GENERAL SERVICE LETTER

SUPPORT AND SALES MANAGEMENT FOR OPERATORS
40220 Tarnos – France
Tel. (33) (0) 5 59 74 40 00

JFE/TB/CL

General Service Letter no. 1937/01 - 6th issue

This General Service Letter supersedes the issue dated January 4, 2018 and the Service Letters listed on page 3 of this document.

Subject: All engines

Equipment approved for vibration check on engines from Safran Helicopter Engines.

Dear Sir or Madam,

The purpose of this Service Letter is to draw up a summary of the devices approved for performing vibration checks on engines from Safran Helicopter Engines.

The user must refer to the concerned engine's Vibration Check Task from the Engine Maintenance Manual, in order to know what type of equipment he can use to carry out the Engine Vibration Check.

The Safran Helicopter Engines-approved devices that are currently available throughout the world for measuring the vibration levels are:

“Stand-Alone” systems:

- Simplified B&K 2513 system for field checks (HBK – HOTTINGER, BRÜEL & KJÆR Company)
- Simplified B&K 3656-A system for field checks (HBK – HOTTINGER, BRÜEL & KJÆR Company)
- TURBOMECA vibration measurement set (P/N 8817335000)
- B&K PULSE 3641-A/B system (HBK – HOTTINGER, BRÜEL & KJÆR Company)
- B&K PULSE 3648-A/B system (HBK – HOTTINGER, BRÜEL & KJÆR Company)
- B&K PULSE 3649-A/B system (HBK – HOTTINGER, BRÜEL & KJÆR Company)
- RT-2000 system (HELITUNE Company)
- RT-JEM system (HELITUNE Company)
- SYNTHAM 2000.4 system (SEMIA Company)
- SEMIA S5000 and SYNTHAM 5000 systems (SEMIA Company)
- VIPER 4040 Antach version system (ACES SYSTEMS Company)
- CHADWICK-HELMUTH 177M system (CHADWICK-HELMUTH Company)
- CHADWICK-HELMUTH 192A system (CHADWICK-HELMUTH Company)

“On-board” systems:

- EUROARMS/VPU-type system (AIRBUS HELICOPTERS Company).
- M’ARMS-type system (AIRBUS HELICOPTERS Company).
- MDS90-type system (AIRBUS HELICOPTERS Company) – *Qualification In Progress*
- HMS-EVM type system (Health Monitoring System-Engine Vibration Monitoring) (AIRBUS HELICOPTERS Company) – *Qualification In Progress*

CAUTION

ANY VIBRATION CHECK PERFORMED ON OUR ENGINES WITH AN EQUIPMENT THAT IS NOT APPROVED BY SAFRAN HELICOPTER ENGINES LIKE:

- **CHADWICK HELMUTH VIBREX 2000, VIBREX 2000+, 8500 C+,**
- **HONEYWELL VXP, EVXP,**
- **DSS MICROVIB II,**
- **ACES VIPER 2020, VIPER II,**
- **ETC.**

WILL NOT BE CONSIDERED AS RELIABLE ENOUGH TO ENSURE CORRECT MAINTENANCE OF THE ENGINE AND FLIGHT SAFETY.

The remainder of the Service Letter describes all the systems with their specifics, their use limits and their upgrades. The major upgrade is the introduction of thresholds for tooling allowing only the checking of the overall vibration level (tools B&K 2513, B&K 3656-A and S5000/SYNTHAM 5000 without tachometer cable).

Please contact us if you require further information or assistance.

Technical Support Department

Jean-François ESCURET

This General Service Letter 1937 supersedes the following Service Letters:

ARRIEL 1

1829/98/ARRIEL/42	2389/06/AR1S/81	2390/06/AR1C/131	2391/06/AR1M/66
2392/06/AR1MN/43	2394/06/AR1E/25	2695/08/ARL/190	2696/08/AR1D/81
2757/10/ARL	2758/10/AR1D	2801/11/ARRIEL1	2814/11/AR1K
2845/12/ARL	2853/12/ARL	2854/12/AR1D	3021/18/ARL1

ARRIEL 2

1947/00/AR2B/8	1948/00/AR2C/4	1979/00/AR2S1/13	2386/06/AR2B/27
2387/06/AR2C/21	2388/06/AR2S1/23	2393/06/AR2C/22	2395/06/AR2B/28
2697/08/AR2S/36	2755/10/AR2B	2802/11/ARRIEL2	2968/16/AR2C

ARRIUS 1

2437/06/ARRIUS1A/19	2438/06/ARRIUS1M/16	2803/11/ARRIUS1	2812/11/ARRIUS1

ARRIUS 2

1949/00/ARRIUS2B/8	1950/00/ARRIUS2F/9	2396/06/ARRIUS2B/35	2397/06/ARRIUS2F/31
2804/11/ARRIUS2	2815/11/ARRIUS2K	2926/14/ARRIUS2B	

ARDIDEN

2851/12/ARD1

ARTOUSTE II

1083/85/ART/87	2805/11/ARTII	2846/12/ARTII

ARTOUSTE III

2806/11/ARTIII	2847/12/ARTIII

ASTAZOU III

2807/11/ASTIII	2848/12/ASTIII

ASTAZOU XIV

2808/11/ASTXIV	2849/12/ASTXIV

MAKILA 1

1974/00/MAK1A/59	1975/00/MAK1A1/38	1976/00/MAK1A2/4	2405/06/MAK1A/67
2406/06/MAK1A1/45	2407/06/MAK1A2/7	2698/08/MAK1K2/4	2809/11/MAKILA

MAKILA 2

2408/06/MAK2A/1	2810/11/MAKILA2

TM 333 2M2

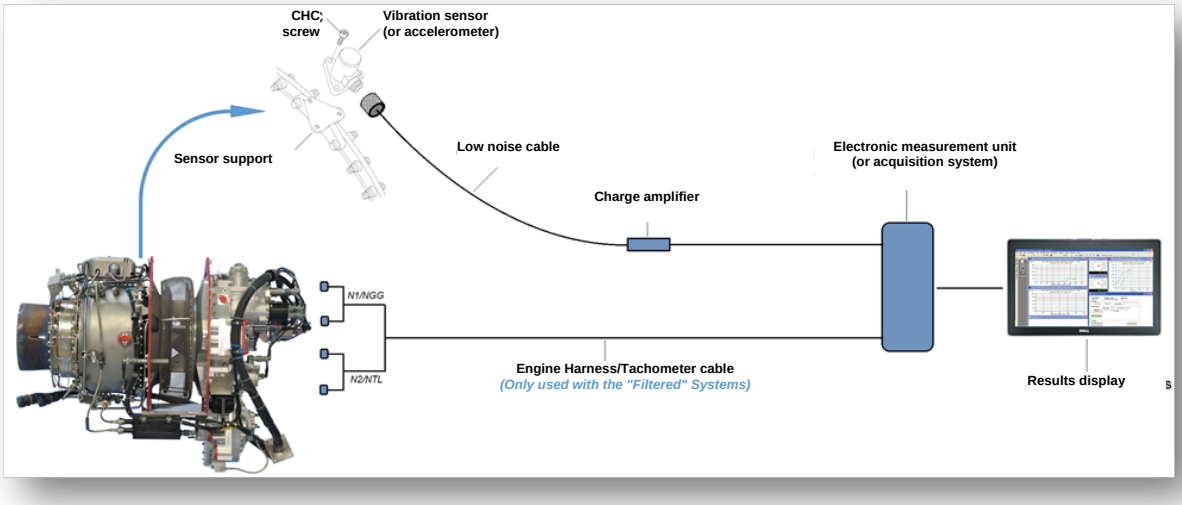
2518/07/TM3332B2/	2816/11/TM3332M2

TURMO IIIC4 - IVB - IVC – IVCA - IVCB

2811/11/TURMO	2850/12/TURMO	2912/14/TURMO

1. General

The vibration measurement sets used to monitor Safran Helicopter Engines engines generally include:



1.1 Sensor supports

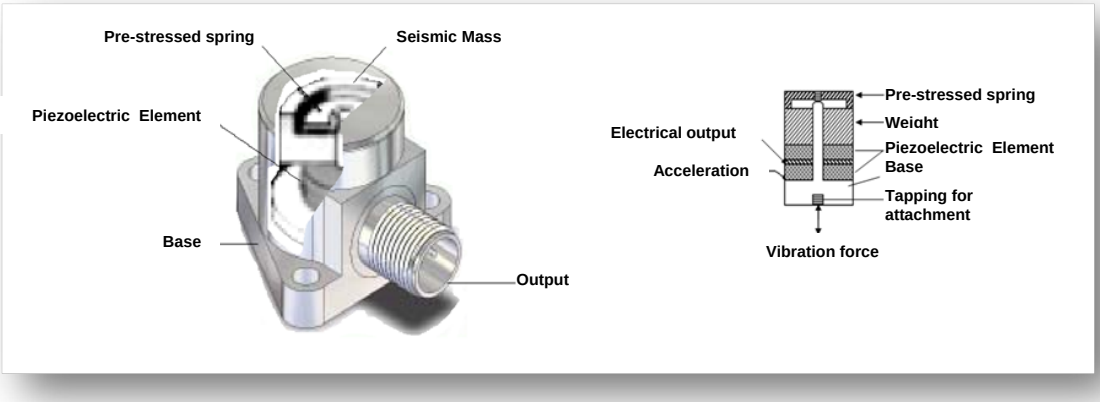
They are specially designed by Safran Helicopter Engines so that the sensor support/vibration sensor assembly resonance frequency does not interfere with the measurements. It is particularly important to ensure that the latter is at least 10% greater than the highest first order frequency encountered on the Gas Generator.

It can be:

- Permanently installed on the engine,
- Installed specifically to perform the vibration check. It is then removed at the end of the acquisition.

1.2 Vibration sensor (or Accelerometer)

This is piezo-electric type and is installed on the front and/or rear reference position of the engine (defined during the certification tests).



The vibration sensors used by Safran Helicopter Engines to perform maintenance on the engines are:

Manufacturer	MANUFACTURER P/N	SAFRAN HE P/N	Sensitivity (pc/g)	Height (mm)	Frequency range +/- 5% (Hz)	Weight (gr)	Use temperature (°C)
Brüel&Kjaer	8324i (*)	9 610 01 770 0	10	25.4	1 ➔ 10000	66	-60 ➔ +480
Endevco	6222S-20A	9 610 02 049 0	20	20.2	1 ➔ 9000	52	-55 ➔ +260
Endevco	6233C-10	9 610 04 636 0	10	25.4	10 ➔ 4000	69	-55 ➔ +482
Endevco	6233CM16	-	10	25.4	10 ➔ 4000	69	-55 ➔ +482
Vibrometer	CA134	9 610 08 611 0	10	39.5	0,5 ➔ 3500	120	-54 ➔ +450
Vibrometer	CA135	9 610 00 333 0	20	34.8	0,5 ➔ 8000	90	-54 ➔ +260
Vibrometer	CA139	9 610 04 443 0	10	31	0,5 ➔ 5500	80	-54 ➔ +400

NOTA : (*) The earlier B&K 8324 accelerometer is no longer usable for the engine vibration check.

The main differences in relation to its successor, the B&K 8324i (the "i" is an index engraved by Safran Helicopter Engines to distinguish between these two types; this is why it is not present on all accelerometers), are the following:

- Height: 31.5 mm
- Weight: 100 gr

The main characteristics of the Vibration Sensor are:

1.2.1 Sensitivity:

This characteristic represents the proportionality of the operable electrical output (voltage, load, current) in relation to the vibration parameter (acceleration, speed, displacement).

It is expressed in terms of electrical output/vibration parameter (pc/g or mV/ms-2). Sensitivity is determined by the weight of the accelerometer.

1.2.2 Weight:

As a general rule, the ratio between the accelerometer weight and the vibrating part on which it is installed must be less than 1/10.

The accelerometer weight is related to its sensitivity and affects the sensor bandwidth, i.e., the frequency range that the sensor can measure.

The choice of the sensor is based on the:

- Engine variant (sensor support).
- Used vibration check tool.
- Location of the measurement (temperature constraint).

The operator must mandatorily refer to the relevant vibration check task of the Maintenance Manual to determine which type of vibration sensors he must use with a given electronic measurement unit to perform the engine vibration check.

Using an unsuitable vibration sensor and/or one that is not indicated in the relevant maintenance task can adversely affect the reliability of the result of the engine vibration check.

1.3 Low noise cable

The low noise cable is chosen to be compatible with the accelerometer and the equipment used.

The Maintenance Manual defines a type of cable for each type of accelerometer; it is not allowed to "mix" accelerometers and low noise cables between them.

Each vibration check tool is supplied with its own low noise cable adapted to the accelerometer to be used.

1.4 Charge amplifier

As the output signal of a vibration sensor (or accelerometer) is weak but has high impedance, it needs to be conditioned via a charge amplifier. This charge amplifier is specific to each equipment as it is adapted for the following components:

- Vibration sensor (or accelerometer),
- Low noise cable,
- Electronic measurement unit.

1.5 Electronic measurement unit (or acquisition system)

Processes the signals from the vibration sensors and displays the vibration level measured on the engine.

1.6 Engine/ tachometer cable harness

Specific to each Safran Helicopter Engines engine variant and used when the electronic measurement unit performs a selective processing of the signal (rating filtering).

2. Processing type

The processing of the signals can be done in two ways:

2.1 Overall (or global) processing

The electronic measurement unit performs overall processing within a band that includes:

- The rotational frequencies of the gas generator and the power turbine,
- The rotational frequencies of the accessories.

It then displays a value representing the observed maximum vibration level of all the vibrating components of the engine in this frequency band.

This processing does not distinguish between the critical frequencies related to the rotation of the gas generator and the power turbine and therefore cannot accurately identify the origin of the vibrations.

NOTA : Latest generation approved systems record raw data. These data, after processing by Safran Helicopter Engines, allow in-depth analysis and engine diagnostics.

2.2 Filtered processing

The electronic measurement unit performs tracking of the first order component of the rotation in the overall vibration signal with a tracking filter controlled by the tachometer signal corresponding to the rotating assembly concerned.

During speed variations, the filter allows tracking of the vibration level at the rotational frequency of each rotating assembly (first order gas generator; first order power turbine). It is then possible to obtain a reading of the vibration level of each of them.

3. Calibration - Periodicity

As for all electronic equipment, Safran Helicopter Engines recommends performing calibration checks of the electronic measurement unit (or acquisition system) and the vibration sensor (or accelerometer) every 12 months.

4. "Stand-Alone" Vibration check equipment approved by Safran Helicopter Engines

4.1 Simplified system type B&K 2513 (P/N 8816694000) for field checks (HBK – HOTTINGER, BRÜEL & KJÆR Company)

4.1.1 General

This tool (Single Channel), which is suitable for field use, performs a global processing of the signal in a dedicated frequency band and displays the vibration level in mm/s RMS through a LED "bar graph".

This system allows:

- Either storage in the memory of the maximum vibration peak measured during the check.
- Or real-time reading of the vibrations during the check.

NOTA : This equipment is approved to perform the NG high rating check on the ARRIEL 1 engine family (if Level 3/Deep Maintenance Operation).

If the permitted threshold is exceeded, a vibration check using a system (filtered system or latest-generation Global system) may be recommended to enable in-depth analysis and engine diagnostics.

NOTA : This tool is no longer commercially available from this time, either from HBK (HOTTINGER, BRÜEL & KJÆR) or from Safran Helicopter Engines.

IMPORTANT

ON JULY 1ST, 2014, THE HBK (HOTTINGER, BRÜEL & KJÆR) COMPANY, ANNOUNCED THE OBSOLESCENCE OF THIS TOOL AND ITS REPLACEMENT BY THE B&K 3656-A SYSTEM (TM4865G001). THIS EQUIPMENT HAS NOT BEEN SUPPORTED OR REPAIRED SINCE JULY 2019.

HOWEVER, THE HBK (HOTTINGER, BRÜEL & KJÆR) COMPANY, HAS AGREED TO CONTINUE TO PROVIDE CALIBRATION (AS LONG AS THE RECEIVED SYSTEM IS FUNCTIONAL) UNTIL JULY 2024.

4.1.2 Qualification for the following engines:

- ARRIEL 1 (All Variants)
- ARRIEL 2 (All Variants)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (Except G1)
- ARTOUSTE II (All Variants)
- ARTOUSTE III (All Variants)

4.1.3 Changes to interpretation of the Vibration Check results

Safran Helicopter Engines updates, at each new publication, the B&K 2513 vibration check maintenance tasks in order to incorporate a new methodology for interpreting the results of the vibration check.

Previously, the result was either “PASSED” or “FAILED”. From now on, once the Maintenance Manual has been updated, the result will be linked to the threshold reached:

Level 1	The engine is Kept in Service.
Level 2	The recorded vibration measurements are sent to Safran Helicopter Engines. The engine is **Temporary Kept in Service** until the data analysis is sent off and recommendations are made by Safran Helicopter Engines.
Level 3	The recorded vibration data (Measurements Page) are sent to Safran Helicopter Engines for analysis and recommendations. Refer to the maintenance manual to decide on the actions to be taken.

4.2 Simplified system type B&K 3656-A (P/N TM4865G001) for check field checks (HBK - HOTTINGER, BRÜEL & KJÆR Company)

4.2.1 General

This tool (Single Channel), developed for field use, performs overall processing of the signal within a dedicated frequency band. Results are expressed in mm/s RMS.

This tool simultaneously displays:

- Real-time reading of the vibrations during the check,
- Maximum vibration value measured during the check,
- Result of the vibration check.

NOTA : This system is approved for the High NG Rating Vibration Check on several engine family (if Level 3/Deep Maintenance Operation).

NOTA : This tool is available from HBK (HOTTINGER, BRÜEL & KJÆR) company and Safran Helicopter Engines.

4.2.2 Qualification for the following engines:

- ANETO 1K
- ARDIDEN 1H1
- ARRANO 1A
- ARRIEL 1 (All Variants)
- ARRIEL 2 (All Variants)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (All Variants)
- ARTOUSTE II (All Variants)
- ARTOUSTE III (All Variants)
- ASTAZOU III (All Variants)
- ASTAZOU IV M1 – M3
- ASTAZOU XIV (All Variants)
- AST 600 1A
- MAKILA 1 (All Variants)
- MAKILA 2 (All Variants)
- RTM 322 01/9 – 01/9A
- TM333 (All Variants)
- TURMO (All Variants)

4.2.3 Changes to interpretation of the Vibration Check results

Safran Helicopter Engines updates, at each new publication, the B&K 3656-A vibration check maintenance tasks in order to incorporate a new methodology for interpreting the results of the vibration check.

Previously, the result was either “PASSED” or “>LIMIT”. From now on, once the Maintenance Manual has been updated, it will be linked to the threshold reached:

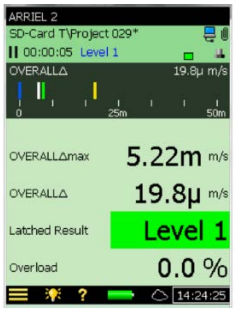
Level 1	The engine is Kept in Service
Level 2	The **raw** vibration data are sent to Safran Helicopter Engines. The engine is **Temporary Kept in Service** until the data analysis is sent off and recommendations are made by Safran Helicopter Engines.
Level 3	The **raw** vibration data are sent to Safran Helicopter Engines for analysis and recommendations. Refer to the maintenance manual to decide on the actions to be taken

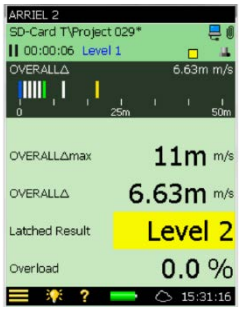
A B&K 3656 software update was specified to HBK (HOTTINGER, BRÜEL & KJÆR) and validated by Safran Helicopter Engines in order to integrate these thresholds into the tool acquisition page.

The Software Update will be made by HBK (HOTTINGER, BRÜEL & KJÆR) during the return of the tool in calibration from January 2021.

Result on the Acquisition Page (with Current Software)

Result on the Acquisition Page (with Updated Software)





4.3 TURBOMECA vibration measurement set (P/N 8817335000)

4.3.1 General

This tooling defined by Safran Helicopter Engines comes in the form of a suitcase with a specific engine kit.

This device uses tracking filters, allowing vibration levels to be monitored, during speed variations at the rotational frequency of each rotating assembly (gas generator and power turbine) and thus to have an image of its vibratory state. It displays the vibration level curve, plotted on paper (no digital recording possible), in mm/s RMS.

NOTA : This tool is no longer commercially available from Safran Helicopter Engines

4.3.2 Qualification for the following engines:

- ARRIEL 1 (Except Variants 1K – 1K1)
- ARRIUS 1 (All Variants)
- ARTOUSTE II (All Variants)
- ARTOUSTE III B – B1 – D
- AST 600 1A
- MAKILA 1 (All Variants)
- TURMO C4 – III C4 UK – IV C

4.4 B&K PULSE 3641 A/B system for field checks (HBK - HOTTINGER, BRÜEL & KJÆR Company)

Kit Description

NOTA : The kit B&K 3641-B is equivalent to the kit B&K 3641-A without the accelerometer.

4.4.1 General

This tool (Four Channels), developed for field use, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time and can be edited as an automatic Word report (vibration curves and time plots of engine ratings).

It allows saving of vibration and tachometer signals during engine start to perform a more accurate analysis of measured vibrations.

NOTA : This tool is available from HBK (HOTTINGER, BRÜEL & KJÆR) Company.

4.4.2 Qualification for the following engines:

- ANETO 1K
- ARDIDEN 1H1
- ARRANO 1A
- ARRIEL 1 (All Variants)
- ARRIEL 2 (All Variants)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (All Variants)
- MAKILA 1 (All Variants)
- MAKILA 2 (All Variants)
- RTM 322 01/9 – 01/9A
- TM333 2B2 – 2M2
- TURMO III C4 – III C4 UK – IV C

4.5 B&K PULSE 3648 A/B system for field checks (HBK - HOTTINGER, BRÜEL & KJÆR Company)

Kit Description

Computer
(Not Included)

+

NOTA : The kit B&K 3648-B is equivalent to the kit B&K 3648-A without the accelerometer.

4.5.1 General

This tool (Four Channels), developed for field use, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time and can be edited on an automatic Word report (vibration curves and time plots of engine ratings).

It allows vibration and tachometer signals to be saved during engine start, to perform a more accurate analysis of the engine vibrations.

NOTA : This tool is no longer available from HBK (HOTTINGER, BRÜEL & KJÆR) Company.

4.5.2 Qualification for the following engines:

- ARDIDEN 1H1
- ARRIEL 1 (All Variants)
- ARRIEL 2 (Except Variants 2D – 2E – 2N)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (Except Variants 2 G1 – 2 R)
- MAKILA 1 (All Variants)
- MAKILA 2 (All Variants)
- RTM 322 01/9 – 01/9A
- TM333 2B2 – 2M2
- TURMO III C4 – III C4 UK – IV C

4.6 B&K PULSE 3649 A/B system for field checks (HBK - HOTTINGER, BRÜEL & KJÆR Company)

Kit Description *(with Acquisition Module Type 3650 B-FRAME)*

\+

Laptop Computer *(Not Included)*

Kit Description *(with Acquisition Module Type 3050 LAN-XI)*

\+

Laptop Computer *(Not Included)*

NOTA : The kit B&K 3649-B is equivalent to the kit B&K 3649-A without the accelerometer.

4.6.1 General

This tool (Four Channels), developed for field use, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time and can be edited on an automatic Word report (vibration curves and time plots of engine ratings).

It allows vibration and tachometer signals to be saved during engine start, to perform more detailed analysis of the engine vibrations.

NOTA : This tool is available from HBK (HOTTINGER, BRÜEL & KJÆR) Company.

IMPORTANT

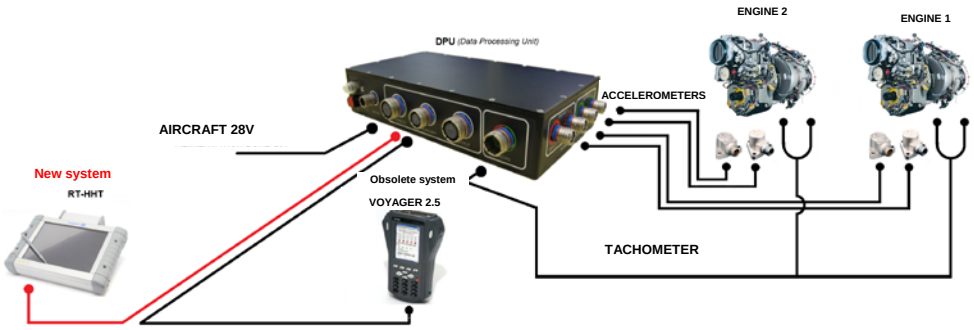
ON JANUARY 30TH, 2014, THE HBK (HOTTINGER, BRÜEL & KJÆR) COMPANY ANNOUNCED THE OBSOLESCENCE OF THE ACQUISITION MODULE TYPE 3650 B-FRAME AND ITS REPLACEMENT BY THE ACQUISITION MODULE LAN-XI TYPE 3050.

HOWEVER, THE HBK (HOTTINGER, BRÜEL & KJÆR) COMPANY HAS AGREED TO CONTINUE TO PROVIDE CALIBRATION (AS LONG AS THE SYSTEM RECEIVED IS FUNCTIONAL).

4.6.2 Qualification for the following engines:

- ANETO 1K
- ARDIDEN 1H1
- ARRANO 1A
- ARRIEL 1 (All Variants)
- ARRIEL 2 (All Variants)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (All Variants)
- MAKILA 1 (All Variants)
- MAKILA 2 (All Variants)
- RTM 322 01/9 – 01/9A
- TM333 2B2 – 2M2
- TURMO III C4 – III C4 UK – IV C

4.7 RT-2000 system (HELITUNE Company)



Also included Accelerometers / Accelerometer Cables / Tachometer Cable.

4.7.1 General

This tool, which can be used to connect two engines simultaneously, developed for field use, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time in digital format and recorded in a Compact Flash type memory card.

The data can be displayed in graph form and transferred via a serial port to a PC for processing using database software.

It allows vibration and tachometric signals to be saved during engine start.

NOTA : This tool is available from HELITUNE.

IMPORTANT

ON 12 DECEMBER 2016, HELITUNE DECLARED THE OBSOLESCENCE OF "VOYAGER 2.5 TERMINAL" AND ITS REPLACEMENT BY "HAND-HELD TERMINAL (RT-HHT)".

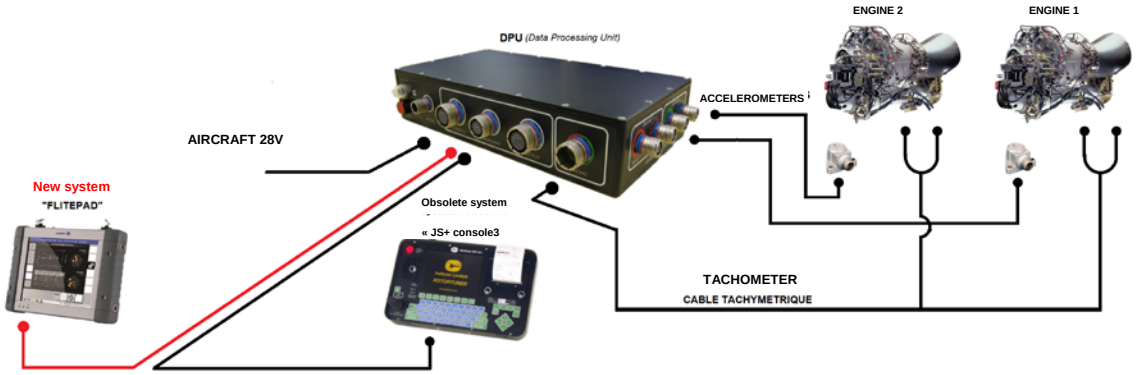
HOWEVER, HELITUNE HAS AGREED TO CONTINUE TO PROVIDE CALIBRATION (AS LONG AS THE RECEIVED SYSTEM IS FUNCTIONAL) AND SUPPORT UNTIL DECEMBER 2017.

QUALIFICATION OF THE SYSTEM UPGRADE IS PLANNED FOR 2021. THE DOCUMENTATION UPDATE WILL BE MADE AT THE END OF THIS QUALIFICATION.

4.7.2 Qualification for the following engines:

- MTR 390 2C – E

4.8 RT-JEM system (HELITUNE Company)



Also included: Accelerometers / Accelerometer Cables / Tachometer Cable.

4.8.1 General

This tool, which can be used to connect two engines simultaneously, developed for field use, performs:

- Filtered processing of the signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time in digital format and recorded in a Compact Flash type memory card.

The data can be displayed in graph form and transferred via a serial port to a PC for processing using database software.

It allows vibration and tachometric signals to be saved during engine start.

NOTA : This tool is available from HELITUNE.

IMPORTANT

FOLLOWING THE REPLACEMENT OF THE RT-5 JS+ SYSTEM (USED BY THE US COAST GUARD) BY THE RT-6 SYSTEM, HELITUNE DECLARED THE OBSOLESCENCE OF THE "JS+ CONSOLE" AND ITS REPLACEMENT BY THE "FLITEPAD".

THE QUALIFICATION OF THE SYSTEM UPGRADE IS PLANNED FOR 2021. THE DOCUMENTATION UPDATE WILL BE MADE AT THE END OF THIS QUALIFICATION.

4.8.2 Qualification for the following engines:

- ARRIEL 2 C2 CG

4.9 SYNTHAM 2000.4 system (SEMIA Company)

Acquisition system

Laptop Computer (Included)

Fixed Installation Kit Example (On ARRIUS 2B1 - 2B1A - 2B2)

Also included: Specific Engine Kit (Accelerometers / Accelerometer Cables / Tachometer Cable / Work Card)

4.9.1 General

This tool (Four Channels), developed for field use, performs:

- Filtered processing of the signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It does not have the capability to show the variation over time of the N1/NGG and N2/NPT ratings.

It displays the vibration level curve, which is available in real time on a PC screen and can be transferred to paper, in mm/s effective.

A LED "bar graph" allows the overall vibration level to be displayed in real time.

NOTA : This tooling is no longer available at this time, either from SEMIA Company or from Safran Helicopter Engines.

IMPORTANT

ON SEPTEMBER 2018, THE SEMIA COMPANY ANNOUNCED THE OBSOLESCENCE OF THIS TOOL (END OF MANUFACTURING: DECEMBER 2020) AND ITS REPLACEMENT BY THE S5000 / SYNTHAM 5000 SYSTEMS.

HOWEVER, THE SEMIA COMPANY HAS AGREED TO CONTINUE TO PROVIDE:

- **SUPPORT AND REPAIR FOR THIS TOOL UNTIL DECEMBER 2025.**
- **CALIBRATION (AS LONG AS THE SYSTEM RECEIVED IS FUNCTIONAL) UNTIL DECEMBER 2028.**

4.9.2 Qualification for the following engines:

- ARDIDEN 1H1
- ARRIEL 1 (All Variants)
- ARRIEL 2 (Except Variants 2D – 2E – 2N)
- ARRIUS 1 (All Variants)
- ARRIUS 2 (Except Variants 2G1 – 2R)
- ARTOUSTE III B – III B1
- MAKILA 1 (All Variants)
- MTR 390 2C – E
- TM333 2B2 – 2M2
- TURMO III C4 – III C4 UK – IV C

4.10 S5000 and SYNTHAM 5000 systems (SEMIA Company)

Also included: Accelerometers / Accelerometer Cables / Tachometer Cable.

4.10.1 General

These tools (Four Channels), developed for field use, perform (depending on whether or not the tachometer cable is used):

- Filtered processing of the signal with a tracking filter controlled by N1/NGG or N2/NPT ratings. They process the vibration sensor signal, perform Gas Generator First Order (O1 GG) and Power Turbine First Order (O1 PT) extraction.

AND/OR

- A Global (OA) processing of the signal in a dedicated frequency band.

The results, in mm/s RMS, are shown in real time on the display screen of the acquisition module and stored in a database. They can be edited in the form of an automatic report (vibration curves and time plots of engine ratings).

The data can be displayed in graph form and transferred via a USB key to a PC for processing using database software and raw data can be downloaded and sent to Safran Helicopter Engines for analysis.

NOTA : This system is also approved for the High NG Rate Vibration Check on several engine family (if Level 3 / Deep Maintenance Operation).

The S5000 system is dedicated to engine vibration checks only and the SYNTHAM 5000 system is dedicated to both engine and Airframe (Track and Balance) vibration checks.

NOTA : These tools are available from SEMIA.

4.10.2 Changes to interpretation of the Vibration Check results

Safran Helicopter Engines updates, at each new publication, the S5000 and SYNTHAM 5000 vibration check maintenance tasks (acquisition of the Overall level alone without tachometer cable) in order to incorporate a new methodology for interpreting the results of the vibration check.

Thus, once the Maintenance Manual has been updated, it will be linked to the threshold reached:

Level 1	The Engine is Kept in Service.
Level 2	The plots and vibration's **raw** data are sent to Safran Helicopter Engines. The engine is **Temporary Kept in Service** until the data analysis is sent off and recommendations are made by Safran Helicopter Engines.
Level 3	The plots and **raw** vibration data are sent to Safran Helicopter Engines for analysis and recommendations. Refer to the maintenance manual to decide on the actions to be taken

An Update of the S5000 / SYNTHAM 5000 software was specified to HBK (SEMIA Company) and validated by Safran Helicopter Engines in order to integrate these thresholds on the tool acquisition page.

4.10.3 Qualification for the following engines:

- ARRIEL 1B – 1C – 1C1 – 1D – 1D1 – 1E2
- ARRIEL 2B – 2B1 – 2B1A – 2C – 2D
- ARRIUS 1 (All Variants)
- ARRIUS 2B1 – 2B1A – 2B2 – 2F – 2R
- ASTAZOU III / XIV
- MAKILA 1A – 1A1 – 1A2
- MAKILA 2 (All Variants)
- TURMO IIIC4 – IIIC4 UK – IVC

4.11 VIPER 4040 Antach version system (ACES SYSTEMS Company)

Also included: Accelerometers / Accelerometer Cables / Tachometer Cable.

4.11.1 General

This tool (Four Channels), developed for field use, performs:

- Filtered processing of the signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It also shows the variation over time of the N1/NGG and N2/NPT ratings.

The results, in mm/s RMS, are displayed in real time on the acquisition module display unit and saved in a database.

The data can be displayed in graph form and transferred via a USB key to a PC for processing using database software.

It allows vibration and tachometric signals to be saved during engine start.

NOTA : This tool is available from ACES SYSTEMS Company.

4.11.2 Qualification for the following engines:

- ARRIEL 1B – 1D – 1D1
- ARRIEL 2B – 2B1 - 2B1A – 2C – 2CPM – 2C1 – 2C2 – 2S1 – 2S2

5. Other "Stand Alone" equipment usable for performing engine vibration checks

The following systems have been entered in the Maintenance Manual and can therefore be used to perform the engine vibration check. Nevertheless, the technology of these systems does not make it possible to determine the source of the vibrations if vibration limits are exceeded.

5.1 CHADWICK 177M system (CHADWICK-HELMUTH Company)

Also included: Accelerometer/Accelerometer Cable.

5.1.1 General

This tool, suitable for field use, is a spectrum analyzer. It can provide an image of the vibratory behavior of the Gas Generator and the Power Shaft.

The results are expressed in 0-peak IPS (Inches Per Second).

If the permitted limit is exceeded, the vibration values must be sent to Safran Helicopter Engines.

A vibration check using a system (latest generation Global system) may be recommended to enable in-depth analysis and engine diagnostics.

NOTA : This tool is available from CHADWICK HELMUTH Company.

5.1.2 Usable for the following engines:

- ASTAZOU III - XIV
- ARTOUSTE II - III

5.2 CHADWICK-HELMUTH 192A system (CHADWICK-HELMUTH Company)

Also included: Accelerometer/Accelerometer Cable.

5.2.1 General

This tool, suitable for field use, is a spectrum analyzer. It allows to have the image of the vibratory behavior of the Rotating Assemblies (Gas Generator and Power Turbine).

The results, expressed in 0-peak IPS (Inches Per Second), are plotted on paper using a plotting table.

If the permitted limit is exceeded, the plots must be sent to Safran Helicopter Engines.

A vibration check using a system (latest generation Global system) may be recommended to enable in-depth analysis and engine diagnostics.

NOTA : This tool is available from CHADWICK HELMUTH Company.

5.2.2 Usable for the following engines:

- MAKILA 1A – 1A1 – 1A2

6. "On-Board" Vibration check equipment approved by Safran Helicopter Engines

These equipment items, permanently installed on the helicopter, do not require any operation (no prior installation of equipment) other than the downloading of vibration data. This data is analyzed with a ground station.

6.1 EUROARMS/VPU System (AIRBUS HELICOPTERS Company)

6.1.1 General

This system, integrated in the helicopter, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

It systematically records the vibration data from:

- The first engine started, during a run-up from Engine START to FLIGHT.
- The two engines during the flight as per the specifications given by Safran Helicopter Engines.

Data are stored in a PCMCIA memory card and can be transferred after flight to a specific ground station.

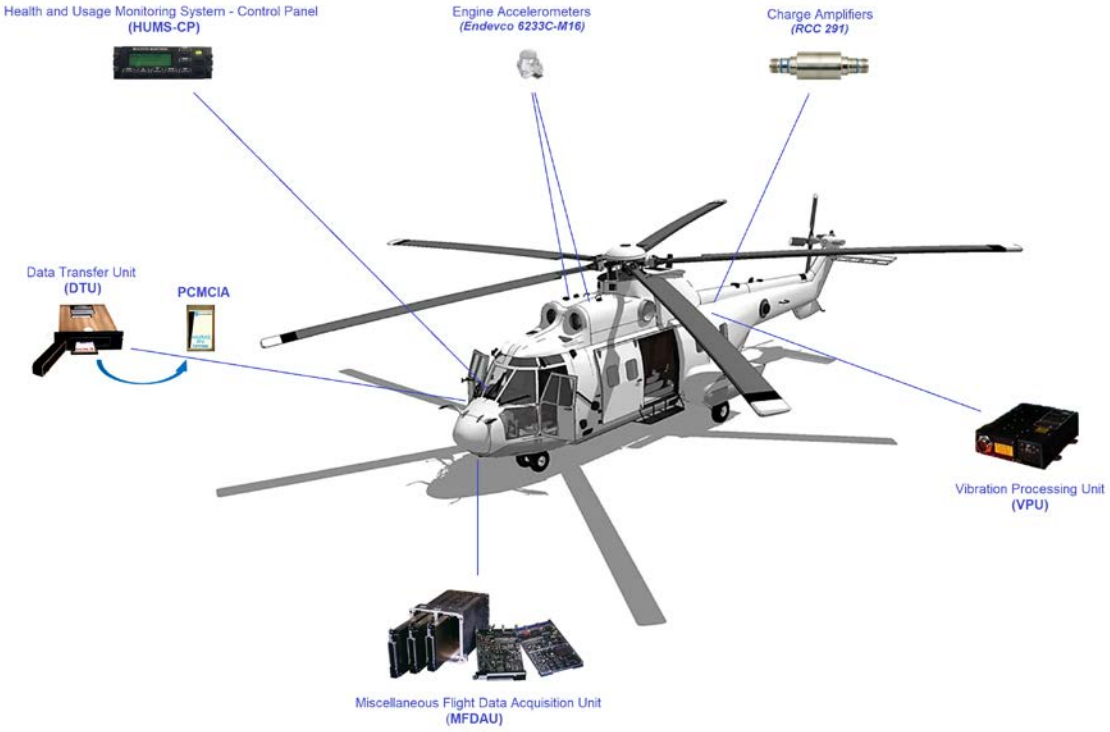
If the permitted threshold is exceeded, the raw vibration data (".332" files) must be downloaded and sent to Safran Helicopter Engines for in-depth analysis and engine diagnostics.

NOTA : This tool is available from AIRBUS HELICOPTERS Company.

6.1.2 Qualification for the following engine:

- MAKILA 1A2

6.2 M'ARMS-type system (AIRBUS HELICOPTERS Company).



6.2.1 General

This system, integrated in the helicopter, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

The system systematically records the vibration data from:

- The first engine started, during a run-up from Engine START to FLIGHT.
- The two engines during the flight as per the specifications given by Safran Helicopter Engines.

Data are stored in a PCMCIA memory card and can be transferred after flight to a specific ground station.

If the permitted threshold is exceeded, the raw vibration data (".dn3" or ".155" or ".225" depending on the aircraft type) must be unloaded and sent to Safran Helicopter Engines for in-depth analysis and engine diagnostics.

NOTA : This tool is available from AIRBUS HELICOPTERS Company.

IMPORTANT

SAFRAN HELICOPTER ENGINES COMPANY AND AIRBUS HELICOPTERS COMPANY AGREED IN OCTOBER 2010 TO UPDATE THE GROUND STATION TO INCORPORATE NEW VIBRATION LIMITS ON THE ARRIEL 2C/2C1 ENGINE FAMILIES.

MAKE SURE THAT THE VIBRATION LIMITS OF THE MAIN GROUND STATION ARE COMPLIANT (REFER TO TASKS "VIBRATION CHECK PROCEDURE - GENERAL" IN THE MAINTENANCE MANUAL.) IF THEY ARE NOT, PLEASE CONTACT THE AIRBUS HELICOPTERS SUPPORT DEPARTMENT.

6.2.2 Qualification for the following engines:

- ARRIEL 2 C – 2 C1
- MAKILA 2 A – 2 A1

7. "On-Board" Vibration check equipment Pending Qualification by Safran Helicopter Engines

These equipment items (Qualification in Progress), permanently installed on the helicopter, do not require any operation (no prior installation of equipment) other than the downloading of vibration data. The data is analyzed with a ground station.

7.1 MDS90 System (AIRBUS HELICOPTERS Company)

Non-Contractual Picture - Refer to Aircraft Maintenance Manual

7.1.1 General

This system, integrated in the helicopter, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

The system systematically records the vibration data from:

- The first engine started, during a run-up from Engine START to FLIGHT.
- The two engines during the flight as per the specifications given by Safran Helicopter Engines.

Data are stored in a PCMCIA memory card and can be transferred after flight to a specific ground station.

If the permitted threshold is exceeded, the raw vibration data (files "VIB102" / "VIB104" depending of the engine position for the data on Ground ♦ "VIB10103" / "VIB10303" depending on the engine position for the In-Flight data) must be downloaded and sent to Safran Helicopter Engines for in-depth analysis and engine diagnostics

NOTA : This tool is available from AIRBUS HELICOPTERS Company.

7.1.2 Qualification (In Progress) for the following engines:

- RTM322 01-9 / 01-9A

7.2 HMS-EVM (Health Monitoring System-Engine Vibration Monitoring) System (AIRBUS HELICOPTERS Company)

Non-Contractual Picture - Refer to Aircraft Maintenance Manual

7.2.1 General

This system, integrated in the helicopter, performs:

- Filtered processing of the vibration signal with a tracking filter controlled by N1/NGG or N2/NPT ratings,
- Global (OA) processing of the signal within a dedicated frequency band.

The system systematically records the vibration data from:

- The first engine started, during a run-up from Engine START to FLIGHT.
- The two engines during the flight as per the specifications given by Safran Helicopter Engines.

Data are stored in a Compact Flash type memory card and can be transferred after flight to a specific ground station.

If the permitted threshold is exceeded, the raw vibration data ("_E.hms" files) must be unloaded and sent to Safran Helicopter Engines for in-depth analysis and engine diagnostics.

NOTA : This tool is available from AIRBUS HELICOPTERS Company.

7.2.2 Upcoming qualification for the following engines:

- ARRIEL 2E
- ARRANO 1A

8. Qualification matrix for the Vibration Check Tooling

Engines	Engine Vibration Check Tools qualified by SAFRAN HELICOPTER ENGINES																
	Stand Alone Systems													On-Board Systems			
	B&K 2513 (8816694000)	B&K 3656-A (TM4865G001)	Valise TM (8817335000)	B&K 3641 A/B	B&K 3648 A/B	B&K 3649 A/B	RT-2000	RT-JEM	SYNTHAM 2000.4	S5000 SYNTHAM 5000	VIPER 4040	CHADWICK 177M	CHADWICK 192A	EUROARMS/VPU	M'ARMS	MDS90	HMS-EVM
ANETO 1		K		K		K											
ARDIDEN 1		H1		H1	H1	H1			H1								
ARRANO 1		A		A		A											A (Qualification In Progress)
ARRIEL 1	All Variants	All Variants	All Variants (Except K - K1)	All Variants	All Variants	All Variants			All Variants	B - D - D1 C - C1 E2	B - D - D1						
ARRIEL 2	All Variants	All Variants		All Variants	All Variants (Except D – E – N)	All Variants		C2 CG	All Variants (Except D – E - N)	B - B1 - B1A - C - D	B - B1 - B1A C - C1 - C2 - CPM S1 - S2				C - C1		E (Qualification In Progress)
ARRIUS 1	All Variants	All Variants	All Variants	All Variants	All Variants	All Variants			All Variants	All Variants							
ARRIUS 2	All Variants (Except G1)	All Variants		All Variants	All Variants (Except G1 - R)	All Variants			All Variants (Except G1 - R)	B1 - B1A - B2 - F - R							
ARTOUSTE II	All Variants	All Variants	All Variants									All Variants					
ARTOUSTE III	B - B1 - D	B - B1 - D	B - B1 - D						B - B1			All Variants					
AST 600		1A	1A														
ASTAZOU III		A - B - C2 - N2								All Variants		All Variants					
ASTAZOU IV		M1 - M3															
ASTAZOU XIV		B - F - H - M - M1								All Variants		All Variants					
MAKILA 1		All Variants	All Variants	All Variants	All Variants	All Variants			All Variants	All Variants (Except 1K2)			All Variants (Except 1K2)	A2			
MAKILA 2		All Variants		All Variants	All Variants	All Variants				All Variants					A - A1		
MTR 390							2C - E		2C - E								
RTM 322		01-9 / 01-9A		01-9 / 01-9A	01-9 / 01-9A	01-9 / 01-9A										01-9 / 01-9A (Qualification In Progress)	
TM 333		2B2 - 2M2		2B2 - 2M2	2B2 - 2M2	2B2 - 2M2			2B2 - 2M2								
TURMO		IIIC4 - IIIC4 UK - IV	IIIC4 - IIIC4 UK - IV	IIIC4 - IIIC4 UK - IV	IIIC4 - IIIC4 UK - IV	IIIC4 - IIIC4 UK - IV			IIIC4 - IIIC4 UK - IV	IIIC4 - IIIC4 UK - IV							