AP 101B-1300-5G1
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# HUNTER (ALL MARKS)

## VIBRATION ANALYSIS SCHEDULE

BY COMMAND OF THE DEFENCE COUNCIL

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Ministry of Defence



Sponsored for use in the

ROYAL AIR FORCE by MOD AIR ENG 30d

Prepared by Central Servicing Development Establishment, RAF

Service users should send their comments through
the channel prescribed for the purpose in:

AP 100B-01 Order 0575 (RAF)

## AMENDMENT RECORD CERTIFICATE

1. This certificate is for Ministry of Defence (Air) ALs only.
2. Amendments are to be inserted in numerical sequence except where Non-Availability slips for particular ALs are issued.

| AL No. | AL MONTH AND YEAR OF ISSUE | AMENDMENT INCORPORATED SIGNATURE | DATE OF INCORPORATION |
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## INTRODUCTION

1. This Topic 5G1 has been introduced to provide condition monitoring of rotating components by establishing vibration characteristics.

2. Glossary. The servicing operations detailed in all parts of this schedule have the meaning given in the Concise Oxford Dictionary except for the following:

a. Inspect. Review the work carried out by tradesmen to ensure it has been performed satisfactorily.

b. Check. Make a comparison of a measurement of time, pressure, temperature, resistance, dimension or other quantity with a known figure for that measurement.

c. Test. Ascertain, by using the appropriate test equipment, that an item or system functions correctly.

d. Examine. Carry out a survey of the condition of an item. For example, the condition of an item can be impaired by one or more of the following:
(1) Insecurity of attachment.
(2) Cracks, fractures or crazing.
(3) Delamination (of honeycomb/composite structure).
(4) Corrosion, contamination or deterioration.
(5) Distortion.
(6) Loose or missing rivets.
(7) Chafing, fraying, scoring or wear.
(8) Faulty or broken locking devices.
(9) Loose clips or packing on, obstruction of, or leaks from pipelines.
(10) External damage.
(11) Overheating or leaking of fluids, possibly indicated by discolouration.

e. Examine as far as possible. This operation has the same meaning as 'Examine', but is used only where access to an item is restricted and the examination is to be limited to the area which is accessible.

f. Operate. Ensure an item or system functions correctly, as far as can be ascertained without the use of test equipment or reference to measurements.

g. Replenish. Refill a tank, bottle, or other container to a predetermined level, pressure or quantity, and where necessary:
(1) Remove caps, or covers from filler orifices and/or drains.
(2) Clear orifices.
(3) Fill container as directed in item operation.
(4) Ensure drains are free from obstruction.
(5) Ensure gaskets and caps or covers are free from damage.
(6) Refit caps or covers.
(7) Fit locking devices as necessary.

h. Fit. Correctly attach one item to another.

j. Refit. Fit an item which has been previously removed.

k. Replace. Remove an item and fit new or serviced item.

l. Disconnect. Uncouple or detach cables, pipelines or conduits.

m. Reconnect. Reverse of sub-para l.

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|---|---|---|
| n. | Verify. | Ascertain that the conditions are correct. No remedial action is to be taken but the appropriate authority is to be informed. |
| p. | NB: | A mandatory instruction. |
| q. | Note: | An advisory instruction. |

3. Additional Servicing. The instructions contained in all parts of this schedule do not absolve personnel from responsibility for acting upon circumstances which may come to their notice indicating the need for additional servicing.

4. New or amended matter will be indicated by triangles (▶ ◀) to show the extent of the amendment.

5. Amendment procedure is detailed in AP100B-01 Order 0561.

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## SERVICING NOTES

1. When using the Analyser VM3C Mk II (VM3C) the following precautions are to be taken:

   a. The padded carrying bag is to be used when handling/storing the VM3C.

   b. Accelerometer is to be handled with care - sharp blows can shatter the Piezo Electric Crystals.

   c. Cables are to be handled with care and are not to be used when coiled.

2. Equipment is to be calibrated every 12 months.

3. VM3C batteries are to be re-charged immediately after use.
Note: The batteries cannot be over-charged.

4. Control of this equipment for both calibration and repair is exercised by the Unit EETEC.

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Safety and Servicing Notes are to be read and complied with throughout the work detailed in this technique.

| | | |
|---|---|---|
| 1. | Technique. | HUNTER/VIB/1. |
| 2. | Components to be Examined. | Engine change unit and associated engine driven components. |
| 3. | Purpose of Test. | To obtain vibration signatures. |
| 4. | Equipment Required. | (i) 4XV/2084599 Analyser VM3C Mk II (VM3C).<br>(ii) 4XV/2141536 Accelerometer CA900-6.<br>(iii) 4XV/2141529 Cable low noise 16 metre.<br>(iv) LM Accelerometer Mounting Bracket. (Fig.1 Avon 122, Fig.2 Avon 207).<br>(v) 4XV/2141526 High Pass Filter (45 Hz).<br>(vi) 4XV/4826 Low Pass Filter (320 Hz). |
| 5. | Preparation - Aircraft. | |
| 5.1 | Gearbox access panel. | Open. |
| 5.2 | Accelerometer. | Fit to mounting bracket. |
| 5.3 | Mounting bracket. | Fit to engine on the compressor casing/front bearing housing joint at 5 o'clock position facing forward. (Fig.3 Avon 122, Fig.4 Avon 207). |
| 5.4 | Cable. | (i) Connect to accelerometer.<br>(ii) Connect to VM3C. |
| 6. | Preparation - Equipment. | |
| 6.1 | VM3C. | |
| | (a) Top panel. | Remove. |
| | (b) High pass filter. | Ensure in position '1'. |
| | (c) Low pass filter. | Ensure in position '4'. |
| | (d) Filter selector switch. | Set to 'FILT 1-4'. |
| | (e) Top panel. | Refit. |
| | (f) Supply mode switch. | Set to 'CHECK BATT'. |
| | (g) Meter. | Ensure indicating in Blue zone. |
| | (h) Supply mode switch. | Set to 'ON'. |
| | (j) Mode switch. (Outer). | Set to 'MAGN TEST'. |
| | (k) Mode switch. (Inner). | Set to 'TEST'. |
| | (l) Meter. | Ensure indicating in upper Blue zone. |
| | (m) Filter centre frequency (FCF) coarse switch. | Set to '100 ÷ 330 Hz'.<br>Note: This action defines the range of FCF fine control as being between 100 and 330 Hz. |

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| | | |
|---|---|---|
| (n) | FCF fine tuning control. | Adjust slowly to obtain maximum meter deflection. (150 Hz minimum 175 Hz maximum). |
| (p) | Sensitivity switch. | Set to '10 pC/g' using slot as pointer. |
| (q) | Mode switch. (Outer). | Set to 'PIEZO'. |
| (r) | Mode switch. (Inner). | Set to 'DISPL'. |
| (s) | Range switch. | Set to 40 on Red scale (0.01 in. as indicated on mode switch). Note: This defines the meter full scale as 40 x 0.01 = 0.40 in. |
| (t) | FCF coarse switch. | Set to 'OFF' to put VM3C into broadband mode. |

7. Broadband Vibration Recording

NB 1 During vibration recording the vibration limits for continuous running are shown in Fig.5.

NB 2 If broadband limits are reached, hold the engine at the same rev/min and carry out Vibration Analysis.

| | | | |
|---|---|---|---|
| 7.1 | Engine. | (i) | Start in accordance with relevant publications. |
| | | (ii) | Run until normal operating temperatures are obtained. |
| | | (iii) | Set to 'GROUND IDLE'. |
| 7.2 | VM3C. | | |
| | (a) Range switch. | | Adjust range setting until meter reading approximately 2/3 scale. |
| | (b) Meter. | | Record reading. |
| 7.3 | Engine. | | Repeat Sub-item 7.2 for the following rev/min settings: '3 000, 3 500, 4 000, 4 500, 5 000, 5 500, 6 000, 6 500, 7 000, 7 200, 7 400, 7 600, 7 800, 8 000 and 8 100'. |
| 7.4 | Meter readings obtained in Sub-items 7.2 to 7.3 inclusive. | (i) | Plot on graph of amplitude versus per cent rev/min. (Fig.5). |
| | | (ii) | Compare results with previous graphs for same engine and note trends. |

8. Vibration Analysis.

NB Sub-items 8.1 to 8.4 inclusive are applicable only if maximum vibration levels are exceeded during Sub-items 7.2 and 7.3.

| | | |
|---|---|---|
| 8.1 | Engine. | Accelerate to rev/min setting which exceeded vibration limits. |
| 8.2 | Component frequency chart. (Fig.6 Avon 122, Fig.7 Avon 207). | Note frequency value of IE and accessories for rev/min set in Sub-item 8.1. |

8. Vibration Analysis. (Contd)

| | | |
|---|---|---|
| 8.3 | VM3C.<br>(a) FCF coarse switch.<br>(b) FCF fine switch.<br>(c) Meter. | Set to give required range, and tune to give maximum deflection on meter scale for frequencies noted in Sub-item 8.2. Record readings. |
| 8.4 | Vibration limits chart. (Fig.5). | Refer to and compare with meter readings recorded in Sub-item 8.3. Rectify or reject engine as necessary. |

9. Recovery.

| | | |
|---|---|---|
| 9.1 | Cable. | Remove. |
| 9.2 | Accelerometer complete with mounting bracket. | |
| 9.3 | Bolt. | Refit to compressor casing/front bearing housing joint and torque load in accordance with relevant publications. |
| 9.4 | Gearbox access panel. | Close. |

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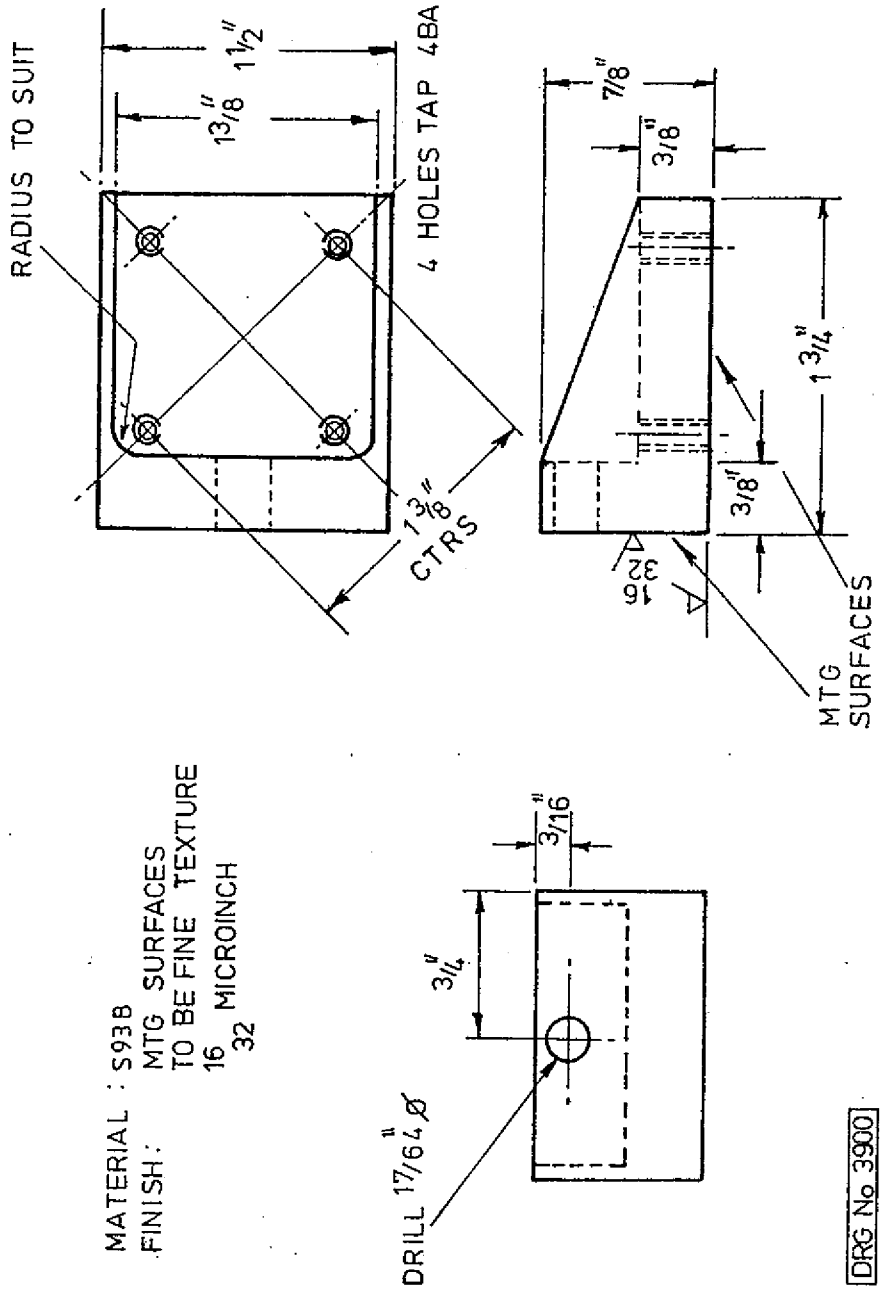


Fig.1 Avon 122 Accelerometer Mounting Bracket

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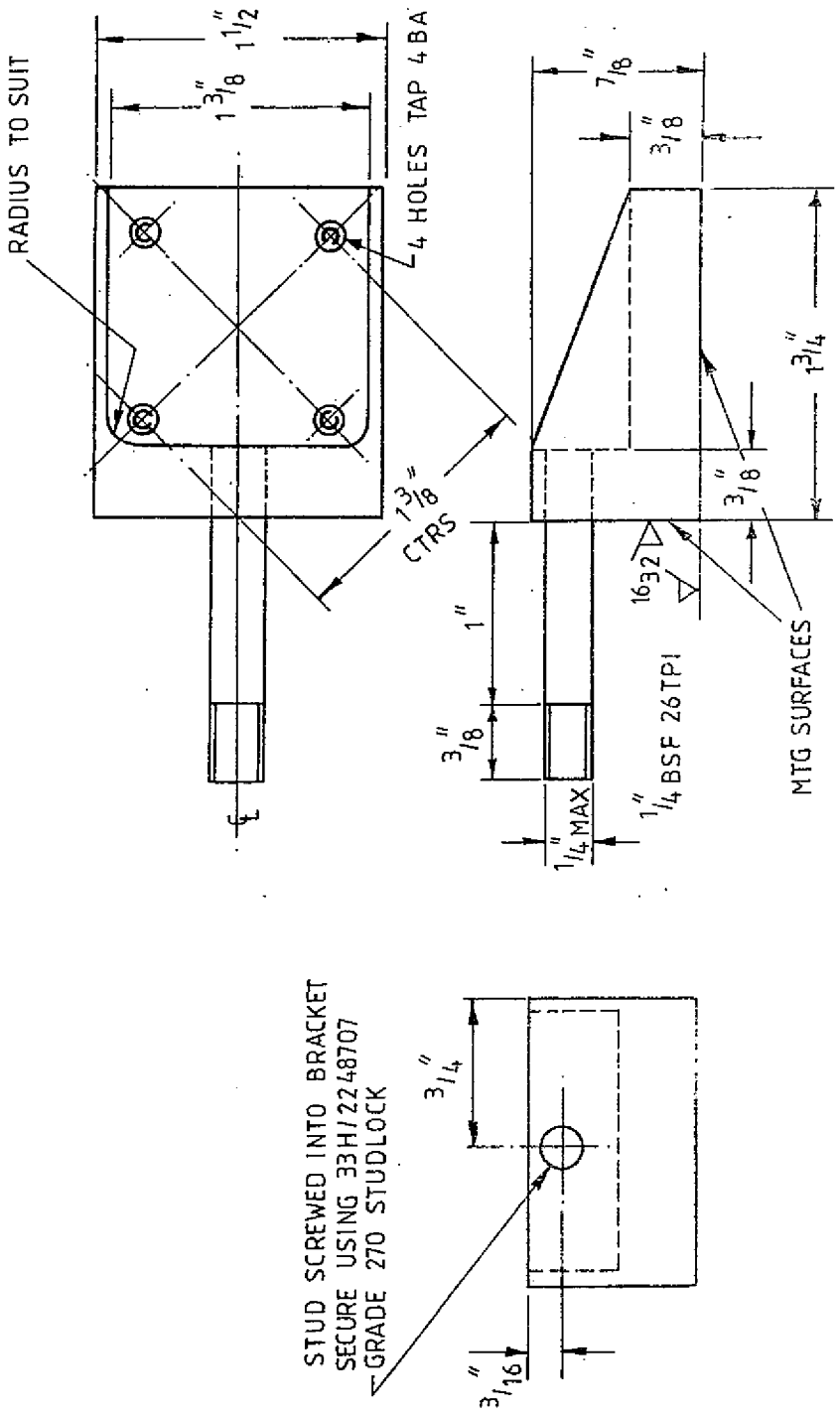


Fig.2 Avon 207 Accelerometer Mounting Bracket

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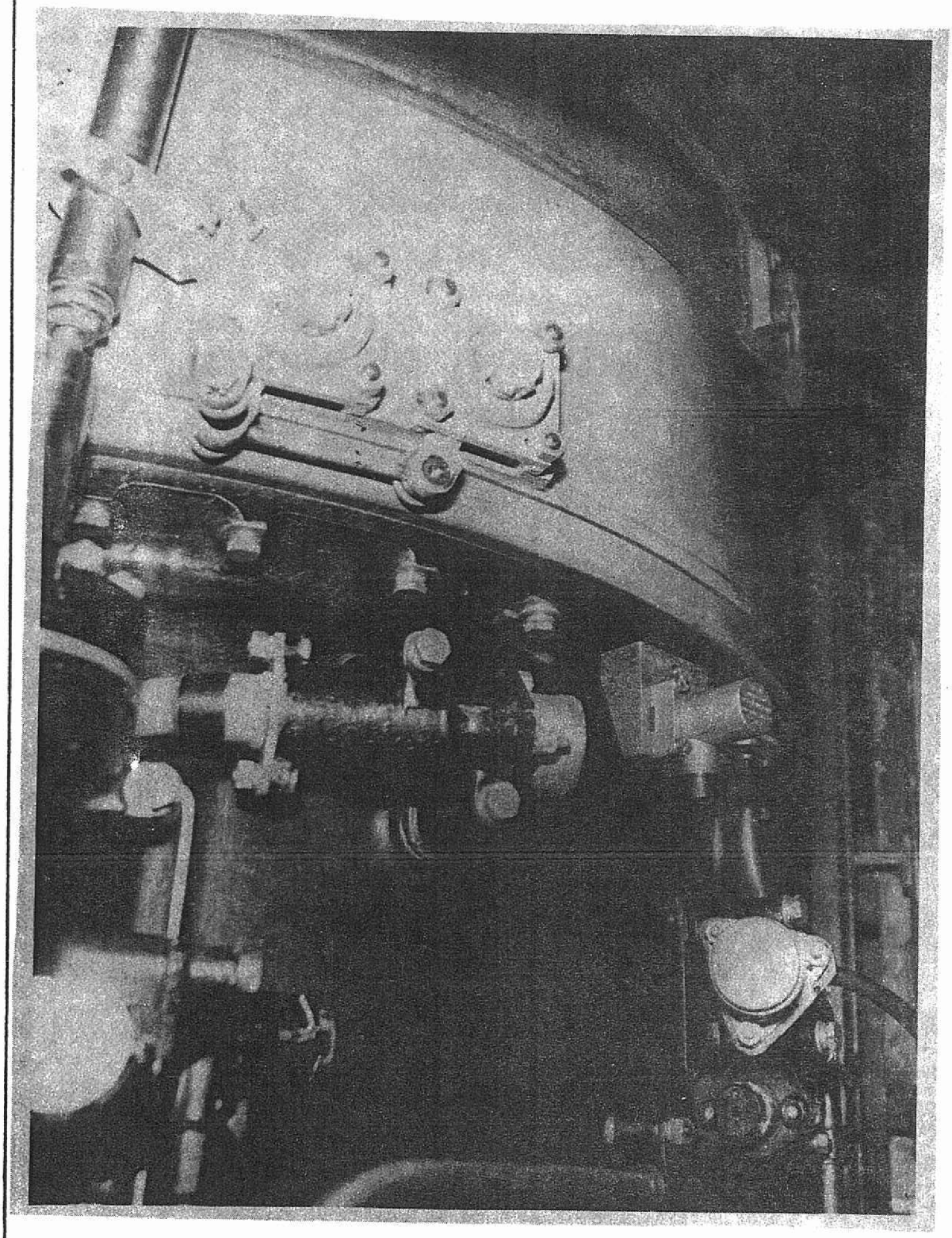

Fig.3 Avon 122 Accelerometer and Mounting Bracket Position

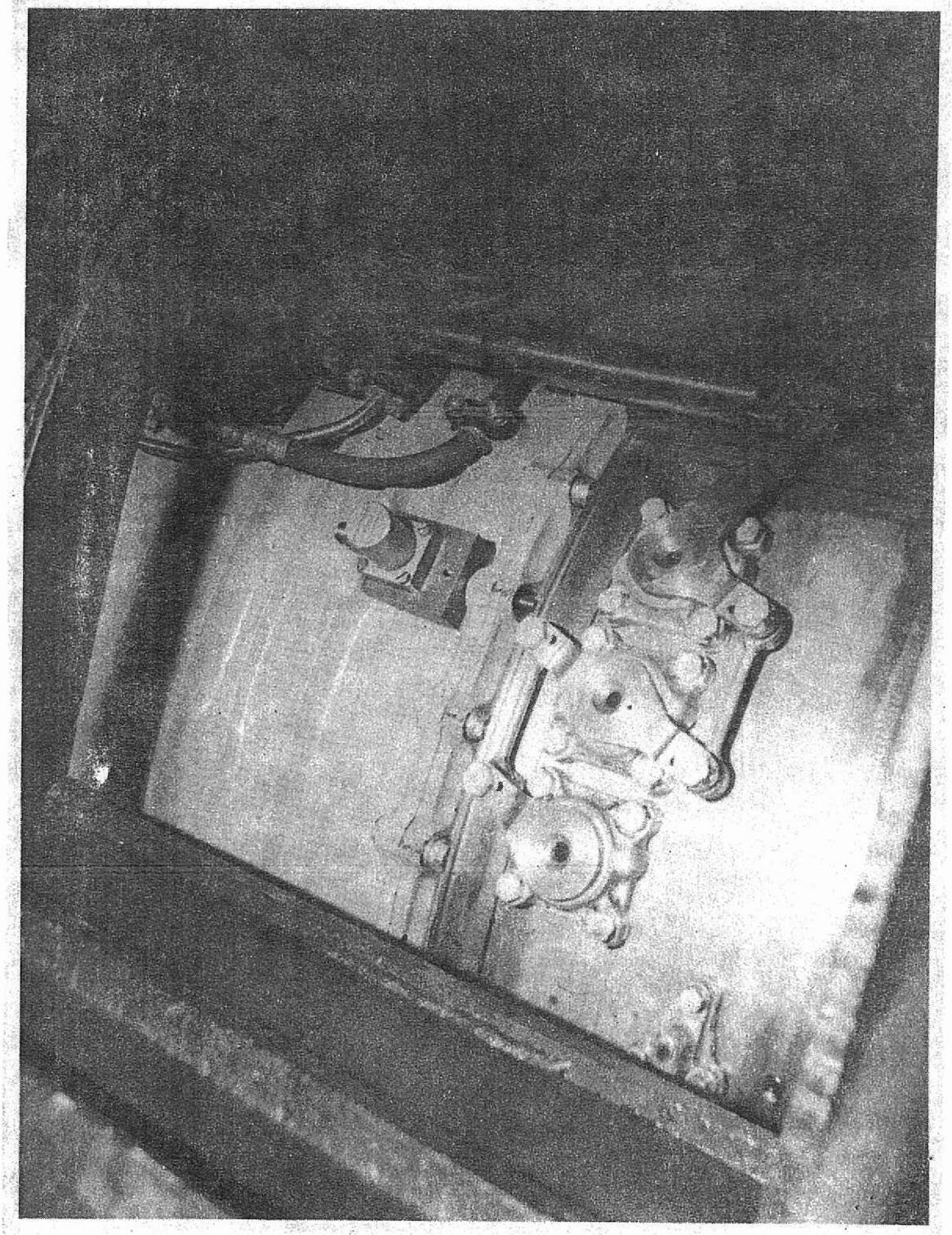

Fig.4 Avon 207 Accelerometer and Mounting Bracket Position

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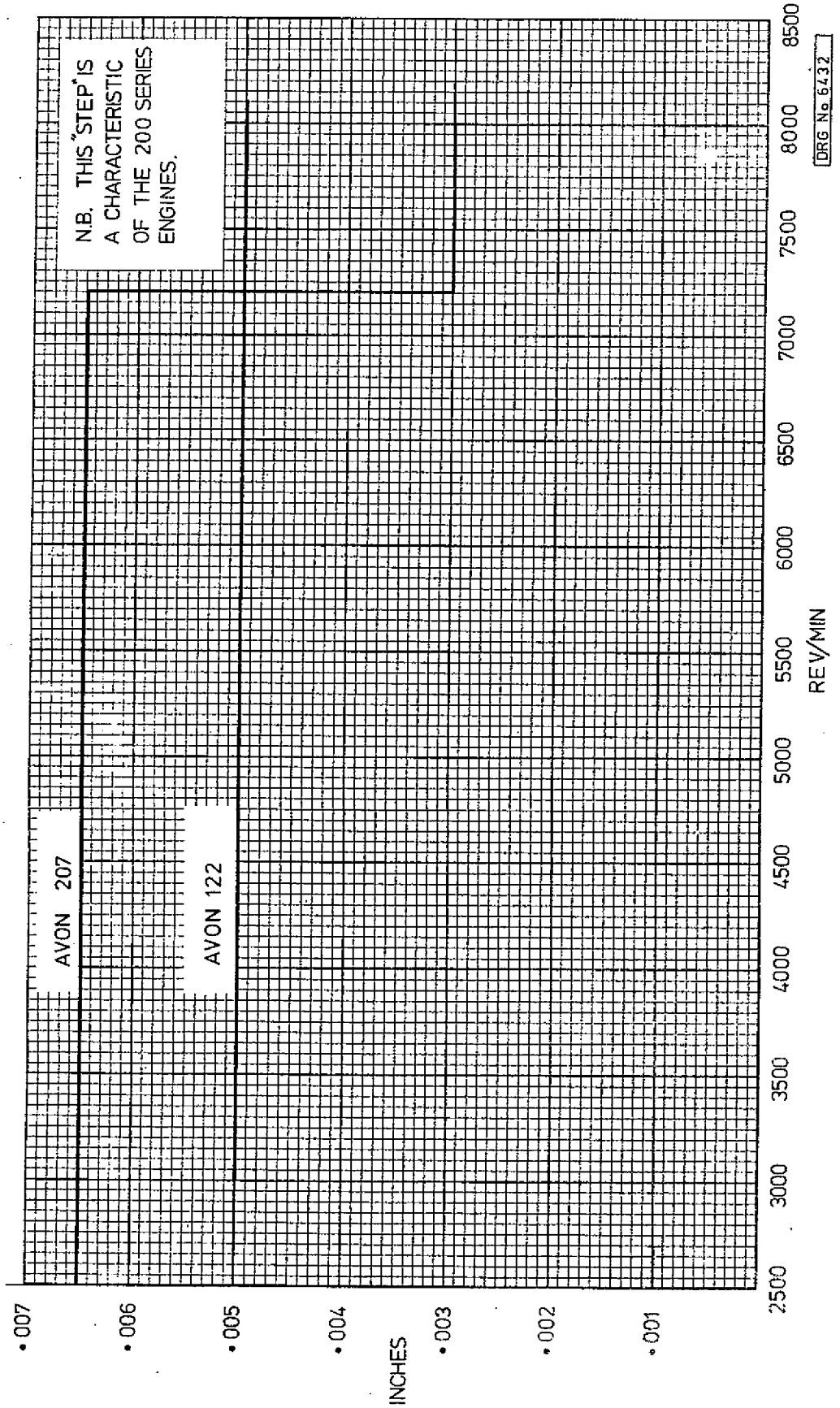


Fig.5 Engine Vibration Limits

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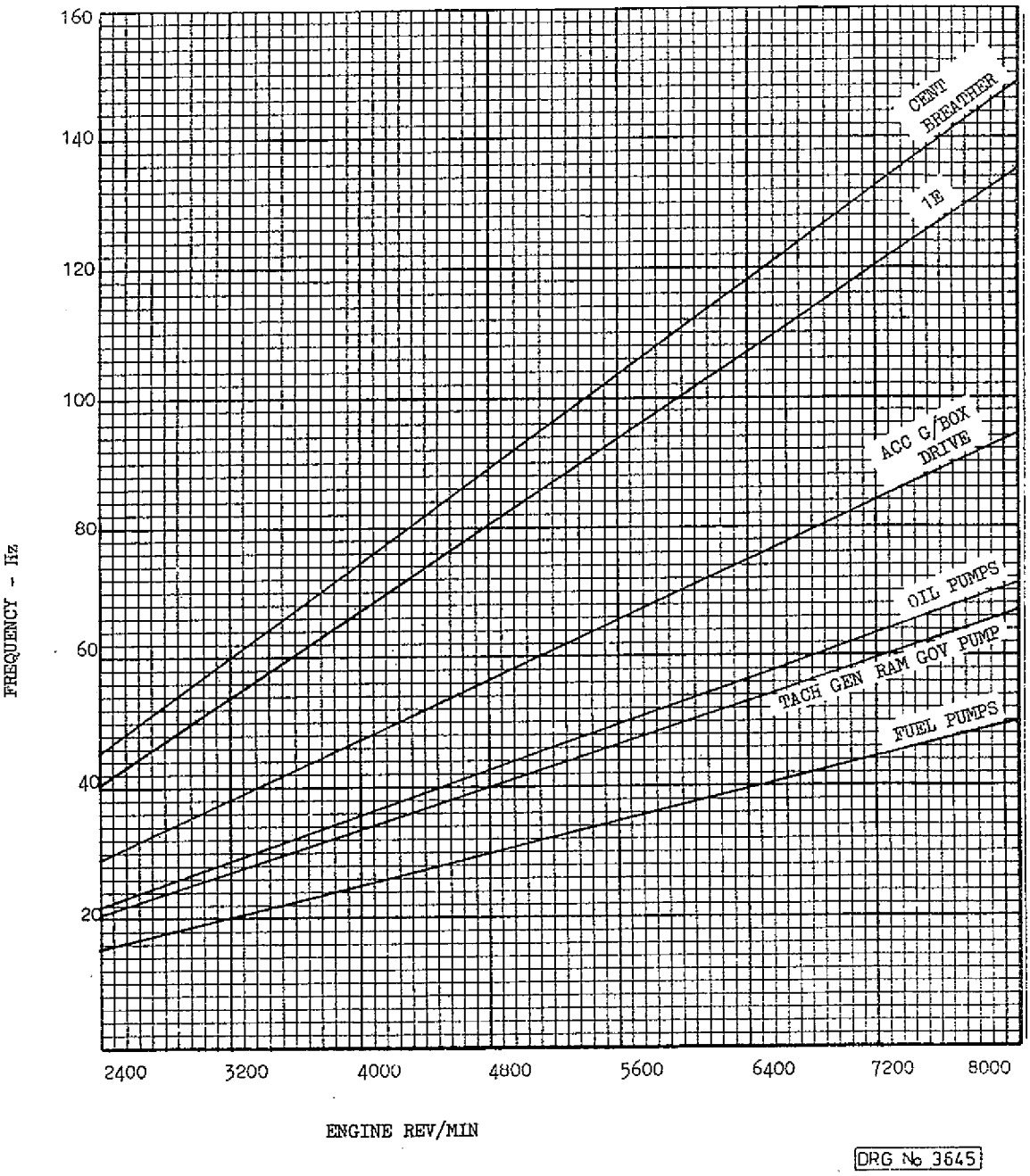


Fig.6 Avon 122 Component Frequencies Chart



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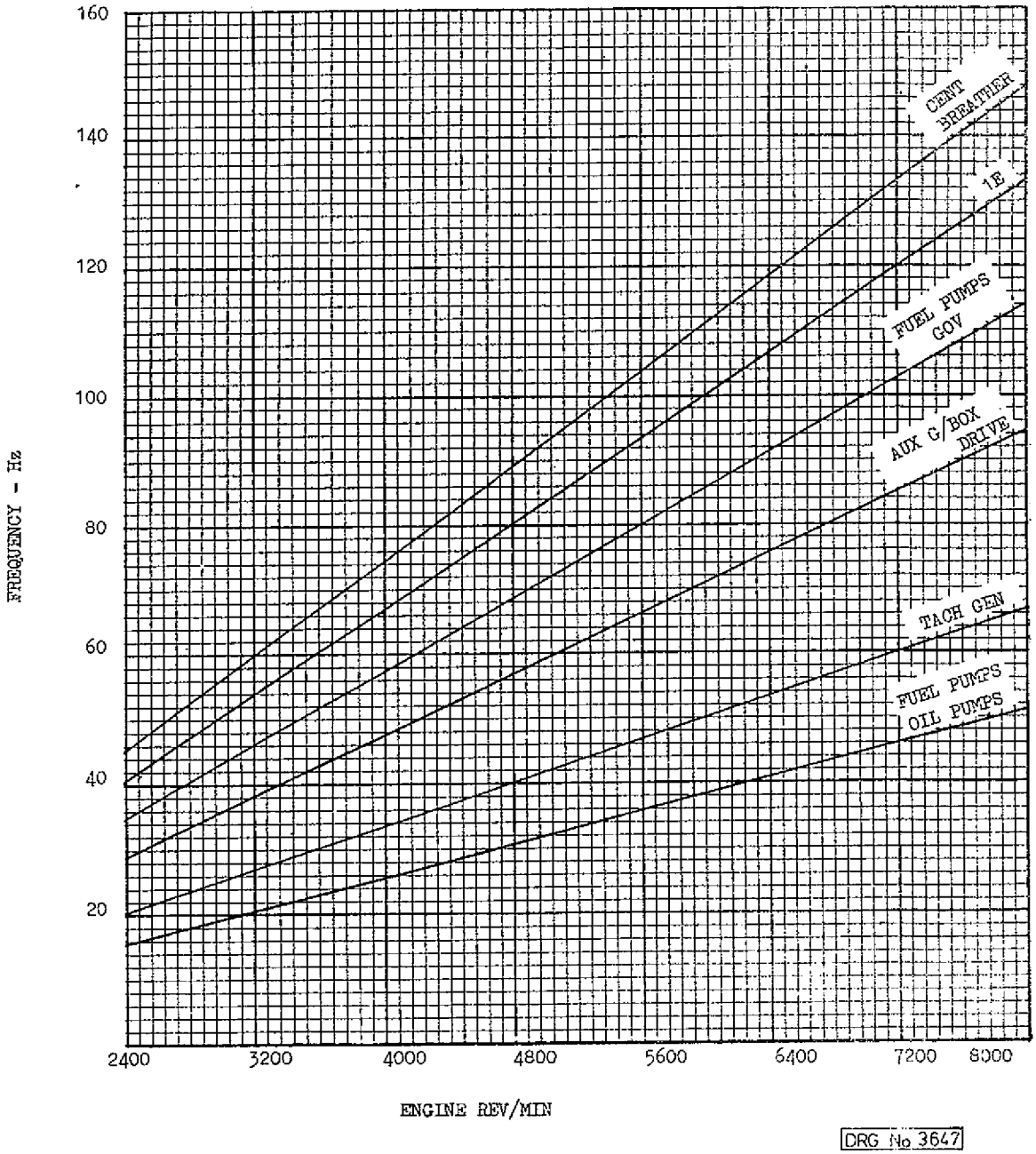


Fig.7 Avon 207 Component Frequencies Chart



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