HUMS Arising Management guidelines – General fault description

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Data module	Title
39-A-31-30-00-00A-042A-A	Monitoring and Diagnostic System (MDS) – Description of function
39-A-31-30-00-00A-412A-A	FM Arising Management – Detected fault
39-A-31-30-00-00A-412B-A	TVM Arising Management – Detected fault
39-A-31-30-00-00A-412C-A	RTB Arising Management – Detected fault
39-B-31-30-00-00A-042A-A	Monitoring and Diagnostic System (MDS) – Description of function
39-B-31-30-00-00A-412A-A	FM Arising Management – Detected fault
39-B-31-30-00-00A-412B-A	TVM Arising Management – Detected fault

Description

1 TROUBLESHOOTING GUIDELINES

1.1 FM GUIDELINES

The maintenance procedures following the reporting of a FM Arising by Heliwise should be performed in accordance with the following guidelines:

- If needed, the operator can analyse the FM source data, using the analyse function available for every Arising: following the relevant link, the operator will be presented with the FM Arising and source data form where it would be possible to verify the source data details (occurrence Date&time, Occurrence duration, number of occurrences).

- It is also possible to correlate the FM source data with the Helicopter operating conditions at occurrence recording Date&time using the Basic Usage and Operation Monitoring information and/or the SUM Operations information.

1.2 VM GUIDELINES

The maintenance procedures following the reporting of a VM Arising by Heliwise should be performed in accordance with the following guidelines:

1. Every VM Arising should be authenticated in order to ensure that it is not the consequence of signal corruption or sensor failure.

2. The authenticated VM Arising will not, by itself, cause the request for maintenance actions; these should be substantiated through a confirmation process which should consider:

- The reliability of the exceeding HI
- The comparison to equivalent HI
- The assessment of the HI trend
- Previous experience in similar occurrences
- The assessment of other monitoring results (i.e., chip detections)
- A limited period of close monitoring (refer to [K0077] [K0340] [K0341] [K0342] 39-A-31-30-00-00A-042A-A or [K0698] 39-B-31-30-00-00A-042A-A for details on close monitoring).

3. Unsubstantiated VM Arising will not be sufficient to justify gearbox removal (transmission stripping may be required after substantiation of the fault indication with other TVM results, correlation with other monitoring system outputs, dedicated inspections on the gearbox).

4. The maintenance procedures should avoid as much as possible to cause unnecessary maintenance on the aircraft.

5. Major maintenance actions (e.g. a gearbox replacement) should only be carried out after agreement with the Design Authority (DA).

1.2.1 HI DATA BEHAVIORS

It shall be remarked that the typical HI values may change for several reasons; in addition to the maximum reached HI values, also the shape and slope of the HI trend can provide useful information about the possible cause of the HI modification:

- **Gradual drift:** this can be associated to both a decrease and an increase of the HI, usually caused by long term wear of the component or by "bedding in" after initial installation
- **Rising trend:** a faster rise than gradual drift; normally it indicates a developing fault in the component
- **Step changes:** typically caused by maintenance actions, sensor failures, sensor/calibration changes, but also sudden component failures (e.g. debris ingestion, loss of shaft balance weights) or change in the mode of operation
- **Data spikes:** usually not related to a fault, therefore alerts caused by data spikes can normally be rejected by specific filtering techniques
- **Scattered data:** erratic and widely varying results can be caused by unstable acquisition conditions, inadequate signal quality (including low meshing tone amplitude) and, in some cases, anomalies in the acquisition chain.

  Anyhow, it shall be underlined that a threshold Arising merely indicates that the typical characteristic of the processed vibration signal has undergone such a significant change to exceed the threshold value. This does not necessarily indicate that a fault has occurred.

1.2.2 VM FAILURE DETECTION CAPABILITIES

The VM system effectiveness in terms of failure modes that can be detected by the system is presented in the system qualification documents. These indicate this system as a failure detection method for a well-defined group of components and failure modes, for which the system already proved its effectiveness. The comparison between the detection capabilities listed in the maintenance procedures and the qualification documents highlights the different approach used in the compilation of these two categories of documents.

In fact, qualification documents are characterised by a conservative approach, i.e. the VM system is mentioned as a failure detection method only for those failures where the system already proved its effectiveness.

On the contrary, the applicable fault isolation publication (39-A-AFIP-00-X), also mentions and requires inspection for all the failure modes that can be potentially detected by the system. Of course these additional inspections will be requested as a secondary task to be performed in case the primary failure isolation process fails to identify the source for the HI Arising.

1.2.3 MAINTENANCE PROCEDURE DIVERSITY CRITERIA

The VM system is characterized by the application of an ensemble of analysis algorithms to the vibration signals acquired by the accelerometers fitted on the Helicopter.

Apart from a few exceptions with dedicated processing (notably, multi-mesh gears and epicyclical stage monitoring, RTB monitoring), these analysis algorithms are the same for all the acquisitions and produce the same HI for every monitored component.

Therefore, the recurrent characteristics of the computed VM data reflect into the number of different maintenance procedures which can be defined.

The level of detail in the definition of the different maintenance procedures should take into account the following criteria:

1.2.3.1 Fault detection criteria:
1. The type of component monitored: different inspection procedures will be defined according to the type of component monitored by the HI (e.g. gears/shafts or bearings, rotors) and, consequently, type of performed analysis (synchronous, asynchronous).

2. The type and reliability of the HI: different procedures and inspections will be defined according to the typical trustworthiness of the Arising.

1.2.3.2 Fault isolation criteria:
1. The type of failure modes: different inspection procedures will be defined according to the failure modes monitored by the HI (e.g. localized, distributed defects).

2. Fault isolation capability: the capacity to precisely indicate the transmission component affected by the failure mode which caused the detected Arising. Some HI are focused on single component whilst other only highlight a general modification of the vibration pattern, not attributable to any specific component: different inspection procedures will be defined according to the failure isolation capability of the HI.

3. Location of the monitored component: different inspection procedures will be defined according to the position of the monitored component (e.g. internal to the gearbox or connected to external shafts).

1.2.4 MAINTENANCE PROCEDURE STEPS AND PHASES

The main goal of the definition of effective troubleshooting and maintenance procedures is the minimization of the consequences of the generation of false Arising, while retaining the capability of correctly identifying the genuine failure indications.

It is well known that the VM system may generate Arising at a rate which is some orders of magnitude higher than the real failures which the system shall monitor; the achievement of a low number of unnecessary maintenance actions on the helicopter transmission is a firm recommendation in the aviation authority requirements and is a crucial issue to achieve the required trustworthiness on the VM system.

The VM system should indicatively produce:

- No more than one maintenance request every 50 Flight Hours
- The number of alarms not exceeding the 5% of the total number of Arising.

A “false alarm” is defined as an "alert that after further processing or investigation has resulted in the unnecessary removal of a component or nugatory maintenance action". It is therefore evident

that effective Arising assessment and filtering procedures, to be applied to the available VM data, play an important role in achieving the expected false alarm rate.

To this aim, the troubleshooting and inspection procedures should be split, whenever possible, into successive phases of increasing effort in terms of maintenance on the helicopter, which, besides, also correspond to a decreasing effort in terms of VM data assessment:

- **1. VM data validation:** following the generation of a VM Arising, this first phase only involves the validation of the VM data, aiming at rejecting the Arising indications which are due to sensor failures, data corruption or are the direct consequence of maintenance performed on the transmission system; this usually involves the evaluation of secondary HIs which monitor the quality of the processed signal, but also, when available, the cross correlation of comparable results relevant to equivalent VM analyses. No direct access to the Helicopter shall be requested at this stage, apart from inspections on the VM system components.

- **2. HI and TVM signal analysis:** this second phase involves the assessment of the VM data validated in the previous phase, aiming at either rejecting the Arising which are clear false alarms or confirming the indications which are authenticated by the validation checks; it is accepted that in some cases the checks will not be sufficient to definitely reject or authenticate the Arising; in the latter case the DA can be consulted through standard enquiry forms. The tasks in this phase may involve both the evaluation of the historical trend of the computed HI, but also, when available, the close inspection of the signals downloaded by the on-board system. No direct access to the helicopter transmission system is planned at this stage. The availability of similar former occurrences may support this analysis; this particularly applies to the inquiries to the DA. This phase may also include a limited period of close monitoring during the following flights.

- **3. Inspections:** when the assessment of the VM downloaded data is not sufficient to clearly tag the Arising as a false alarm, or when the downloaded data suggest a possible failure on the transmission/rotor, the maintainer will be called to perform specific inspections on the transmission/rotor; considering the failure isolation capabilities of the VM system, the inspections will generally be directed on a specific component or, in the worst case, a limited portion of the helicopter transmission/rotor system. Similarly, indications about the possible failure will be given to the maintainer. In order to reduce the false alert rate, the inspection procedures defined in this phase will be split into different steps, initially involving visual (i.e. minor) inspection procedures and, later, detailed (i.e. major) ones. It shall be remarked that the effectiveness of the inspections on the transmission/rotors is greatly dependent on the type of postulated failure: some failure modes as well as some failure locations can hardly be directly inspected. Other monitoring system outcomes can be used to substantiate the alert. The troubleshooting procedures will take into account these characteristics.

- **4. Component adjustment:** when the component location and the type of the detected anomaly allow to perform an adjustment (e.g. shaft re-indexing, RTB activities) such a maintenance action will be specified in the troubleshooting procedure.

- **5. Component removal:** when the transmission inspections described above are not sufficient to either identify or exclude a transmission component failure, the DA may advise the customer to remove the suspected component (at LRU level) for detailed inspections, including stripping. This implies that such a removal needs to be agreed with the DA following a request for VM data analysis support. Considering the effort associated to such a request, especially if the removal involves a large gearbox, it can be understood that this last step of the troubleshooting process will only be directed when there is the reasonable confidence that a failure is present

and following a careful assessment of the VM available data, including the historical database which is maintained by DA and VM system provider.

1.2.5 ARISING VALIDATION GUIDELINES

1.2.5.1 TVM ARISING VALIDATION

1.2.5.1.1 DATA CROSS CHECK

The first step of the TVM Arising validation procedure implies the cross check of the TVM Arising with other transmission faults which may also indicate possible drive system failures.

The check aims at assessing the general condition of the rotor drive system by concurrently considering the health data reported by TVM and other systems designed to monitor different failure effects of the same failure mode (e.g. temperatures, pressures, debris oil contamination, accessories operational status, etc.) . The detection of other failure effects substantiates the TVM Arising and allows to skip the initial validation phase, passing directly (if required by the overall assessment of the failure data) to the inspection phase.

The operator should check the simultaneous presence of both a drive system faults and an Arising in one of the TVM monitored components.

In case such a combination is not present, the operator should pass to the following TVM failure isolation step. In practice, the TVM occurrence should be individually managed without the support of any additional drive system fault indication.

In case a combination is present, the operator should initially carry out the fault isolation procedure specified by the applicable fault isolation publication (39-A-AFIP-00-X) for the drive system fault. In case the inspections are sufficient to isolate the drive system anomaly, the operator should perform the relevant corrective maintenance and, in parallel, can close the TVM Arising assessment procedure. In case the fault isolation procedures does not allow to identify the drive system anomaly (or even to enhance the inspection thanks to the fault isolation capabilities of some TVM analyses), the operator should directly pass to the visual inspection of the involved component. Under specific circumstances, when the execution of the available fault isolation and TVM procedures does not allow to identify any drive system anomaly, the operator can request support from the Helicopter Manufacturer.

1.2.5.1.2 ACQUISITION VALIDATION

The operator should initially validate the reliability of the Arising, in order to ensure that it is not caused by sensor failure nor signal corruption.

The acquisition validation check aims at discarding the HI originated by the analysis of signals acquired by failed or not properly installed sensors; these anomalies may cause signal corruption and ultimately the Arising of the relevant thresholds.

Signal corruption and unreliable results are highlighted by the presence of the corresponding FM Arising on the VM instrumentation.

1.2.5.1.3 ACQUISITION CROSS CHECK

The operator should then validate the reliability of the Arising by cross-checking the results of the component (i.e. acquisition) which generated it with comparable values computed on the same transmission part using a different sensor. These equivalent analyses are identified with different component names, usually by explicitly referring to the input sensor.

This check aims at inspecting the consistency of the health data computed by the ON-BOARD SYSTEM in the situation where equivalent information is generated by more than one TVM acquisition. As a result, the check can also allow to authenticate the genuine Arising indications.

Considering the redundancy of the acquisitions and analyses techniques of the TVM system, this cross check can only be performed on a subset of the TVM acquisitions.

The operator should first verify if a sufficient number of data for at least one of the other Acquisitions belonging to the group are available in the same operation interval of the component which generated the Arising.

If no comparable data are available, the operator should skip this step, otherwise, the operator should check the trend of the same HI on the other acquisitions belonging to the same group.

In case the other acquisitions do not show any indication of component degradation trend considering the same Helicopter operations interval of the acquisition with Arising, the Arising can be considered as spurious.

In case the cross-check of the other HI/Acquisitions does not allow to unequivocally either refused or validate the Arising, the operator should pass to the following step.

1.2.5.1.3.1 DATA CROSS CHECK CRITERIA

The data cross-check is based on the comparison of the trend of the same HI computed by different acquisitions; typically, real failures cause the increase of all of the analyses performed by different sensors, whilst sensor anomalies only affect a single acquisition. Differences due to the different signal transmission paths may be expected. The data cross-check requires, for Arising validation, that at least one of the other HI/components of the group shows a similar HI degradation trend.

It is understood that this check also involves some subjective engineering judgment, therefore it is recommended to tag the Arising as spurious only if there is sufficient confidence that the other acquisitions do not show any component degradation trend. Uncertain data patterns should not allow to invalidate the Arising; in this case the operator should proceed to the following step.

1.2.5.1.4 HI CROSS CHECK

The operator should then validate the reliability of the Arising by cross-checking the results of the HI which generated it with subsidiary HI computed on the same component.

This check aims at assessing the reliability of the HI Arising by looking at the quality and adequacy of the acquired signal, as measured by secondary HI computed on the same component; these further HI may have either general applicability (when they measure the quality of the acquired signal and are used to assess all of the primary HI) or a specific role (when they measure specific features of the acquired signal and are used to validate one or few HI).

Depending on the exceeding HI, this assessment could also be performed more than one time using different validation criteria.

If the subsidiaries HI confirm the reliability of the HI Arising, the operator can pass to the following step, otherwise the Arising can be considered as a spurious indication; no further actions are required to manage the TVM Arising. In order to define an Arising as spurious, it is sufficient that one of the HI validation criteria fails.

1.2.5.1.5 MAINTENANCE CHECK

The operator should then verify if the Arising was caused by previous maintenance actions performed on the helicopter transmission system.

This check aims at ensuring that the HI Arising was not caused by maintenance actions previously performed on the aircraft, which modified the transmission configuration, ultimately leading to the modification of the vibration pattern. Changes in the vibration pattern may cause the HI threshold Arising.

These modifications are characterized by step changes in the HI values exactly in correspondence of the maintenance action. No increasing trend is usually associated to such occurrences.

The operator should first identify the location of the component which caused the Arising. The operator should then verify if maintenance (e.g. replacement, removal/installation, shaft re-indexing) was performed on the component, or higher level assembly containing the component, at the time when the HI step is detected.

In order to accomplish this task, the operator should also plot the HI trend and identify the step change date and time. If no maintenance actions can be identified on the component at the step change date and time, the operator should skip this step.

If a possible HI/maintenance relationship is identified, the operator should first ensure that the maintenance activity was properly executed and certified. In case of successful verification, Arising can be considered as a consequence of the maintenance action.

1.2.5.1.6 HI TREND CHECK

The operator should then validate the reliability of the Arising by assessing the historical trend of the HI which generated it.

This check aims at establishing the reliability of the HI Arising by assessing the consistency of the HI historical behaviour, considering the HI values, distribution and growth. This exercise should also take into account the outcome of previous similar occurrences. As a result, the trend validation check can also allow to authenticate the genuine Arising indications.

The trend checks may have either general applicability (when the assessment rules are the same for all of the HI) or a specific target (when they consider specific features of each single HI type).

If no indications of validation criteria are provided for the involved HI, the operator should skip this step, otherwise, the operator should check the HI trend data according to the rules provided. Depending on the exceeding HI, this assessment could also be performed more than one time using different rejection and validation criteria.

In case at least one check can provide a definite indication of Arising refusal the operator should consider the Arising as a spurious indication; no further actions are required to manage the TVM Arising.

If no one of the checks can provide a clear and unambiguous indication of either rejection or confirmation, the operator should pass to the following step.

1.2.5.1.7 Trend Assessment Display Settings

The HI trend assessment mainly relies on the display of the historical data present in the database; the effectiveness of this task is affected by the following factors:

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Amount of available historical data: a low number of historical results (e.g. immediately following the installation of the monitored component) reduces the effectiveness of the trend check
- Distribution of the historical data: trend data relevant to helicopter operations separated by large interruptions are best analysed using the Helicopter “Flight Hours” as time axis selection, instead of “Date/Time”.

1.2.5.2 SIGNAL ANALYSIS

The operator should validate the reliability of the Arising by checking the signal which generated it.

This check aims at verifying the trustworthiness of the computed HI in order to ensure that the Arising was not caused neither by signal corruption or distortion. This check requires the display and examination of the signal causing the threshold Arising, possibly in comparison to previous signals within the threshold value. It is particularly important, during this assessment, to inspect the presence and evolution of the specific signal features which may confirm the presence of a genuine failure.

Considering that this check requires some experience in order to carefully assess the signal characteristics, it should not be considered as mandatory and should only be performed by qualified personnel.

The signal analysis is based on:

- The correlation between the computed HI values and the characteristics of the analysed signals or the relevant spectrum
- The detection and quantification of the signal features which caused the threshold Arising.

As a result, the signal analysis check can also allow to authenticate the genuine Arising indications.

This check only applies to a limited number of HI among those computed by the ON-BOARD SYSTEM.

The operator should check the characteristics of the exceeding signal and, if possible, of previous signals, in order to:

- Verify if the Arising is the result of signal corruption/distortion
- Identify and evaluate the expected signal features correlated to the exceeding parameter.

If the inspection highlights an unambiguous indication of signal corruption/distortion, the operator should consider the Arising as a spurious indication; no further actions are required to manage the TVM Arising.

Otherwise, if the inspection does not either allow to clearly highlight any indication of potential signal corruption/distortion, the operator should pass to the following step.

1.2.5.3 AVDM ARISING VALIDATION

The AVDM Arising validation involves the determining of maintenance performed, the trend type and TVM HIs crosscheck aiming at rejecting the Arising generated due to sensor fault, data corruption, maintenance influenced step change, or unreliable threshold setting.

1.2.5.3.1 MAINTENANCE CHECK

Refer to Para 1.2.5.1.5

1.2.5.3.2 AVDM HI TREND CHECK

The operator should validate the reliability of the AVDM Arising by assessing the historical trend of the HI which generated it.

This check aims at establishing the reliability of the AVDM Arising by assessing the consistency of the HI historical behaviour, considering the HI values, distribution and growth. This exercise should also take into account the outcome of previous similar occurrences. As a result, the trend validation check can also allow to authenticate the genuine Arising indications.

The following general criteria may apply:

- **HI step change**: This behaviour may be due to maintenance activity performed on the related component, as a result of a mechanical fault (e.g., TRDS balance weight fall-off) or of HUMS hardware replacement (e.g., accelerometer replacement).
- **HI rising trend:** This behaviour usually occurs as a result of the component wear/fault. Clear rising trend is highly unlikely a result of an instrumentation fault.
- **Scattered trend**: This behaviour can be due to instrumentation or data processing issue, but also to the normal behaviour of a particular component.
- **Signal spikes**: This behaviour can be due to the flight profile or to impending instrumentation issue, but also to unreliable threshold setting
- **Stable trend above the threshold**: This behaviour can be due to unreliable threshold settings.

1.2.5.3.3 PROBABILITY COMPUTATION ANALYSIS

When the AVDM Arising has been validated, the operator should then check and analyse the results of the probability computation in order to identify the TVM HIs group (e.g. imbalance/misalignment) most involved in the AVDM Arising generation.

The results of the probability computation are displayed using Radar Charts. Each Radar Chart displays in separate branches the probability associated to the normal/failure condition. Different AVDM Radar Chart types are displayed, based on the way the probability computation is performed: the operator should take into consideration the chart that has highlighted more clearly a possible failure condition.

1.2.5.3.4 TVM HI ANALYSIS

After the most involved TVM HIs group has been identified, the operator should perform the analysis of the relevant TVM HIs (refer to Para 1.2.5.1.7).

1.2.6 ROTOR DRIVE SYSTEM VISUAL INSPECTION

In order to reduce the incidence of nugatory maintenance actions, this first inspection task shall only involve visual inspections.

The investigations aim at identifying and isolating failure evidences which can substantiate the HI Arising without requiring major maintenance burden.

Considering the failure isolation capabilities of the TVM system, the inspections will generally be directed on a specific component or, in the worst case, a limited portion of the rotor drive system.

Similarly, indications about the possible failure mode to be scrutinized, based on the exceeding HI, will be given to the maintainer.

It shall be remarked that the effectiveness of the inspections on the transmission is greatly dependent on the type of investigated failure: some failure modes as well as some failure locations can hardly be inspected.

In general, the maintainer will be required to inspect:

- The monitored component itself (not applicable to gearbox internal components)
- The shaft supporting the monitored component (not applicable to gearbox internal components)
- Any item driven by (or connected to) the monitored component (and relevant shaft) and rotating at the same frequency (e.g. gimbals, flanges, flex couplings) (when applicable)
- The bearings supporting the monitored component and the relevant shaft (when feasible and applicable)
- The area of drive system surrounding the above listed components (when applicable)
- The structural fittings supporting the monitored component or transmission assembly (when applicable).

If the visual inspections allow to identify evidence of failure, the maintainer should proceed as specified in the Aircraft Maintenance Manual (39-A-AMP-00-X) in order to isolate the fault and correct it.

If the results of the visual inspections are not sufficient to identify any failure evidence, the maintainer should pass to the following troubleshooting step (detailed drive system inspections).

1.2.6.1 Visual Inspection Procedures

Every time it is required to inspect the transmission, the maintainer should:

- Verify the chip detector plugs relevant to the gearbox involved into analysis.

It shall be noted that the assessment of the TVM data may focus the investigations on a specific component and/or failure mode. Whenever possible, the results of this assessment should be used to prioritize the components and failure mode to be inspected.

1.2.7 ROTOR DRIVE SYSTEM DETAILED INSPECTION

When the results of the visual inspections are not sufficient to identify any failure evidence, the maintainer should perform detailed inspections on the drive system

This second inspection step still aims at identifying and isolating failure evidences which can substantiate the Arising. It shall be considered as a delta investigation which integrates the previous one, by making use of any possible and effective inspection procedure not already applied in the previous visual inspection of Para 1.2.5.

The criteria for the definition of the inspection procedures are equivalent to the ones previously described, with the only exception of the type of required investigations.

In general, the maintainer should be required to inspect:

- The monitored component itself (this may involve a borescope inspection, especially for gear teeth)
- The shaft supporting the monitored component
- Any item driven by (or connected to) the monitored component (and relevant shaft) and rotating at the same frequency (e.g. gimbals, flanges, flex couplings) (when applicable)
- The bearings supporting the monitored component and the relevant shaft (when feasible and applicable)
- The chip detectors of the gearbox containing the monitored component (if applicable)
- The area of drive system surrounding the above listed components (when applicable).

If the detailed inspections allow to identify evidence of failure, the maintainer should proceed as specified in the Aircraft Maintenance Manual in order to isolate the fault and correct it.

If the results of the visual inspections are not sufficient to identify any failure evidence, the maintainer should pass to the following troubleshooting step (component adjustment).

1.2.8 COMPONENT ADJUSTMENT

For external drive system shafts, the operator has the possibility to modify the level of the generated vibrations. Depending on the shaft location, this can either be achieved through:

- The so-called shaft re-indexing, a tuning procedure which allows to modify the relative angular position between coupled shafts. It is known that, although balanced at individual shaft level, the shaft assemblies can occasionally show high 1xRev and 2xRev vibration levels (measured by dedicated HIs), which can be reduced by rotating one shaft with respect to the other
- The Rotor Track and Balance procedure, for the gearbox output shafts connected to Main or Tail Rotors.

In case the HI threshold Arising affects a component/HI authorized for adjustment process, the operator can perform the relevant procedure (refer to the Aircraft Maintenance Manual). The successful rectification of the Arising can be assessed through the analysis of the data acquired in the following flight.

Specifically, for the shaft re-indexing process, it shall be remarked that this procedure involves an empirical approach, therefore the immediate and simultaneous 1xRev and 2xRev reduction cannot be assured. Moreover, the accomplishment of the desired vibration level may involve the repetition of the process.

If the shaft re-indexing process allowed to reduce the shaft vibration level below the threshold values, the operator can close the troubleshooting procedure.

In case:

- The shaft re-indexing process did not allow to reduce the shaft vibration level below the threshold values, or
- The Component/HI is not authorized for adjustment process (e.g. HI Arising relevant to internal gearbox components or to HI which cannot be affected by the re-indexing process),

the operator should pass to the following step.

WARNING: The operator should be made aware of the potential hazardous effect of the misuse of the component adjustment process: if the adjustment process is continuously performed during a failure development phase, it may mask the HI increase, thus preventing the successful detection of the failure. The operator should avoid frequently repeating the component adjustment process on the same component within a small amount of Flight Hours (indicatively 25 FH) without the Manufacturer authorization.

1.2.9 COMPONENT REPLACEMENT

This is the last step of the troubleshooting procedure; it is only attained if the troubleshooting procedure did not isolate a transmission failure as a possible reason for the HI Arising.

In this case, the operator should contact the DA for support; the manufacturer instructions may initially comprise a Close Monitoring phase to assess the HI evolution in the following Helicopter operations, but they can also arrive at the request for component replacement. Considering the

required maintenance effort and the level of maturity of the system, the component replacement will only be instructed following careful assessment of all of the available data.

2 ARISING MANAGEMENT

The following procedure shows the actions to be performed when one or more Arising are visible in Heliwise after the debrief of a new DSN.

Open Heliwise and identify the arising generated in the latest non-analysed debriefed DSN(s).

For every Arising, determine its type as shown in Fig 1:

- If a FM Arising is present refer to [K0077] [K0340] [K0341] [K0342] 39-A-31-30-00-00A-412A-A or [K0698] 39-B-31-30-00-00A-412A-A
- If a TVM Arising is present refer to [K0077] [K0340] [K0341] [K0342] 39-A-31-30-00-00A-412B-A or [K0698] 39-B-31-30-00-00A-412B-A
- If a RTB Arising is present refer to 39-A-31-30-00-00A-412C-A.