

1kW HF Transmitter Terminal

TTA 1885A

SYSTEMS ENGINEERING

Technical Manual

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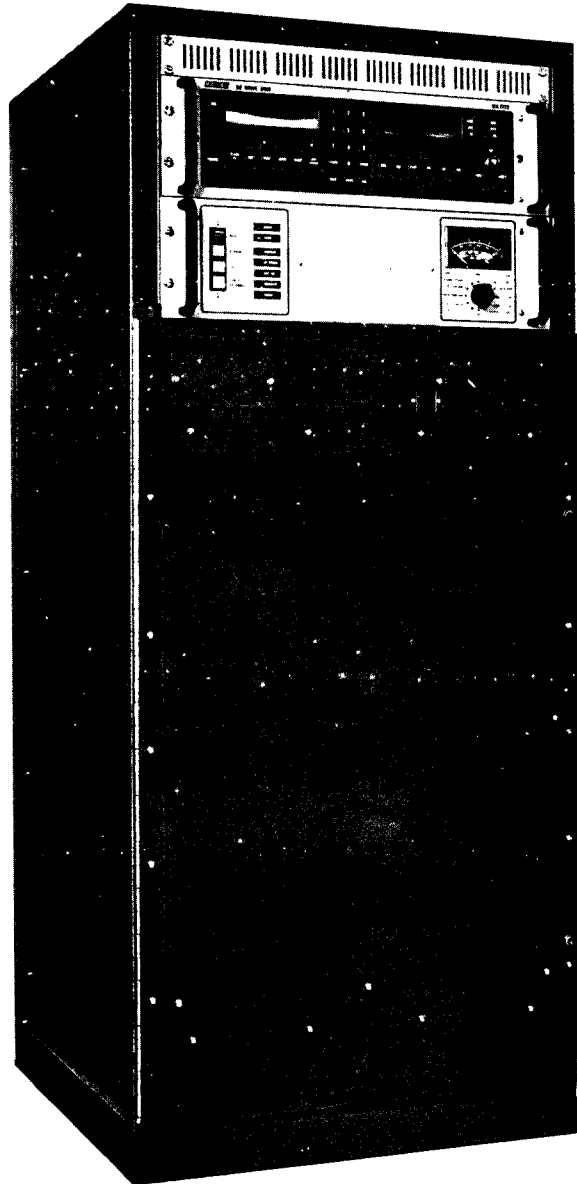
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HANDBOOK AMENDMENTS

Amendments to this handbook (if any), which are on coloured paper for ease of identification, will be found at the rear of the book. The action called for by the amendments should be carried out by hand as soon as possible.

'POZIDRIV' SCREWDRIVERS

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RACAL
TH 3049/A

TTA1885A 1kW Transmitter Terminal

1 kW HF TRANSMITTER TERMINAL

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TTA 1885 A

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Frontispiece TTA 1885 A 1 kW HF Transmitter Terminal

Fig. 1 Interconnection Diagram: TTA 1885 A

Fig. 2 Location of Cabinet Terminal Blocks

TECHNICAL SPECIFICATION

Frequency Range	1.6 to 30 MHz in 100 Hz steps.
Channel storage:	Up to 100 channels of frequency and mode information. Storage time greater than 12 months.
Frequency stability:	(a) Using Racal-Dana type 9442 Ovened Crystal Oscillator. (i) Temperature: ± 6 in $10^{10}/^{\circ}\text{C}$. (ii) Long term: ± 5 in 10^{10} per day after three months continuous operation (b) Provision is made for the use of a Racal-Dana type 9420 standard or an external frequency generating source.
Power Output:	1 kW ± 1 dB, PEP and CW
Load Impedance:	50 ohms nominal, unbalanced
Load VSWR:	3:1 maximum
Modes of emission:	USB/LSB (R3E, J3E) Compatible AM (H3E) ISB (B7E, B8E or B9E) CW (A1A) FSK (F1B)
Carrier suppression:	Suppressed -50 dB Preset internally from -10 dB to -30 dB in 1 dB steps.
Unwanted sideband suppression:	Better than 50 dB relative to PEP.
Audio input level:	-30 dB to +10 dBm into 600 ohm (balanced) by preset adjustment.
Intermodulation products:	Better than -36 dB relative to either one of two equal tones in a standard two tone test.
Harmonic Emission:	Better than -43 dB relative to PEP (CCIR Rec. 329-3).
RTTY keying input:	Neutral or polar keying, +5 V, -5 V or -5:0:+5 V from external source. Input impedance 500 ohm. Sense reversal by internal linkage.

Frequency shift: 85 Hz to 850 Hz by preset adjustment.
Centre frequency - nominal carrier (FSK) or
2 kHz offset from nominal carrier (ISB2,
ISB3). Stability within 2% of total
deviation.

On/Off keying ratio: Better than 55 dB.

Environmental: Designed to operate to full specification
under the following temperature conditions:

- (a) Operating -10°C to +55°C
- (b) Storage -40°C to +70°C
- (c) Relative Humidity 95% at 40°C

Dimensions: Height: 1310 mm (51.6 in)
Width: 555 mm (21.9 in)
Depth: 570 mm (22.4 in)

Weight (including drive unit): Approximately 270kg

Power supply: 200-250 V in 10 V steps, $\pm 6\%$ single phase,
47-63 Hz.

CHAPTER 1

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GENERAL DESCRIPTION

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CHAPTER 1

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GENERAL DESCRIPTION

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INTRODUCTION

1. The TTA 1885/A is a 1 kW HF Transmitter Terminal. The terminal embodies a TA 1823 1 kW linear Amplifier and an MA 1723 HF Drive Unit.
2. The terminal is a stand-alone assembly which can be operated from front panel controls. Provision is made for remote control, using an additional unit.

TRANSMISSION MODES AND CHANNELS

3. The MA 1723 Drive Unit allows up to 100 channels of frequency and mode information to be stored, and recalled as required. The frequency and modes which can be used are given in the Technical Specification. A pilot carrier, at an internally preset level, can be used with USB, LSB or ISB modes.

BRIEF TECHNICAL DESCRIPTION

4. The following paragraphs give brief descriptions of the main units of the terminals. Reference should be made to the appropriate handbooks for detailed information.

MA 1723 HF DRIVE UNIT

5. This is a solid state unit with a frequency range of 1 MHz to 29.9999 MHz (usable over the 1.6 to 29.9999 MHz range in the TTA 1885/A). The output power is internally variable over the range 25 mW to 200 mW.
6. Up to 100 channels of frequency and mode can be stored in the Drive Unit. A channel is retrieved from memory as required, the entry causing automatic tuning of the transmitter.
7. Comprehensive metering and monitoring facilities are provided by displays on the front panel of the unit. All storage into the memory of the unit, and recall from memory, is carried out at front panel controls.

TA 1823 HF LINEAR AMPLIFIER

8. The TA 1823 Linear Amplifier accepts a low-level r.f. signal in the range 1.6 MHz to 30 MHz and provides an amplified output of 1 kW ± 1 dB.
9. The r.f. amplification is effected in two steps. A three-stage wideband amplifier raises the signal level to about 25 W and then a single-stage tuned amplifier provides the final output. The wideband amplifier, which employs solid state devices, operates in class A. The final amplifier stage is a single ceramic tetrode valve operating in class AB1.

10. The power amplifier stage uses a PI-L output network to transform the load impedance presented by the antenna to that required at the PA valve anode. The network uses switched, fixed-value ceramic capacitors and servo-driven variable inductors.
11. During the tuning procedures, the linear amplifier is operated at reduced power output. On completion of the tuning, the overall stage gain is set to its nominal value and the power output is then maintained constant by means of an automatic level control (ALC) system.
12. Comprehensive metering and monitoring facilities are provided. Protection circuits are incorporated which prevent damage to the equipment under fault conditions.

ASSOCIATED HANDBOOKS

13. The following handbooks describe the main units of the Terminals:
TA 1823 1 kW Auto-Tuned Linear Amplifier Technical Manual Ref. TH 2354
MA 1723 HF Drive Unit Technical Manual Ref. TH 3071

TERMINAL INTERCONNECTIONS

14. The Interconnection Diagram, Fig. 1, shows the connections between the Linear Amplifier and the Drive Unit. Other connections are given in the appropriate unit handbooks.
15. Audio inputs to the terminal are made at terminal blocks TB11 and TB12. The RF input to the Linear Amplifier is fed from SK2 of the MA 1723. The RF output of the Linear Amplifier is fed directly from the VSWR Unit (not shown on Fig. 1).
16. Remote control connections can be made to terminal blocks TB13 and TB14. The remote control system can be channel control or Racal SCORE system (for details refer to the MA 1723 Handbook).
17. The a.c. supply to the Drive Unit is via terminal block TB19 of the cabinet and PL1 of the Drive Unit. The supply is available regardless of the position of the cabinet master switch, and is protected by a 1 A fuse, FS4, located at the base of the cabinet near the earthing stick stowage. The supply is normally maintained to the Drive Unit at all times to provide maximum stability of the crystal frequency.

CHAPTER 2

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OPERATING INSTRUCTIONS

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CHAPTER 2

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OPERATING INSTRUCTIONS

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INTRODUCTION

1. The procedure given in this chapter covers local operation from the front panel controls of the Terminal. Other modes of operation (such as remote, manual tuning etc.) are detailed in the appropriate handbooks for the individual units.
2. Prior to operating the equipment it is essential to ensure that the Setting-Up procedure (Chapter 3) has been correctly carried out, that the Terminal is driving into a suitable antenna or dummy load, and that the RF compartment door of the Linear Amplifier is closed.

INITIAL PROCEDURE

3. Ensure that the Linear Amplifier is set for automatic operation (MANUAL RANGE SELECTION switch to AUTO and MANUAL ALC switch to OPERATE). The two switches are normally covered by a plate located at the top left hand side of the RF compartment door.

OPERATING PROCEDURE - LINEAR AMPLIFIER

4. (1) Set the cabinet master switch to EHT SHORTED.
(2) Check that all four pushbuttons on the Control Unit of the Linear Amplifier are OFF (released).
(3) Set the cabinet master switch to ON (fully clockwise). Check that the POWER indicator illuminates on the panel of the Control Unit.
(4) Press the CONTROL EXTENDED pushbutton and check that the lamp in the pushbutton illuminates. Control is now transferred from the Control Unit to the front panel controls of the Drive Unit.

OPERATING PROCEDURE - DRIVE UNIT

5. The procedures for frequency entry, mode selection, channel operation, recall operation, enter operation and remote operation are given in the following paragraphs. Before attempting to operate the drive unit, it is important to note that when it is operating in the $\triangle!$ mode ($\triangle!$ symbol is displayed), the front panel display may not indicate the drive unit operating frequency and mode.


Frequency Entry

6. To enter a frequency, press and release the FREQ pushbutton. This selects the display only mode ($\triangle!$ displayed), sets the frequency display to zero, and enters a - prompt in the 10 MHz digit position. The numeric pushbuttons are enabled, and if 0, 1 or 2 is pressed, the digit is displayed in the 10 MHz digit and the prompt moves one position to the


right. If the first digit pressed is in the range 3 to 9, it is ignored as the highest operating frequency available is 29999.9 kHz. The numeric pushbuttons are now used to enter the remainder of the required operating frequency, and the prompt moves to the right after each entry. When all six digits have been correctly entered, the prompt disappears and further numeric entries are ignored. If, during a frequency entry (i.e. before the prompt disappears), a non-numeric pushbutton other than ENTER, RCL or a transmitter function pushbutton (STANDBY, EHT, TUNE, MUTE, RESET, LOW POWER) is pressed, a zero is entered into the prompt position and the frequency entry mode is terminated. In the case of a transmitter function pushbutton, frequency entry is not affected and continuation is possible.

7. If, during frequency entry, an error is made, i.e. the wrong numeral button is pressed, press and release the **FREQ** pushbutton and start again. To set the drive unit r.f. output to the new frequency, press and release the **ENTER** pushbutton. Any unentered digits of the operating frequency are set to zero (thus trailing zeros need not be entered), and the drive unit is then muted to allow time for the synthesiser to settle before the coarse tune initiate signal is produced. If the associated linear amplifier tunes correctly, a **READY** signal is sent back to the drive unit, and **READY** is illuminated on the right-hand display panel. The tune signal is then removed (unless manual tune is selected) and normal operation is restored. A tuning failure at the associated linear amplifier may result in the transfer of a fault signal to the drive unit, and this is indicated by the illumination of the **RESET LED**.

Mode Selection

8. The required mode is selected by pressing and releasing the appropriate mode pushbutton (**USB**, **LSB**, **PILOT**, **AM**, **CW**, **FSK**, **ISB1**, **ISB2**, **ISB3**). If **PILOT** is selected without previously selecting **USB**, **LSB** or **ISB**, the selection is ignored. If the unit is in the display-only mode i.e.  is displayed, the new mode will only be entered after the **ENTER** pushbutton is pressed and released. The **FSK**, **ISB2**, **ISB3** modes can only be used if the **MA 1723** is fitted with the optional **FSK board**.


Channel Operation

9. To enter the display-only channel mode, press and release the **CHAN** pushbutton. The parameters and channel number of the last channel to be accessed are displayed, together with the  symbol to indicate that the displays do not indicate the current operating parameters. Two numeric pushbuttons may now be pressed, in turn, to display the parameters of a different channel number. After two numeric pushbuttons have been pressed, the numeric pushbuttons revert to their second function, so to select a different channel number, the **CHAN** pushbutton must first be pressed and released again. To set the drive unit to the displayed channel parameters, press and release the **ENTER** pushbutton. To restore the front panel displays to the current operating parameters, press and release the **RCL** pushbutton.


NOTE: Only channels that contain stored frequency and mode data can be recalled. If a non-programmed channel number is selected following operation of the **CHAN** pushbutton, the selection is ignored.

10. To store the displayed frequency and mode settings into a particular channel, press and hold the STORE pushbutton. The word CHANNEL is displayed (if not already displayed) and any previously displayed channel number is blanked. Now use the numeric pushbuttons to select the required channel number (00 to 99), most significant digit first, and then release the STORE key. If the store operation fails, the channel number is displayed, and the frequency and mode displays are blanked. Selecting a new frequency and mode will return the unit to normal operation.

Recall Operation

11. The RCL pushbutton is used to cancel the display-only mode ( displayed) and to display the current operating parameters.

Enter Operation

12. The ENTER pushbutton is used, when in the display-only mode ( displayed), to set the drive unit to the displayed parameters.

Remote Operation

13. The REMOTE pushbutton is used to transfer control to a remote unit. The word REMOTE is displayed (left-hand display panel) and in this condition the front panel controls apart from the LINE/SET/RF metering switch are disabled. A further press of the REMOTE pushbutton extinguishes the REMOTE indication and returns the unit to local control.
14. The REMOTE pushbutton is also used to select a self-test routine, as described in para. 21.

STANDBY Pushbutton

15. Selecting STANDBY routes a control signal to the associated linear amplifier to select the standby condition. The revertive information from the linear amplifier is used to illuminate the LED above the STANDBY pushbutton. A further press of the STANDBY pushbutton toggles the control signal to switch off the standby condition. When STANDBY is selected, the LED above the RESET pushbutton is illuminated to denote that in order to tune the associated linear amplifier, the RESET pushbutton must be pressed and released.

EHT Pushbutton

16. The EHT pushbutton toggles a control signal which is routed to the linear amplifier to switch the EHT supply, provided STANDBY has already been selected.

TUNE Pushbutton

17. This pushbutton toggles the tune status. When selected, a continuous unmodulated carrier, at the selected operating frequency and at a preset amplitude level, is produced at the RF OUT connector on the rear panel.

MUTE Pushbutton

18. Pressing this pushbutton toggles the mute function. When MUTE is selected (indicated by the illumination of LED above the MUTE pushbutton), the drive unit sends a mute signal to the associated linear amplifier and the drive unit RF output is muted.

LOW POWER Pushbutton

19. This pushbutton toggles the low power select circuit. When LOW POWER is selected (indicated by the illumination of the LED above the LOW POWER pushbutton), the drive unit RF output is reduced to a preset level (Chapter 18 of MA 1723 Handbook). The LOW POWER pushbutton is disabled when manual TUNE is selected.

RESET Pushbutton

20. Provided MUTE is not selected, pressing the RESET pushbutton generates the coarse tune initiate (CTI) signal.

Self-Test Routines

21. The MA 1723 contains a number of self-test routines. These are used, together with other procedures, to functionally test the unit and to assist in the location of a fault. To enter the self-test mode, ensure that the unit is not in the display-only mode (⚠ not illuminated), press and hold the REM pushbutton, press and release the numeral 0 pushbutton twice, and then release the REM pushbutton. The test number is displayed in the channel number position, and various other indicators are used to indicate the pass or failure of the test. For further details, refer to Chapter 17 of the MA 1723 Handbook. To exit from the self-test mode, press and release the RCL pushbutton.

LINEAR AMPLIFIER METER READINGS

22. Typical meter readings at the linear amplifier, in no drive and CW transmission conditions, are given in Tables 1 and 2.

TABLE 1 LINEAR AMPLIFIER METER READINGS, NO DRIVE

Switch Setting	Typical Reading	Meter FSD
EHT	2.9 kV	5 kV
Ik	300 mA	1 A
Vg2	225 V	500 V
Ig2	0 mA	+50 mA
+28	28 V	50 V
RF Va	0 kV	5 kV
FWD PWR	0 W	1500 W
REF PWR	0 W	400 W
I/P PWR	0 mW	400 mW
LOAD	+	50
TUNE	+	50

+ Reading depends on frequency selected, decreasing with increasing frequency.

TABLE 2 LINEAR AMPLIFIER METER READINGS, TUNING COMPLETED, CW TRANSMISSION

Switch Setting	Typical Reading	Meter FSD
EHT	2.9 kV	5 kV
Ik	650 mA to 680 mA	1 A
Vg2	225 V	500 V
Ig2	-10 mA to +20 mA	+50 mA
+28	28 V	50 V
RF Va	4.2 kV	5 kV
FWD PWR	800 W to 1200 W	1500 W
REF PWR	*	400 W
I/P PWR	100 mW	400 mW
LOAD	+	50
TUNE	+	50

* Reading depends upon external load impedance, but will not exceed 300 W.

+ Reading depends on frequency selected, decreasing with increasing frequency.

- (1) Place the unit on a flat, clean working surface.
- (2) Remove the overall top cover plate (if fitted), secured with quarter-turn quick-release fasteners.
- (3) Locate the six switches on the processor board (SA to SF) and check that all set to the open (OFF) position.
- (4) Locate switches SA and SB on the modulation board. Set to the closed (normal) position for AGC ON (SA for USB, SB for LSB), to the open position for AGC OFF.

Line Level Adjustment

6. The two line level potentiometers are mounted on the rear panel (marked LINE 1 and LINE 2), and may be adjusted as follows:
 - (1) Check that the voltage selector is correctly set to suit the supply.
 - (2) Connect an audio signal generator, set to a frequency of approximately 1 kHz and an output level approximately equal to the intended audio line level, to pins 1 and 2 of SK4 on the rear panel (balanced line 1 audio input, 600 ohms).
 - (3) Connect a suitable 50 ohm load to the RF OUT socket SK2 on the rear panel. On AMPLIFIER socket SK6 link pin 3 to pin 9 to simulate the AMPLIFIER READY condition. On AUDIO socket SK4 connect pin 8 to pin 20 to remove the INTERLOCK which causes the drive unit to mute.
 - (4) Connect the unit to the source of supply and set the POWER switch to ON.
 - (5) Check that REMOTE is not illuminated on the left-hand display panel. If it is, press and release the REM pushbutton.
 - (6) Press and release the RESET button. Ensure that the associated LED is extinguished and READY is indicated on the right hand display panel.
 - (7) Press and release either the USB or LSB mode pushbutton and check that the appropriate mode is displayed.
 - (8) Place the LINE/SET/RF switch to the SET position.
 - (9) Set the VOX/PTT/TX switch to PTT.
 - (10) Adjust the LINE 1 control on the rear panel for a front panel AF meter indication of 0 dBm.
 - (11) Transfer the audio signal generator to pins 3 and 4 of SK4 on the rear panel.
 - (12) Press and release the ISB1 pushbutton.

- (13) Press and release the METER pushbutton so that SET 2 is illuminated on the right-hand display panel.
- (14) Adjust the LINE 2 control on the rear panel for a front panel AF meter indication of 0 dBm.
- (15) Switch off and disconnect the signal generator.

RF Output Level Adjustment

7. The RF output level should be adjusted to 100 mW by the adjustment of R1 on the RF output board as follows:
 - (1) Connect a suitable 50 ohm load to the RF OUT socket SK2 on the rear panel. On the AMPLIFIER socket SK6 link pin 3 to pin 9. On the AUDIO socket SK4 link pin 5 to 17 and pin 8 to 20.
 - (2) Connect the unit to the source of supply and set the POWER switch to ON.
 - (3) Check that REMOTE is not illuminated on the left-hand display panel. If it is, press and release the REM pushbutton.
 - (4) Check that none of the six red status indicators are illuminated. Any that are may be extinguished by pressing and releasing the associated pushbutton. Press and release the RESET button and ensure that the associated LED is extinguished and READY is indicated on the right hand display panel.
 - (5) Press and release the CW button and ensure that CW is displayed.
 - (6) Place the LINE/SET/RF switch to the RF position.
 - (7) Place the VOX/PTT/TX switch to the TX position. Check that TRANSMIT is illuminated on the right-hand display panel.
 - (8) Adjust R1 on the RF Output board for the required output level, as indicated on the front panel meter (Table 4).

TABLE 4 mW TO dBm CONVERSION

mW	dBm
25	+14
50	+17
80	+19
100	+20
125	+21
160	+22
200	+23

Tune and Pilot Level Adjustment

8. The level of the RF output tuning signal and also the level of the pilot carrier are preset using the numeric pushbuttons in conjunction with switch SC on the processor board (mounted on the inner face of right-hand chassis side member), as follows:
9.
 - (1) Set the front panel POWER switch to OFF.
 - (2) Set switch SC on the processor board to the ON position (in the direction of the arrow).
 - (3) Set the front panel POWER switch to ON.
 - (4) The current tune level relative to full output power is displayed in the channel number position, on the left-hand display panel. If a different level is required (1 dB steps between 0 and -30 dB), press and release the TUNE pushbutton, and then press the required two numeric pushbuttons i.e. for -6 dB press 0 and then 6.
 - (5) The current pilot carrier level relative to full output power is displayed on the right-hand display panel. If a different level is required (1 dB steps from -10 dB to -30 dB), press and release the PILOT pushbutton, and then press the two required numeric pushbuttons i.e. for -16 dB press 1 and then 6.
 - (6) Once the required tune and pilot levels have been preset, set the front panel POWER switch to OFF, return switch SC on the processor board to the open (down) position, and then return the POWER switch to ON.

Line Jacks (Front Panel)

10. Two audio sockets, designated LINE 1 and LINE 2, are provided on the front panel for the connection of items such as a carbon microphone, telephone handset, boom microphone and headset, etc. Connection is via a standard three-ring and tip Post Office type 420 plug (Racal 933837), connections as follows:

Tip:	PTT
Ring 1 (nearest tip):	Carbon Microphone
Ring 2:	Line Monitor/Sidetone
Ring 3:	Earth

11. For SSB operation, LINE 1 is used for USB or LSB, as selected, and LINE 2 is open circuit. For ISB operation, LINE 1 is used for USB, LINE 2 for LSB.

CHAPTER 4

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COMPONENTS LIST

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Components list

Refer to individual handbooks for components which form part of the main assemblies.

