinder head area with stopped engine is recommended. This prevents thermal tension.

The optimal assembly torque is 20Nm, maximal is 25Nm, minimal 15Nm, and it is achieved by using a torque tool. Higher torque or compressed air tool kit will destroy the sensor, lower torque potentially will lead to leakage.

Additives for free movement of threat are not required, when following above assembly procedure. Additives (like oil, grease, lubricants or similar) will follow to deposits of sealing cone or pressure channel. If additives move into combustion chamber abnormalities in combustion will follow like knocking or glow ignition. No sealing washer is required.

For revision work on engine with disconnection of cylinder pressure sensor please use protection cap for sensor connector and protect sensor cable connector by masking. This will protect against damage and pollution.



Figure 05: Sensor + protection cap



2. SAFI (Sensor Actuator Functional Interface)

The following designs must be distinguished:

• SAFI 1

The cabling between the sensor and SAFI 1 is supplied ready connected by the manufacturer of the SAFI 1. No changes are necessary, as the cabling at the front of the unit is not accessible.

• SAFI 2

The cabling between the sensor and SAFI 2 is assembled by GE in Jenbach internally. A check of the assembly must be carried out. The shield is **not connected** and the sensor cable cores should be connected as follows.

Existing sites are equipped with sensor cables from supplier PHOENIX. New projects will be equipped with sensor cables from supplier ESCHA – a differentiation can be done via cable signature. Furthermore the clamping type is changed from screw terminal to spring type terminal.

A corresponding upgrade package for optimization of reliability is available and to be obtained by service.

Connection pin	Core colour PHOENIX->ESCHA	Description	Remark
1	Blue -> Grey	Cylinder pressure sensor signal +, sensor 1	Check the terminal connection is secure
2	Black -> White	Cylinder pressure sensor signal -, sensor 1	Check the terminal connection is secure
3	White -> Red	Sensor power supply +24V, sensor 1	Check the terminal connection is secure
4	Brown -> Brown	Sensor power supply earth, sensor 1	Check the terminal connection is secure
7	Blue -> Grey	Cylinder pressure sensor signal +, sensor 2	Check the terminal connection is secure
8	Black -> White	Cylinder pressure sensor signal -, sensor 2	Check the terminal connection is secure
9	White -> Red	Sensor power supply +24V, sensor 2	Check the terminal connection is secure
10	Brown -> Brown	Sensor power supply earth, sensor 2	Check the terminal connection is secure



Figure 06: SAFI 2 wiring – old harness (PHOENIX)

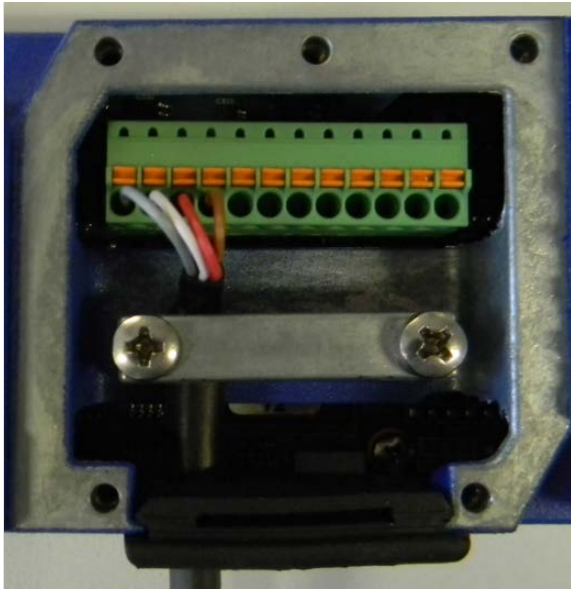


Figure 07: SAFI 2 wiring – new harness (ESCHA) and spring type terminal



3. Troubleshooting

The following error messages can occur on engines fitted with cylinder pressure sensors:

Message number	Description	Remedial measure
2281	Membrane burst	Replace the sensor.
2214	Measuring signal failure cyl. pressure sensor	Check the wiring to the sensor; if the wiring is OK, replace the sensor.
2262	Cylinder peak pressure maximum	Check the engine settings (power controller, emissions); replace the sensor if inadmissible engine running conditions (high peak pressure) can be ruled out.
1048	Knocking failure	Analyse the knocking.
3333	SAFI parameter failure	Reset the parameters of the MORIS system including the SAFI units.

If the engine trips repeatedly due to **Knocking** at one cylinder, the cylinder, and if necessary the entire engine, must be examined to find the cause. Pay particular attention to the following points:

- Deposits and anything unusual mechanical (piston rings, oil ingress).
- Consideration should be given to autoignition in this cylinder in the event of steep knock integrator pulse leading edges, especially with applications with special gases.
- Check the ignition point timing on the engine as a whole.
- Check the emission settings of the engine as a whole.
- Are the mixture temperature control circuits stable?
- Does the knock tripping behaviour change if the ignition point is retarded (e.g. from 20° to 16° BTDC), the mixture is made leaner (e.g. from 500mg to 300mg NO_x), or the mixture temperature t₂' changes (e.g. from 50°C to 40°C)?

If there is a wiring fault, the cylinder pressure sensor signal may on rare occasions be affected by interference. **This can follow to measurement signal failure (alarm 2214).** The effect can be detected by connecting an oscilloscope between connecting pins 1 and 2, or 7 and 8 respectively.

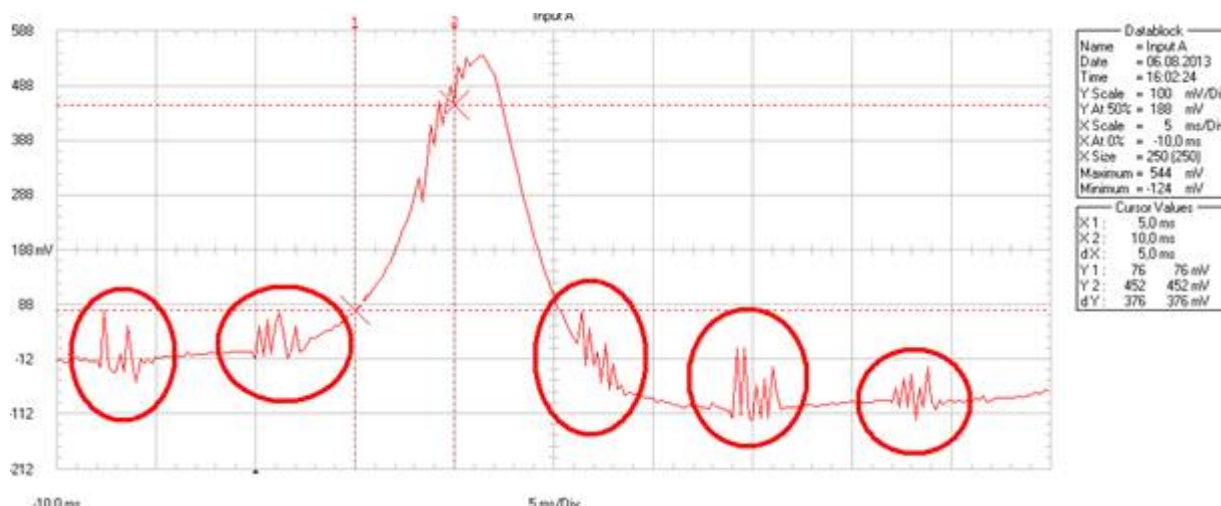


Figure 08: Sensor signal with interference

If this kind of interference occurs in the signal, please contact the author of this document directly. Remedial measures are improved earthing and the installation of filter capacitors at the sensor connection points.



Of particular importance in this context is the MORIS cabling system at both ends of the cabling rail on a J620 (and in the middle for a J624) to ensure that it is cleanly earthed. The strong fit and clean surfaces of grounding screws have to be checked, a minimum square of 10mm² for mixture charged engines need to be guaranteed, for engines with port injection a minimum square of 16mm² is required. The electrical braid of sensor cable is not connected at SAFI housing (strain relief).



Figure 09: MORIS cabling earthing

4. Handling of defective parts

Faulty sensors must be dealt with in accordance with the standard procedure for warranty claims.

A check of the sensors needs to be performed unconditionally before shipment by installing them in a neighbour cylinder for checking the reproducibility.

For this reason, a standard procedure warranty incident must be opened in respect of all faulty sensors, which exhibit malfunctions within the warranty period, and the sensors must be returned to Jenbach following the Service Parts Return Process – Return Materials Authorization (RMA):

GE Jenbacher
Achenseestr. 1-3
6200 Jenbach
Austria
Attn. Schroll Christian (H16), fill in your RMA# / SR#

Due to the high number of non-failed returned sensors at the moment R-components (proofed and used parts) are used until clarification of warranty.

5. Approved engine configuration

- KISTLER and PIEZOCRYST sensors must NOT be mixed, i.e. do not install cylinder pressure sensors from different manufacturers on one and the same engine.
- However, engines may be run with sensors of different types from the same manufacturer. We recommend updating to the latest designs.
- If a change is made on an engine from one manufacturer to another, the sensitivity parameters must be modified in the DIA.NE.



RELEVANT DOCUMENTS

When working on GE Jenbacher modules, all applicable local regulations must of course be observed in addition to our documentation. We would particularly like to emphasise observation of the following documents/systems in connection with this Service Technician Instruction:

- Technical Instruction TA 1100-0105, Engine shut-down
- Technical Instruction TA 1530-0183, Handling of cylinder pressure sensors
- Technical Instruction TA 2300-0005, Safety instructions
- Maintenance Work W 8058, Cylinder pressure sensors
- Service Expert System

REVISION CODE

INDEX	DATE	DESCRIPTION / REVISION SUMMARY
02	Apr. 20, 2016	Revision sensor types, wiring, assembly
01	Nov. 10, 2013	First version of this document

Table: Revision history