

**AZDEC LTD**

**MAINTENANCE DOCUMENT  
FOR  
WORKS ORDER No. EXAMPLE  
(EXAMPLE)**

**Two Way Infra Red Communications System  
(TWIRC)**

<b>DOCUMENT No.</b>	<b>ISSUE</b>	<b>APPROVED BY</b>		<b>DATE</b>
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**AZDEC LIMITED**

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**0.1 Amendment Record**

Issue	Date	Comment
1	-	Issued to customer

**0.2 References & Associated Documents**

- EXAMPLE/021      Installation Guide
- EXAMPLE/032      Setting to Work Instructions
- EXAMPLE/022      User Guide
- EXAMPLE/034      Cable Jointing Instructions
- 970306/201      Noise Attenuating Headset & Mobile Unit - General View
- 970306/202      Lightweight Headset & Mobile Unit - General View
- 970306/203      Battery Pack - Baseline System - General View
- 970306/204      Battery Pack - Enhanced System - General View
- 970306/205      Antenna - General View
- 970306/206      Base Station Baseline System - General View
- 970306/207      Base Station Enhanced System - General View
- 970306/208      Battery Charger - General View
- 970306/209      Antenna - Long Cable - General View
- 970306/210      Auxiliary Power Supply Unit - General View
- 970306/211      Noise Attenuating Headset & Mobile Unit - Enhanced Model - General View
  
- 970306/220      Head pad - Noise Attenuating Headset - General View
- 970306/221      Ear pads - Noise Attenuating Headset - General View
  
- 970306/230      Gland Kit (PG9) - General View
- 970306/231      Gland Kit (PG11) - General View
- 970306/232      Gland Kit (PG13.5) - General View

# 1. INTRODUCTION

## 1.1 Scope

This document describes the Maintenance Procedures to ensure the maximum availability of the TWIRC System. Both preventative maintenance and maintenance in the case of a fault are covered.

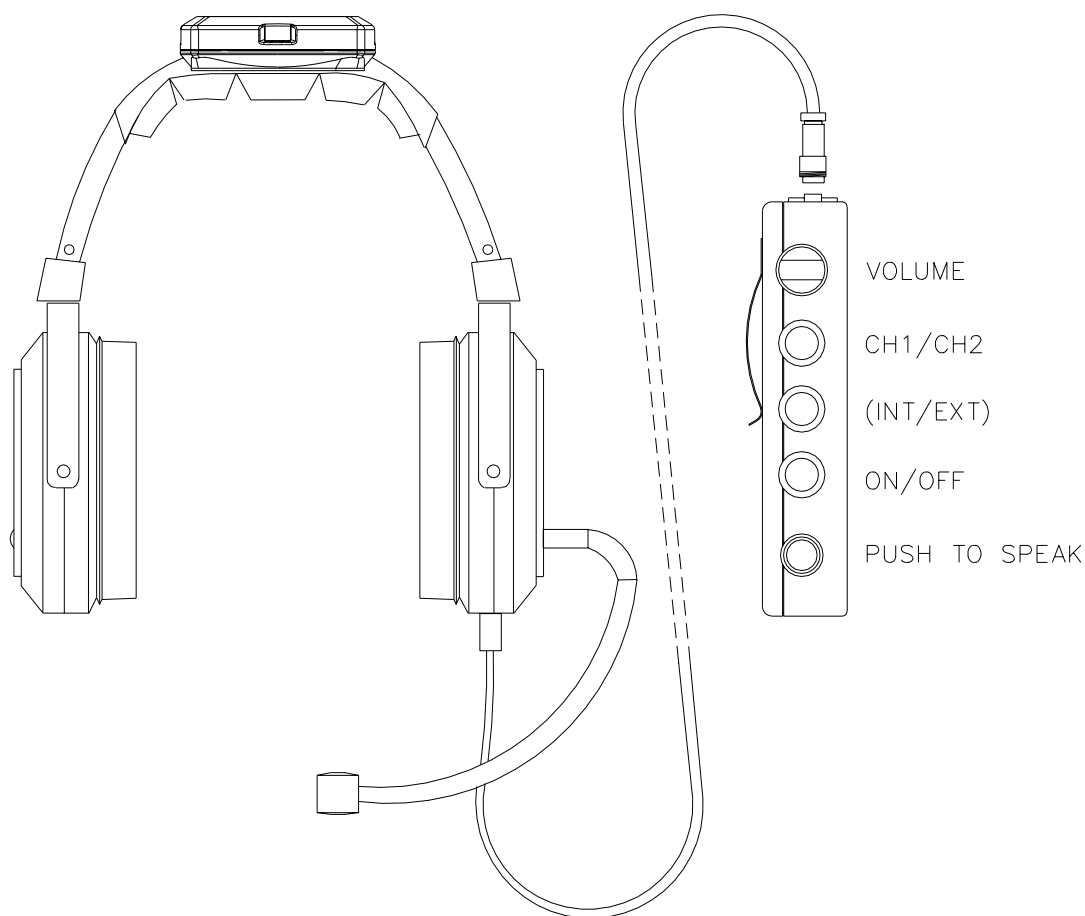
## 1.2 System Description

The Two Way Infra-Red Communication System is a system designed to allow the user to be mobile in an area and to maintain communication with other users of the TWIRC system and users of the Ship's Communication system.

Each TWIRC user will have a Headset & Mobile Unit which allows them to listen to other users using their earpiece and to speak to other users using their microphone. The power for the Headset & Mobile Unit will be provided by a small belt mounted battery pack on which will be mounted the user controls e.g. the Press to Speak key. The battery pack is designed to allow the user to operate in the TWIRC area for at least 4 hours without changing the battery pack (assuming a fully charged battery).

The system (see Figure 5) consists a collection of Antenna mounted above head height in the designated area. The users Headset & Mobile Unit will communicate with the Antenna using Infra-Red signals in both directions. These Antenna are wired to a fixed Base Station which in turn is wired to the Ship's Communication system.

The infra-red communication to and from the Headset & Mobile Unit on any discrete system is not to any particular Antenna, therefore the user may be mobile in the area as long as the system maintains infra-red communication. For this reason the Headset & Mobile Unit is designed such that the infra-red devices are located on the top of the unit.



**Figure 1 - a typical "Man on the Move" equipment**

which consists of two units:

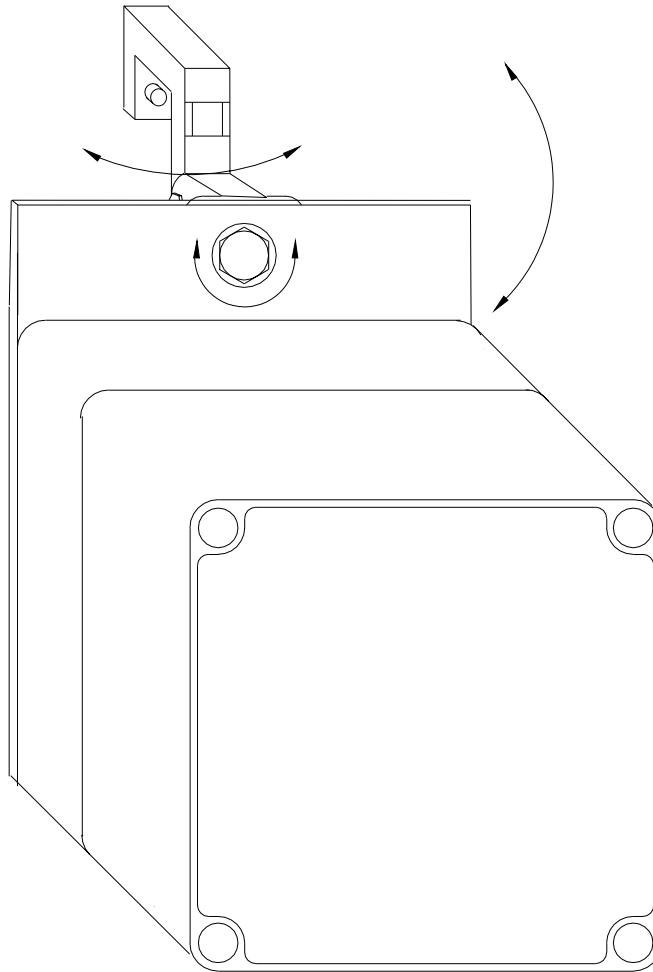
**the Headset & Mobile Unit and the Battery Pack.**

The TWIRC system is a digital communication system which allow the users access to up to 2 channels (Baseline System). The system is such that all users may hear the signal on the particular channel selected. In order to speak on one of the two channels the user must press the Press To Speak (PTS) key. Normal PTS discipline is necessary to ensure all users have access to the channels in order to speak.

When the system is being used to communicate with the Ship's Communication System the TWIRC system is provided with a user's sidetone signal such that the signal from the user speaking is fed back to the all user's earpieces together with the incoming voice signal from the Ship's Communication System.

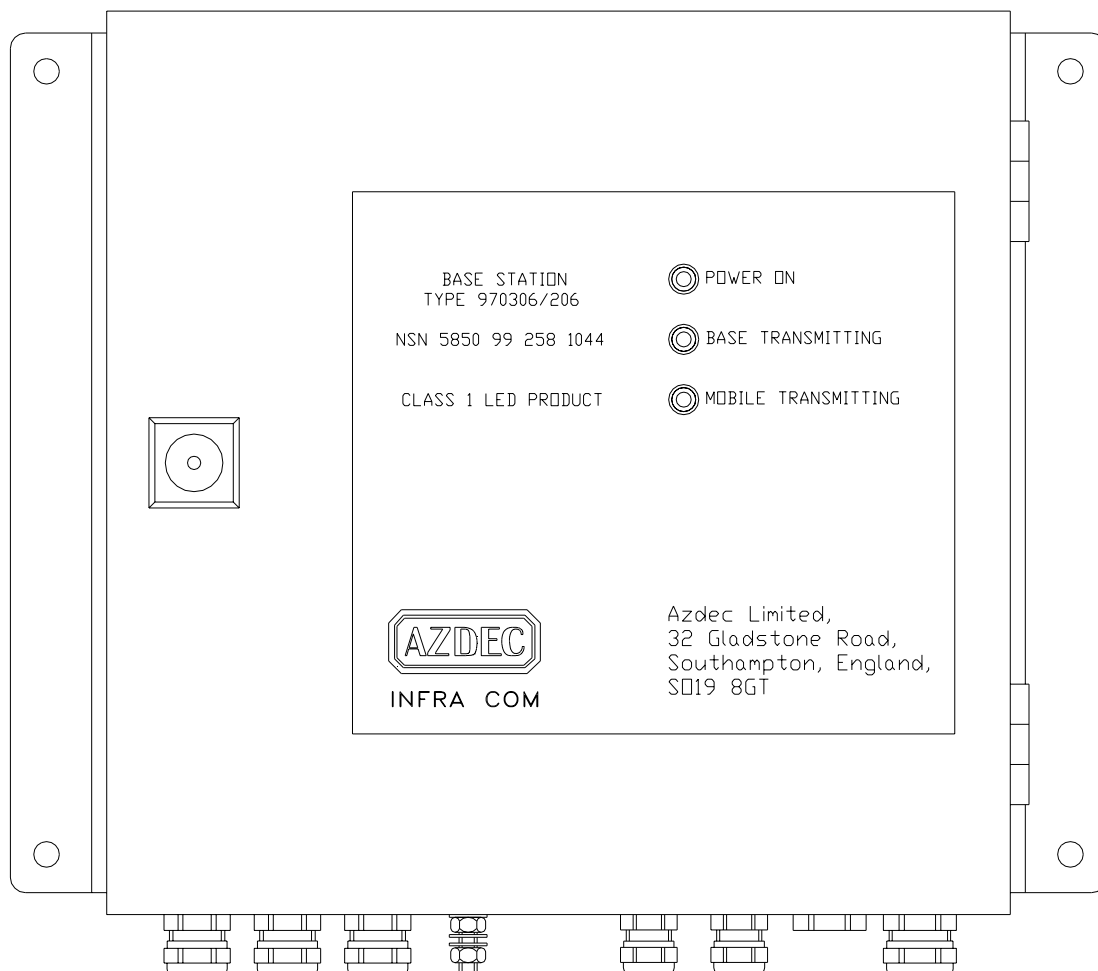
Two systems are available the Baseline System and the Enhanced System. The Baseline system allows the user to communicate with other users on the TWIRC

system and on the Ship's Internal Communication System. The Enhanced System has all the facilities of the Baseline System but has the additional feature of being able to communicate with the Ship's External Communication System.



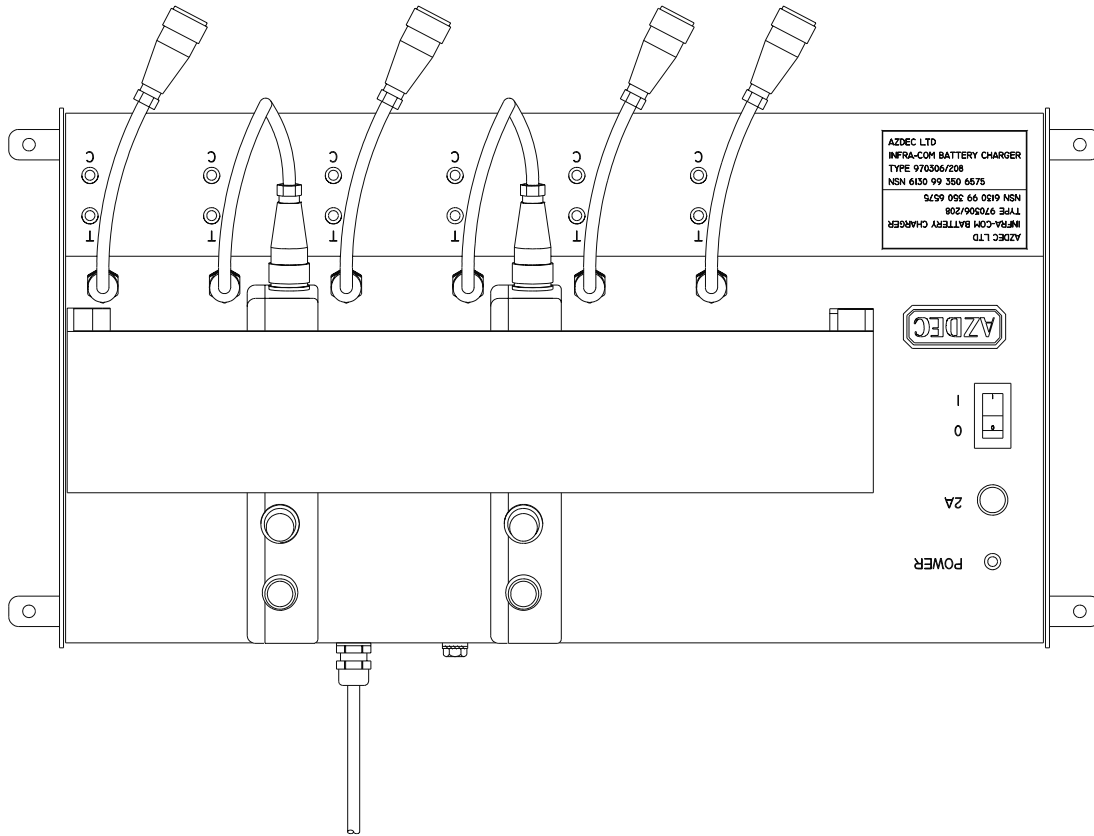
**Figure 2 - Antenna**

970306/205  
or 970306/209  
(showing direction  
adjustment)



**Figure 3 - Base Station**

970306/206  
(or 970306/207 and 970306/210 Auxiliary  
Power Supply not shown)



**Figure 4 Battery Charger**

970306/208  
 (including 2 Battery  
 Packs loaded)

## 2. Preventative Maintenance

The highly reliable modern electronics used in the infra red system requires no specific routine maintenance other than normal housekeeping.

- Ensuring that the equipment is free from mechanical damage.
- Inspecting cords and connectors on the mobile units.
- Ensuring that the antennas are free from grease and dirt.

During the time of a refit, after many years of continuous service, it is recommended that the system be fully tested to ensure continued trouble free operation. Testing would include:

- Checking the accuracy of the Configuration Records
- Calibration of time standards.
- Checking sensitivities are within specifications.
- Assessing the performance of battery packs.
- Checking the output infra red radiator.
- Incorporating any system improvements.
- Visual inspection.

Recommended inspection periods for preventative maintenance are:

Daily visual checks for damage or abuse should be carried out for the mobile equipment. This should be on an informal basis and completed by the operator only.

Every four months a Naval Weapons Engineer should complete a visual inspection of all equipment on a formal basis, ensuring adequate record keeping.

Annual checks should include the activities above and be completed by the Naval Weapons Engineer but be of a more thorough nature, checking each mobile unit and each antenna for functionality and quality of performance. Formal records should be maintained.

Operational experience may well show that an increase in the maintenance periods may be acceptable

### 3. Fault Based Maintenance

#### 3.1 Fault Identification

Fault investigation will normally be started as the result of either a fault being reported or by the operator observing unusual conditions on one or more of the system units.

A visual inspection of the system will normally yield the most information as to the likely cause of a fault. The following sections are intended to assist with the investigation.

##### 3.1.1 Action Required

The maintainer will normally be required to take some action in order to identify and rectify a fault, the fault table in section 3.1.2 identifies several categories:

Y = Probable replacement of unit

N = Normal operation rectify the condition by normal operation

R = Refer to source of problem and take appropriate action

##### 3.1.2 Fault table

Symptom	Possible Fault	Ref.	Action
<b>Base Station</b>		3.2.1	
Power On LED off	24V supply not present		N
	Power switch in off position		N
	Power Supply Faulty		Y
Base Transmitting LED off	Base Station Transmission faulty		Y
	Short on Antenna Data Cable		R
	The Power LED is off		R
Mobile Transmitting LED off	No PTS keys being pressed		N
	Fault on Antenna Data Cable		R
	Faulty Base Station Receive		Y
	The Power LED is off		R
Internal D3 ON	Earth Fault	3.2.1.4	R
Internal D15 ON with no voice signal from the ship	Noise Level above the VOX switch setting. Internal Interface	3.2.1.5	R
Internal D23 ON with no voice signal from the ship	Noise Level above the VOX switch setting. External Interface.	3.2.1.5	R

Symptom	Possible Fault	Ref.	Action
<b>Antenna</b>		3.2.2	
Antenna LED (D1) off	Antenna Power Input Faulty		R
	Antenna Power Supply Faulty		Y
	Antenna Faulty		Y
	Antenna not receiving data from Base Station		R
	Base Station to Antenna Cable damaged		R
Antenna LED (D1) off	Cable from Antenna to next or further Antenna on the Bus damaged		R
	Antenna further down the bus damaged		R
Antenna LED (D1) flashing	Cable from Antenna to next or further Antenna on the Bus damaged and mobile operating		R
	Antenna further down the bus damaged and mobile operating		R
Antenna LED (D1) off but flashes with a mobile operating near by.	Last Antenna not set to loopback.		R
<b>Battery Pack</b>		3.2.4	
Power LED off	On/Off switch in off position		N
	Battery needs recharging		N
	Battery Pack faulty		Y
Double Beep in earpiece	The Battery Pack needs recharging, less than 10 minutes use left.		N

Symptom	Possible Fault	Ref.	Action
<b>Headset and Mobile Unit</b>		3.2.4	
No signal received in earpiece	Battery Pack switched off		N
	Battery Pack needs recharging		N
	Battery Pack switched to unused channel		N
	Battery Pack Volume control set too low		N
	Not in the Infra-Red area		N
	Cable from Headset & Mobile unit disconnected		N
	Cable from Headset & Mobile unit damaged		Y
	Headset & Mobile Unit damaged		Y
	TWIRC System switched off		R
No sidetone in earpiece	PTS key not pressed		N
	Other user speaking		N
	Battery Pack switched off		N
	Battery Pack needs recharging		N
	Battery Pack switched to unused channel		N
	Battery Pack Volume control set too low		N
	Not in the Infra-Red area		N
	Cable from Headset & Mobile unit disconnected		N
	Cable from Headset & Mobile unit damaged		Y
	Headset & Mobile Unit damaged		Y
	TWIRC System sidetone not enabled and ship's system not providing sidetone.		R
	TWIRC System switched off		R

Symptom	Possible Fault	Ref.	Action
<b>Cable</b>		3.2.3	
One or more Antenna LED Flashing	A data cable fault has occurred		R
<b>Battery Charger</b>		3.2.5	
Power Supply LED off	The 115V power to the Battery Charger is not present		N
	The Battery Charger has been switched off		N
	The Battery Charge input fuse has blown		R
	The Base Station power supply is faulty.		Y
<b>Battery Pack on Charger</b>		3.2.5	
Battery Status LED in "Wink-On" State	Battery Pack that has been left in a discharged state for a long period		R
Temperature LED ON	Temperature of Battery Too High or Too Low		R
	Initial Temperature of Battery Too High or Too Low		R
	The Battery Temperature becomes excessive during charging		R
Charge Cycle (Battery LED Steady ON) for a very short time	Ambient Temperature too high, Battery Temperature too high, battery faulty. Check other conditions in this table.		R

## **3.2 Built In Test Equipment**

### 3.2.1 Base Station

The Base Station is provided with several indications of the status of the unit.

#### 3.2.1.1 Power ON/OFF

An LED will indicate the status of the Base Station power supply and the power supply to the Antenna. When the LED is OFF then either

The 24V power to the Base Station is not present

or

The Base Station has been switched off

or

The Base Station has detected a fault in the incoming supply

or

The Base Station power supply is faulty.

This indicates possible system failure and requires immediate attention.

#### 3.2.1.2 Base Station Transmitting

An LED will indicate that the Base Station is transmitting data to the Mobile Units. This LED should be ON all the time that the Base Station is ON.

If the LED is OFF this indicates possible system failure and requires immediate attention.

#### 3.2.1.3 Mobile Transmitting

This LED will indicate that the Base Station is receiving data from the Mobile Units. This LED should be ON when any Mobile Unit is transmitting. If no Mobile Unit is transmitting, i.e. no one is pressing a PTS key, then the LED may be off.

#### 3.2.1.4 Earth Fault

One of the 48V output connections from the Base Station is connected to earth with a low enough resistance to cause the Earth Fault LED D3 to turn on. This may be caused by a fault at the Base Station or Auxiliary Power Supply, by a cable fault or may the fault may be located in one of the Antenna.

### 3.2.1.5 High Noise on Interface

If the LED D15 is ON even when there is no signal on the Ship's Internal Interface then either the Ship's interface is very noisy or the Voice operated switch setting of the Base Station is set too low. Refer to the Setting to Work Instructions (EXAMPLE/032) for the settings of the Voice Operated Switch.

If the LED D23 is ON even when there is no signal on the Ship's External Interface then either the Ship's interface is very noisy or the Voice operated switch setting of the Base Station is set too low. Refer to the Setting to Work Instructions (EXAMPLE/032) for the settings of the Voice Operated Switch.

### 3.2.2 Antenna

The Antenna is a simple device and each Antenna will be provided with an LED indicating the status of the Antenna. The LED will normally be ON and will turn OFF when the Antenna has been determined to be in a fault condition. The Antenna will be bypassed when it is detected as faulty and will therefore not cause a system failure. In high ambient light conditions this LED may only be visible when close to the Antenna.

### 3.2.3 System Fault

By observing the status of the LED on several Antenna and by using a known working Headset & Mobile Unit other potential system problems may be identified.

The Headset may be used to determine if a particular Antenna is working by locating the Mobile Unit in the field of view of the Antenna and then pressing the PTS key. If the LED on the Antenna changes from being off to flashing then the Antenna is transmitting and receiving infra red signals. If when pressing the PTS key the operator also speaks into the microphone and can hear their voice in the earpiece then the cable between the antenna and the base station is functioning correctly.

Several Antenna with the LED off but where the LED flashes when a Mobile is operated near to the Antenna.

Suspect that a cable fault has occurred on the side furthest from the Base Station.

Several Antenna with the LED off but where the LED flashes when a Mobile is operated near to the Antenna and with some Antenna with the LED on.

Suspect that a cable fault has occurred on the side furthest from the Base Station and between the last Antenna with the LED off and the first with the LED on.

### 3.2.4 Mobile Equipment

The Mobile Equipment provides the operator with several indications as to the status of the Units.

#### 3.2.4.1 Power On

The Battery Pack is provided with an LED which indicates that the Battery is in a state that the Mobile Unit may be used. The LED should be ON when the Power ON/OFF switch is in the ON position.

#### 3.2.4.2 Battery Low

A signal will be generated in the Operator's earpiece when the Battery power is low and the Battery Pack should be re-charged. The Battery Low signal is a double beep every 2 seconds. The remaining operational time for the Battery Pack is dependant on the type of usage, listening only will be longer than speaking.

It is recommended that the operator changes the Battery Pack within 10 minutes of first hearing the battery low signal.

#### 3.2.4.3 In the Infra Red Area

A signal is generated in the operator's earpiece when they are in the Infra Red area. The signal is either a voice signal in the earpiece or a single beep at approximately 4 second intervals. Failure to receive this signal when in the Infra-Red area may indicate a faulty Mobile Unit or may indicate that the signal being received from the ship's communication system is very noisy. This noisy condition may be confirmed by checking for the condition in section 3.2.4.4., if sidetone is present then suspect a noisy interface. See Setting to Work EXAMPLE/032 for methods of reducing the effect of noise.

#### 3.2.4.4 Sidetone

During normal operation the operator will hear their own voice in their earpiece when they operate the PTS key and talk. This signal is known as sidetone. Absence of sidetone is an indication of a possible fault condition. Any other mobile talking on the TWIRC system may result in sidetone not being heard. It is therefore necessary to wait for a quiet period on the receive channel to check for sidetone. Lack of sidetone may be caused by the TWIRC system sidetone be set to not enabled and the Ship's Communication System not providing sidetone.

### 3.2.5 Battery Charger

The Battery Charger is not directly connected to the TWIRC system but does have an effect the availability of the TWIRC system as it is used to re-charge the Battery Packs.

The Battery Charger will be able to charge 6 Battery Packs at any one time. Each of the 6 interfaces is provided with two LEDs to indicate the status of the Battery Pack connected to the interface.

An LED will indicate the status of the Battery Charger power supply. When the LED is OFF then either

- The 115V power to the Battery Charger is not present
- or
- The Battery Charger has been switched off
- or
- The Battery Charger input fuse has blown
- or
- The Battery Charger power supply is faulty.

The normal operations for using the Battery Pack and Battery Charger are described in the User Guide. This section describes other conditions that may occur when using the Battery Packs on the Battery Charger.

Possible Fault Symptom	Reference
Battery Status LED in “Wink-On” State	3.2.5.1 or 3.2.5.3
Temperature LED ON	3.2.5.2 or 3.2.5.3 or 3.2.5.4
Charge Cycle (Battery LED Steady ON) for a very short time	Ambient Temperature too high, Battery Temperature too high, battery faulty. Check other conditions in this table.

#### 3.2.5.1 Battery Pack that has been left in a discharged state for a long period

If the battery in the Battery Pack has been left in the discharged state for a long period the voltage of the battery may have reached a voltage outside the range for normal charging. The Battery Charger will detect this condition and will trickle charge the battery until it is in an acceptable state for normal charging. When the battery is being trickle charged the Battery Status LED will “Wink On” (section 3.2.5.5 ). This condition should not normally last for more than 120 minutes. A battery pack in this state for longer than 120 minutes should be replaced.

### 3.2.5.2 Temperature of Battery Too High or Too Low

The Temperature LED will be ON when the temperature of the battery is outside an acceptable range.

### 3.2.5.3 Initial Temperature of Battery Too High or Too Low

When the re-charge cycle is started then if the temperature of the battery is outside an acceptable range the Temperature LED will be ON and the Battery Status LED will be “Wink On” (section 3.2.5.5 ). The battery will be trickle charged until the temperature is in an acceptable range and then the normal discharge/re-charge cycle will start. This condition should not normally last for more than 120 minutes. If the ambient temperature is not extreme then a battery pack in this state for longer than 120 minutes should be replaced.

### 3.2.5.4 The Battery Temperature becomes excessive during charging

If the temperature of the battery exceeds an acceptable range during the charging process, the charging process will be terminated. The excessive temperature will be indicated by the Temperature LED being ON. This is not a normal condition and may result in the Battery Pack not being fully charged. If the ambient temperature is not extreme then a battery pack should be left for 2 hours and then an attempt should be made to recharge it. If it again the Temperature LED comes on and the charging is terminated then the Battery Pack should be replaced.

### 3.2.5.5 Summary of LED Status Indication

#### 3.2.5.5.1 Charge Status LED

Status	Normal Condition	LED Condition	System
Wink ON	No	Off most of the time with a short period on every 1.5 seconds	Battery has not yet started the charge cycle, either the Temperature is out of range (see Temperature LED) or the battery has been excessively discharged. The battery is being trickle charge until both the Temperature and Battery voltage are ready for charging.

### 3.2.5.5.2 Temperature LED

Status	Normal Condition	LED Condition	System
ON	No	Steady ON	The temperature of the battery is outside an acceptable range

## **4. Fault Repair**

The Two Way Wire Free Infra Red Communication System consists of a small number of different types of units, interconnected and interfaced in groups to form a complete system.

None of the individual items of equipment is designed to be appropriate for repair on board ship or for dockyard repair. The use of miniature electronic components has the advantages of small size, low component count, light weight and high reliability. It has the disadvantage that on site maintenance is virtually impossible for the circuit board without expensive and complex equipment. Circuit boards often consist of a limited number of complex integrate circuits. The holding of expensive and delicate components which are not listed in DEF STAN 59-36 is not cost effective compared to holding a small number of complete fully tested replacement units.

### **4.1 System Units**

#### **4.1.1 The Headset & Mobile Unit**

The Headset & Mobile Unit is a combination of two units assembled by the manufacturer. The Headset is an industry standard headset with a short cord connecting it to the Mobile Unit which is located on the top of the Headset Band. Mobile units are small self contained units with a small number of Surface Mount Technology (SMT) devices. Failure of this unit is unlikely unless subjected to mechanical abuse. Maintenance will require specialist equipment and would require a highly trained technician. On Board System Maintenance will be limited to substituting a known working unit for a suspect unit in order to confirm the faulty unit. A quantity of "on-board" replacement units should be held to cover the possibility of defective units being returned to the supplier for repair.

#### **4.1.2 Battery packs**

Battery packs although reliable have a finite life. These non-repairable items should be maintained on a replacement basis only. Adequate spares should be maintained on-board and exhausted units should be returned to the supplier for refurbishment or disposal. The battery charger may be used to provide an indication of the status of a suspect battery pack.

#### **4.1.3 Battery Chargers**

Battery chargers are of a relatively simple design and, therefore, reliable and robust. Built in indication will be provide when the unit is faulty. Sufficient over capacity of battery charging facilities should be provided on board to allow for the possibility of a failure. Repair is limited to checking and replacing the 115V input fuse if necessary. Defective units should be returned to the supplier for repair.

#### 4.1.4 Base Stations

Base Stations are of similar technology to the mobile units and, therefore, are not suitable for being maintained on board ship. A failure of the Base Station is likely to be indicated by a failure of the system. Visual diagnostics will be provided to assist in identifying the Base Station's status. Because of the small number of these units it should only be necessary to hold minimum spares on-board.

#### 4.1.5 Antennas

The total number of infra red antennas is likely to be much greater than the fixed base units. Of similar technology to the mobile and fixed base units the antennas should be maintained on a replacement basis. The Antenna are connected to each other and to the Base Unit by the fixed wiring. A small quantity of on-board antenna spares should be held as replacement for defective units. Any defective units should be returned to the supplier for investigation and refurbishment. Failure of an Antenna should not cause a system failure but will reduce the coverage in the area of the Antenna. The operator of a Man on the Move Unit may need to move into an area covered by another Antenna until the Antenna is replaced.

#### 4.1.6 Cabling

The cabling within the ship consists of power cable and the data cable. In case of failure or damage to the cabling, sufficient quantity should be held on-board ship to allow a complete section to be replaced. Depending on the location of the damaged cable this may or not cause a system failure. In most cases it is more likely to result in reduced coverage due to some Antenna not being operational.

#### 4.1.7 Miscellaneous Items

Items which include any fuses should be held on onboard in small quantities. These items are summarised in section 4.3.

### **4.2 Removal & Replacement**

The removal of equipment in order to replace it with a known working unit shall be carried out in the minimum time possible in order to maintain maximum availability of the system. It is therefore essential that the spares needed are identified prior to removal of the faulty unit and the maintainer is advised to refer to the Installation Guide document reference EXAMPLE/021 and to the Setting to Work Instructions EXAMPLE/032 prior to removing the faulty unit.

#### 4.2.1 The Headset & Mobile Unit

Failure of a Headset & Mobile Unit does not cause a system failure and replacement does not require effect other users of the system.

The Battery Pack should be switched to the off position, the Headset & Mobile Unit cable may then be unscrewed and disconnected from the Battery Pack. A replacement

Headset & Mobile Unit may then be connected to the Battery Pack, the switch changed to the on position and the equipment should be operational again.

#### 4.2.2 Battery packs

Replacement of Battery Packs is a normal operational requirement and therefore replacement of a Battery Pack does not require special instructions.

#### 4.2.3 Battery Chargers

The replacement of the Battery Charger requires that the faulty unit is disconnected from the 115V ac supply and the unit released from its fixing points. The replacement unit may then be fixed to the same fixing points and then connected to the 115V ac supply.

The replacement Battery Charger may be brought into operation in parallel with the faulty unit thus reducing the unavailability time to a minimum. The replacement unit may then be connected to the fixing point at a convenient operational time.

#### 4.2.4 Base Stations

The Base Station is fitted with a removable gland plate which should allow the cables to be carefully unplugged from the electronics assembly and for the gland plate and cables to be separated from the faulty Base Station. Prior to removal of the faulty unit the spare Base Station should be pre set to the correct settings as identified in the ship's record. The gland plate should be removed from the spare Base Station in preparation to accept the existing gland plate and cable assembly.

Before removing the Base Station it is necessary to switch the TWIRC system off. Care should be taken when disconnecting the cables to the Base Station as some may be connected to other systems on the ship, and therefore may need isolation elsewhere.

The existing cables shall be carefully removed from the connectors on the electronics assembly. The Base Station gland plate should be removed with the cables and glands still in place on the gland plate.

The Base Station should then be removed from its fixing points and the spare Base Station shall be attached to the existing fixing points. The existing gland plate and cable assembly may then be carefully fitted to the new Base Station. The completion of the procedure is identified in the Setting To Work Instructions EXAMPLE/032.

The spare gland plate may be fixed to the faulty Base Station in preparation for return to the manufacturer.

#### 4.2.5 Antennas

The replacement Antenna should be prepared prior to starting the procedure. The enclosure base should be prepared to accept the glands.

Before removing the Antenna is necessary to switch the TWIRC system off at the Base Station.

Access to the enclosure is by carefully removing the 4 screws located in the transparent cover. The cables may disconnected by operating the spring loaded levers on the connectors and carefully withdrawing the wires. The connection of the drain wires will involve loosening the nut holding them to the metal cover.

The cable glands may be removed from the enclosure by unscrewing the large back nuts inside the enclosure, and then carefully withdrawing the cable and gland. It may be necessary to separate the ring crimp on the drain wire in order to withdraw the cable.

The cable and glands should be fitted to the replacement enclosure and the large back nut re-fitted and carefully tightened. The cables shall be re-connected to the connectors as identified in the Installation Guide EXAMPLE/021. The drain wires shall be re-attached to the drain wire stud and the nut tightened.

The Antenna shall be set to either Normal or Loop Back as identified in the Ship's records. The transparent cover may be re-fitted ensuring that the cover is in the correct orientation (a peg on one corner of the cover lines up with a depression in one corner of the base).

The system should then be set to work following the procedures of EXAMPLE/032.

#### 4.2.6 Cabling

Cabling between Antenna and between the Base Station and the Antenna shall each be of one continuous piece of cable. That is each section shall not have any joints of any sort.

The replacement cable shall be routed and secured in position prior to disconnection and removal of the damaged cable. The system will need to be powered down prior to removal of the damaged cable. The system is powered down by switching the Base Station Switch to the off position.

A damaged cable may also cause a failure of the Antenna or the Base Station and therefore the system should be checked prior to re-introduction into service.

##### 4.2.6.1 Antenna to Antenna Cabling

The two Antenna at each end of the damaged section of cable will need to have their transparent covers carefully removed in order to expose the cable terminals. The cable shall then be carefully disconnected from the terminals. The gland for the cable may then be released and the cable withdrawn. The gland may be replaced, the new cable inserted and terminated as defined in reference the Installation Guide EXAMPLE/021. The transparent covers may then be replaced.

#### 4.2.6.2 Base Station to Antenna Cabling

The Antenna at one end of the damaged section of cable will need to have its transparent cover carefully removed in order to expose the cable terminals. The Base Station enclosure will need to be opened in order to gain access to the cable connector and allow access to the glands. The cable may then be carefully disconnected from the terminals in the Antenna. The gland for the cable may then be released and the cable withdrawn. The gland may be replaced, the new cable inserted and terminated as defined in the Installation Guide EXAMPLE/021. The transparent cable may then be replaced.

The cable at the Base Station may be unplugged from the Electronics Assembly, the cable socket removed, the gland released and the cable may then be withdrawn. The gland may be replaced, the new cable inserted and the cable socket fitted as defined in the Installation Guide EXAMPLE/021 The system shall then be set to work as defined in document EXAMPLE/032.

#### 4.2.7 Miscellaneous Items

Items which include any fuses should be held on onboard in small quantities. These items will be identified in 4.3.

### 4.3 Fuse Ratings and Types

Unit	Fuse Rating	Fuse Type	Number
Battery Charger 115V input fuse	2A	HRC Anti-surge 20mm x 5mm	NSN 0559 99 225 5450

## **5. Repair and Overhaul Facilities**

The proposed low level of repair dictates a fully interchangeable item policy.

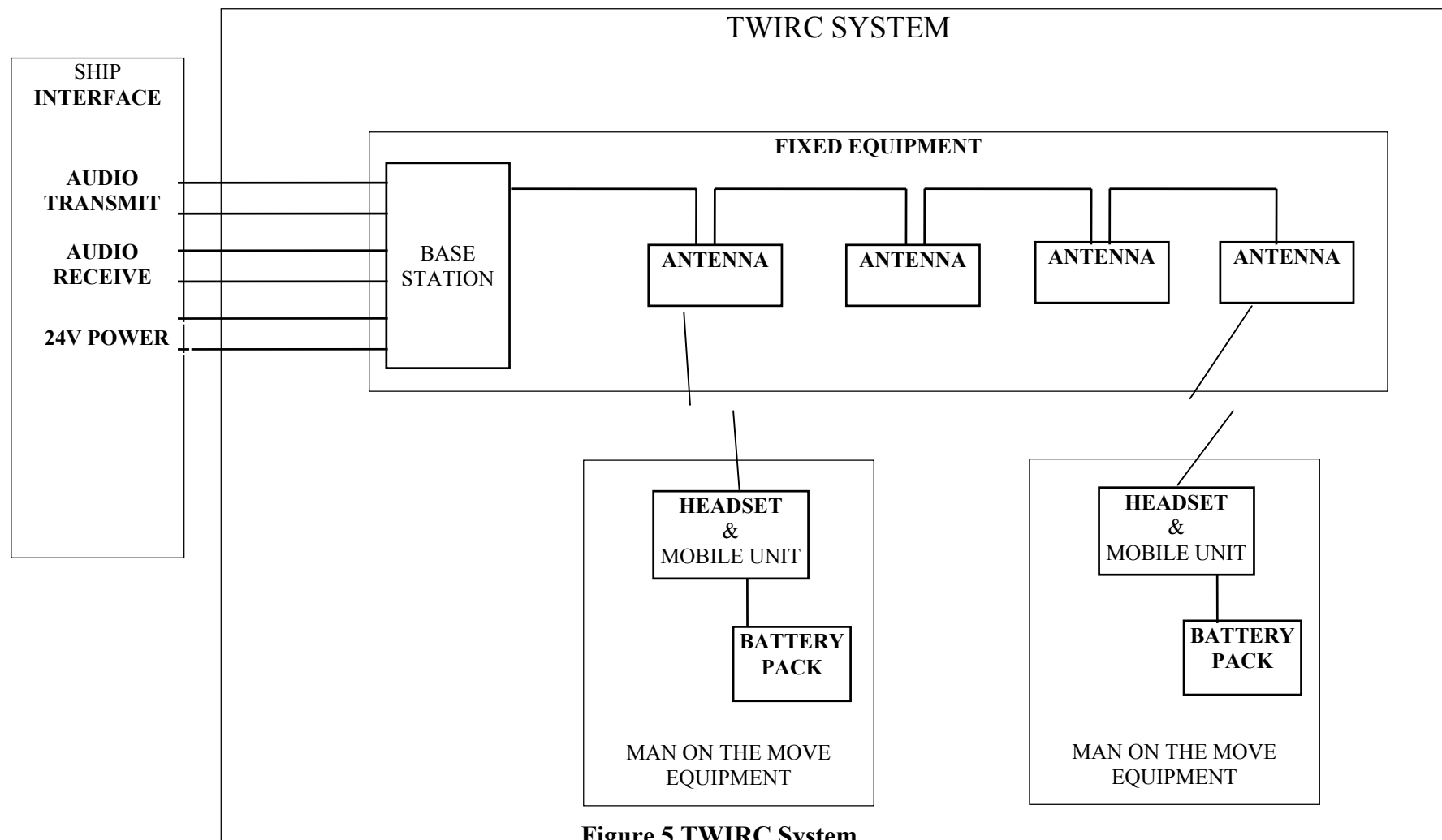
Defective items require standard available test equipment and hand tools to be able to identify a defective unit or item of equipment and carry out the replacement. Accurate configuration records should be maintained, by good housekeeping, such that any replacement unit may be pre-set to the configuration of the unit that it is replacing.

This will maintain the maximum availability of the system.

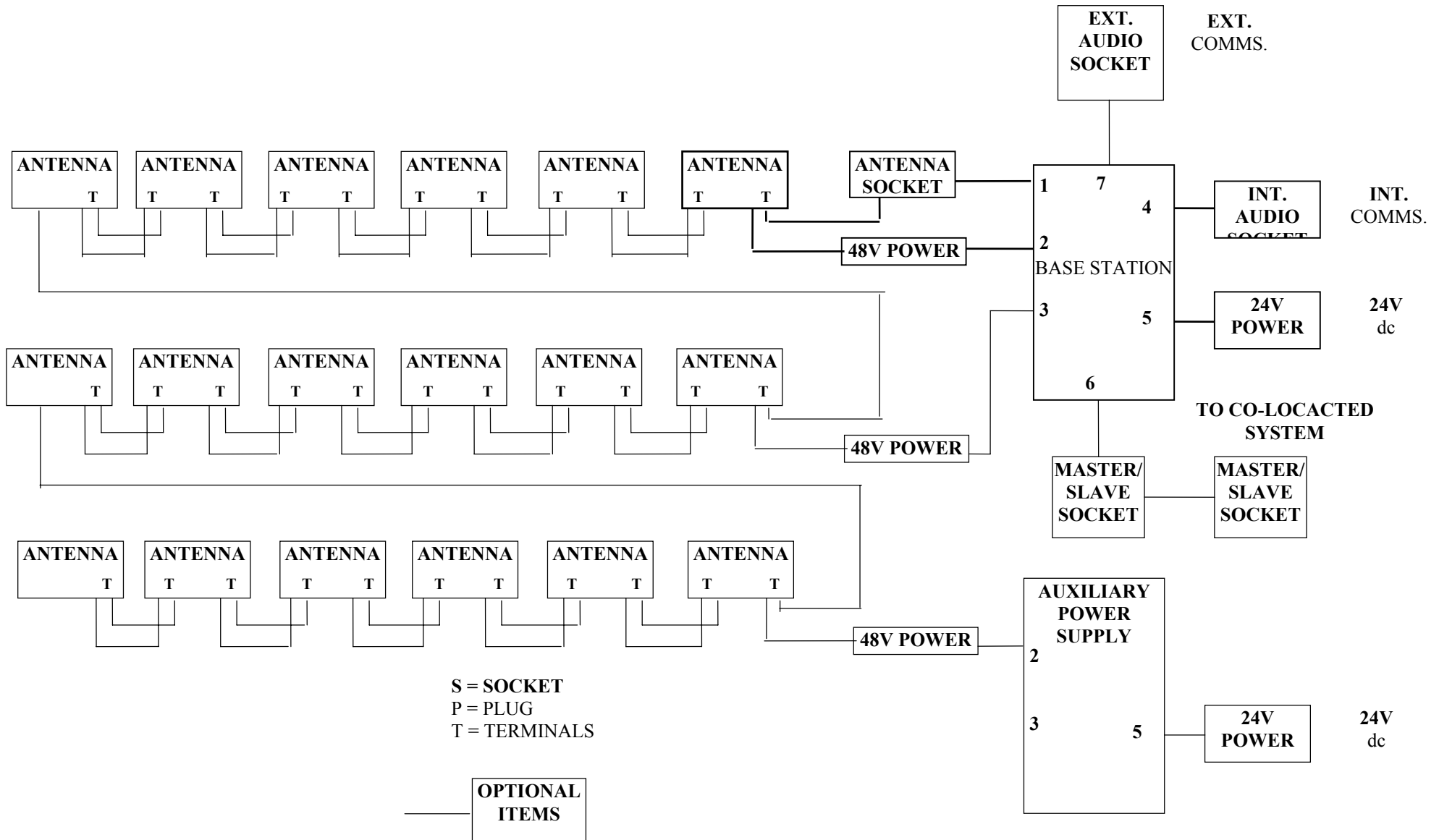
The equipment requires little or no routine maintenance other than normal housekeeping (see section 2). At the time of a major refit the equipment, after many years of service, should be returned to the manufacturer for testing, calibration and refurbishment.

## **6. Facilities Needed by Fleet Maintenance Bases, Maintenance Ships and Forward Support Units**

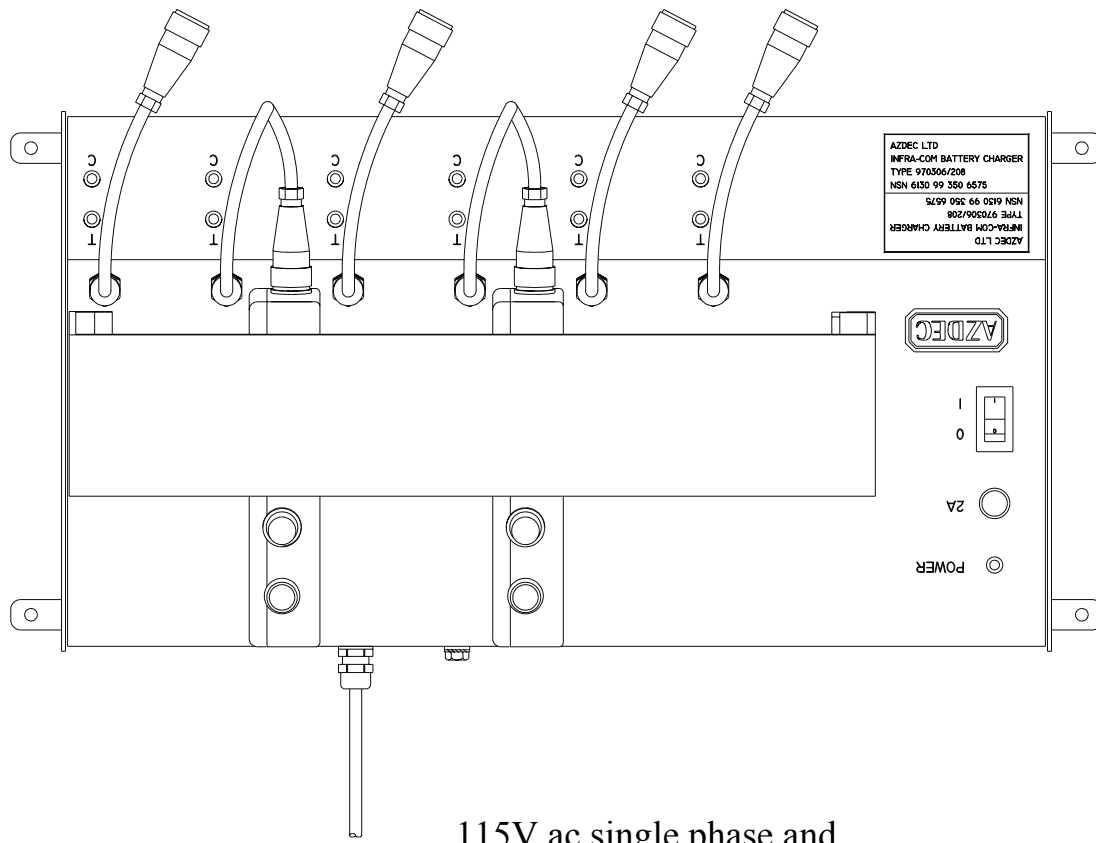
The items of equipment are both small and light weight. With the currently available low cost and rapid world-wide delivery services it is likely to be quicker and more effective to return small items to the manufacturer in the UK. It is proposed that no repair facilities are needed outside the manufacturer.



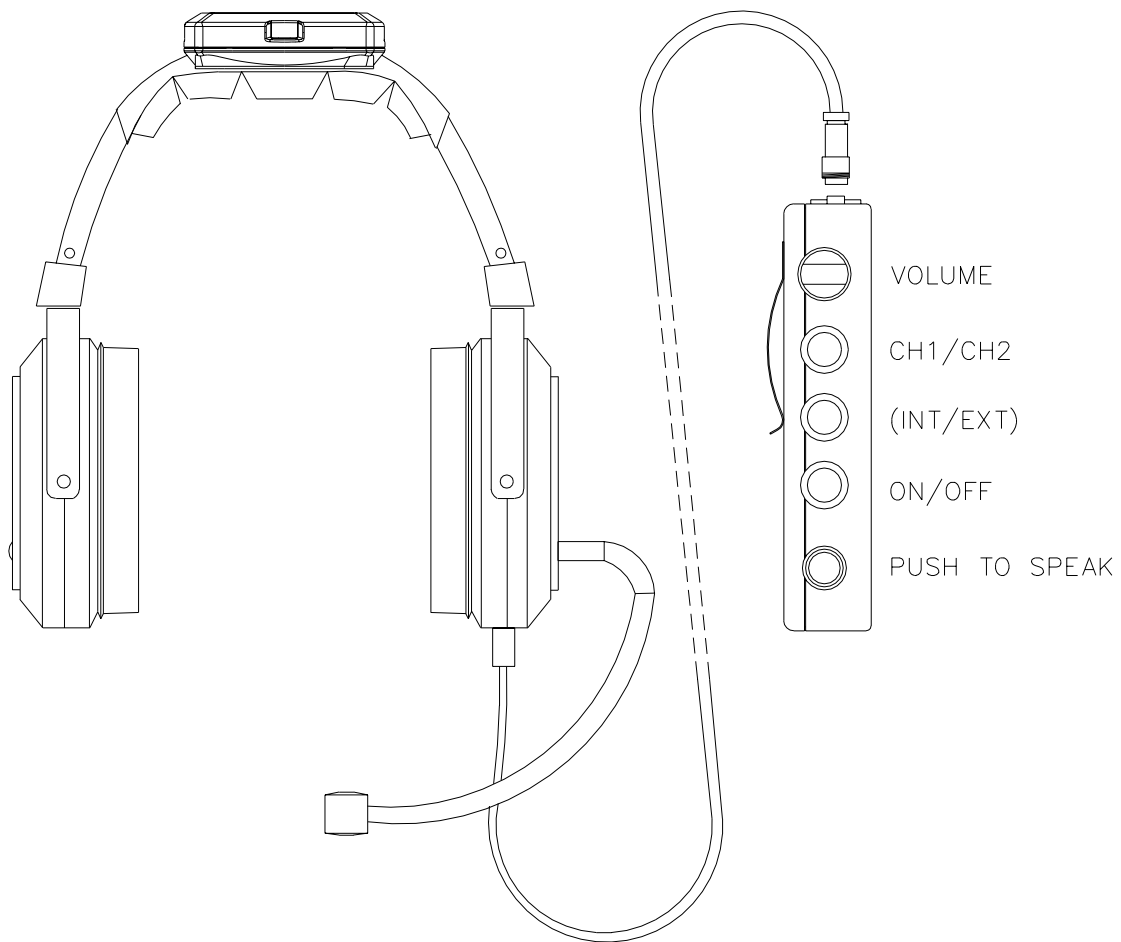
**Figure 5 TWIRC System**



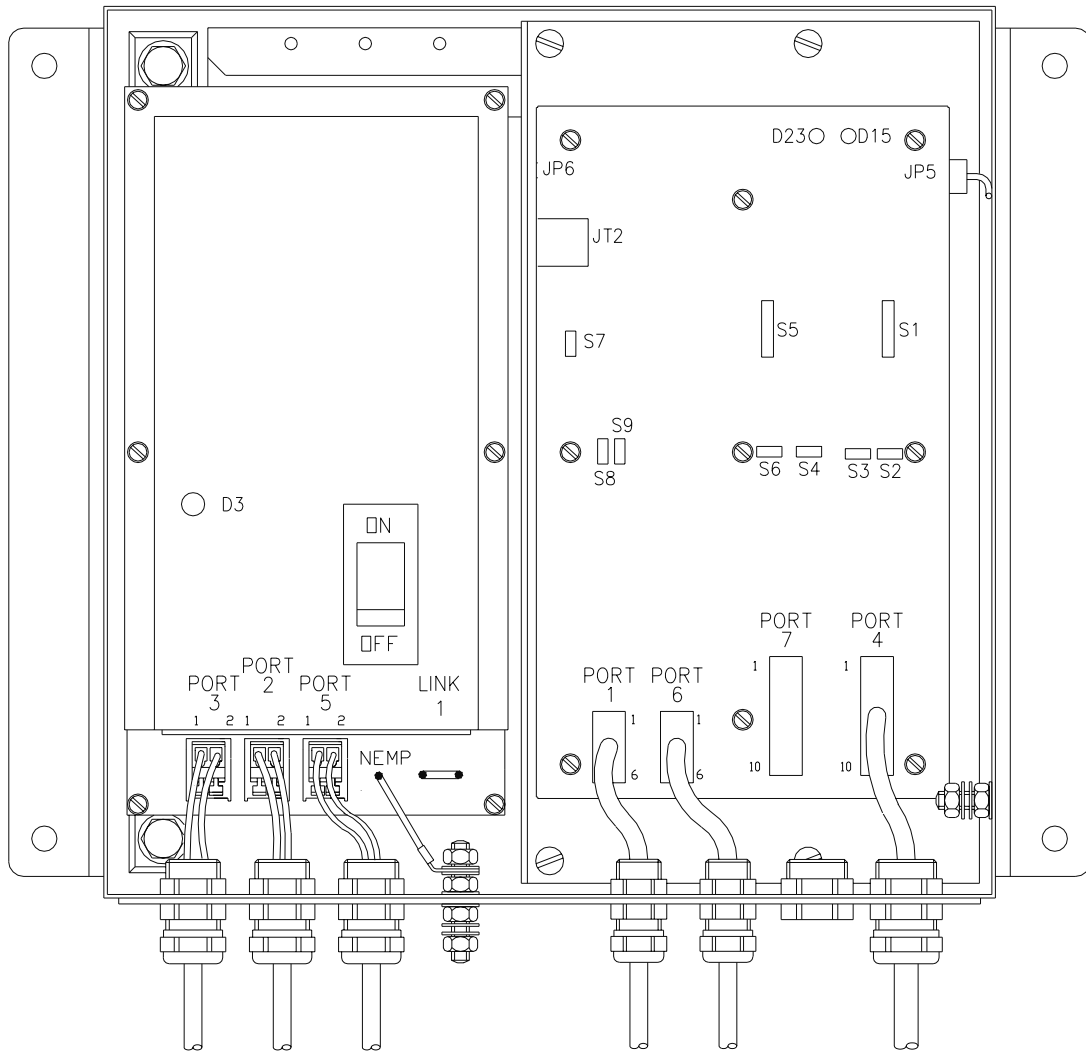
**Figure 6 Fixed Units & Cabling**



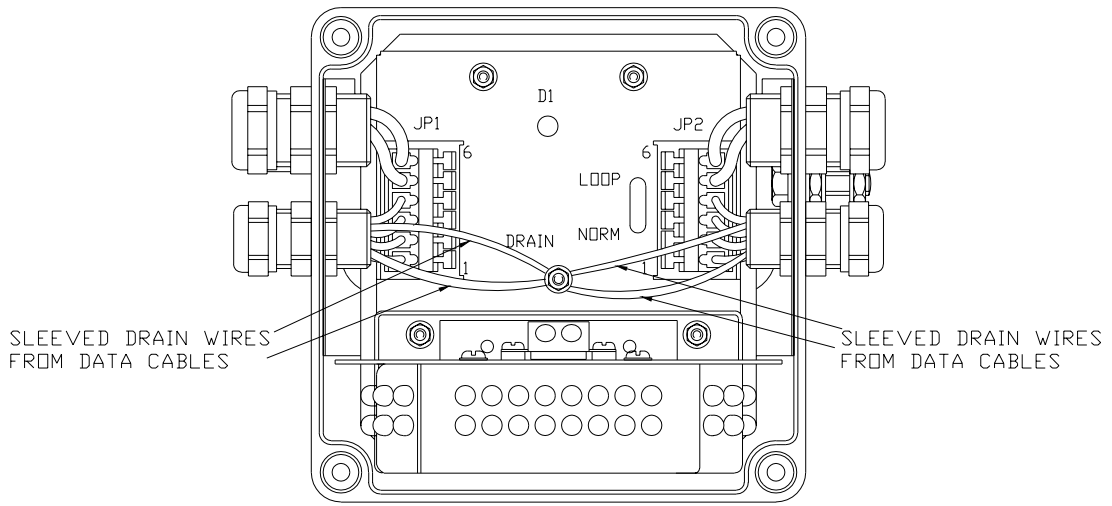
**Figure 7 Battery Charger**



**Figure 8 Mobile Equipment**



**Figure 9 Base Station Internal View**



**Figure 10 Antenna Internal View**







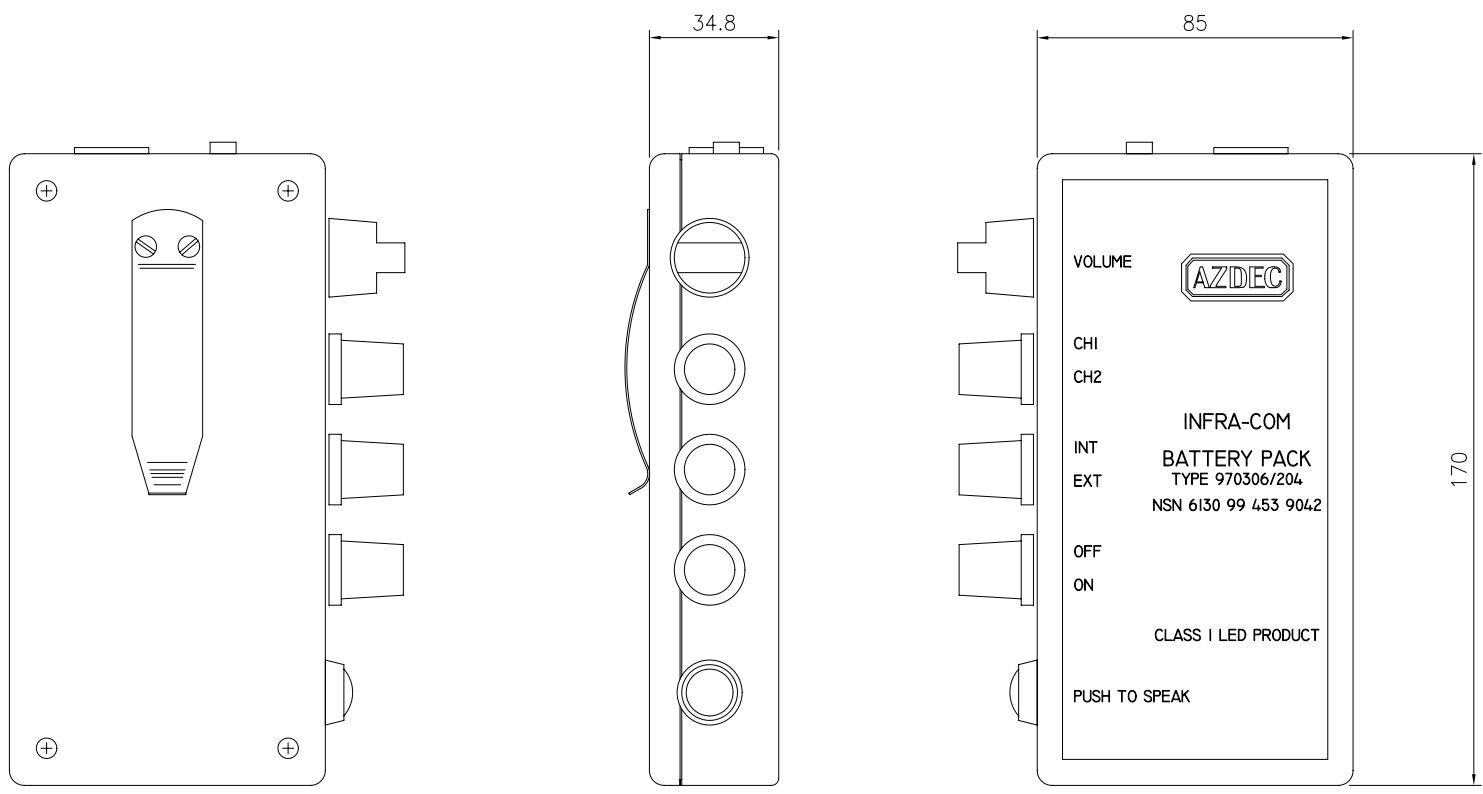
CLASSIFICATION  
**UNCLASSIFIED**

SERVICE  
DRG. NO. 970306/204

SHT 1  
OF 1

3RD ANGLE PROJECTION 

THIS DRAWING COMPLIES WITH BS.308.



100  
90  
80  
70  
60  
50  
40  
30  
20  
10

Colour	Black
Weight	500g nominal
Material	ABS
Content	Steel Belt Clip NiCd Battery & Electronics


NSN 6130 99 453 9042

NO. 10  
MM 10 20 30 40 50 60 70 80 90 100

CERTIFIED					
CHECKED					
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C.Morris		30.11.97	A		
CHANGE NO.	DATE	ISSUE	MP		

MATERIAL	
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SURFACE TEXT.	
ORIG. SCALE	
DIM IN	
TOLERANCES	

DRAWING LOCATION H:\CAD\AUTOCAD\970306  
FILE NAME 204\_1\_1

 32 Gladstone Road,  
Southampton, England. SO19 8GT

TITLE TWIRC BATTERY  
PACK – ENHANCED  
GENERAL VIEW

NS.NO.

CLASSIFICATION UNCLASSIFIED

SERVICE DRG. NO. 970306/204

SHT 1  
OF 1

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CLASSIFICATION  
**UNCLASSIFIED**

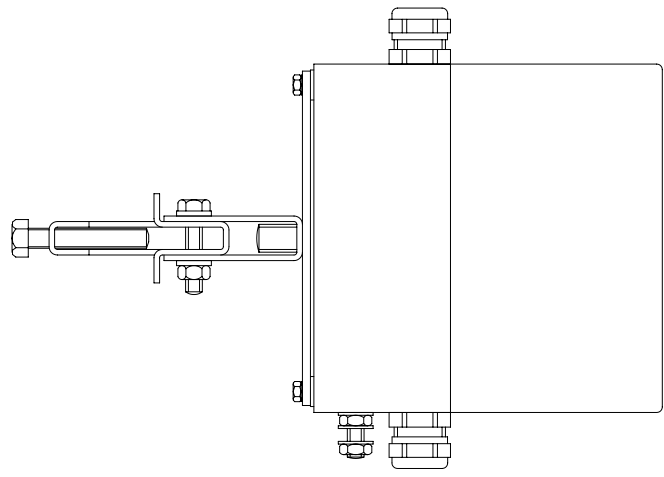
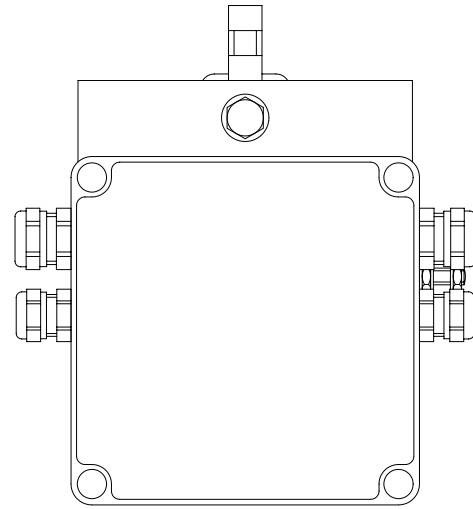
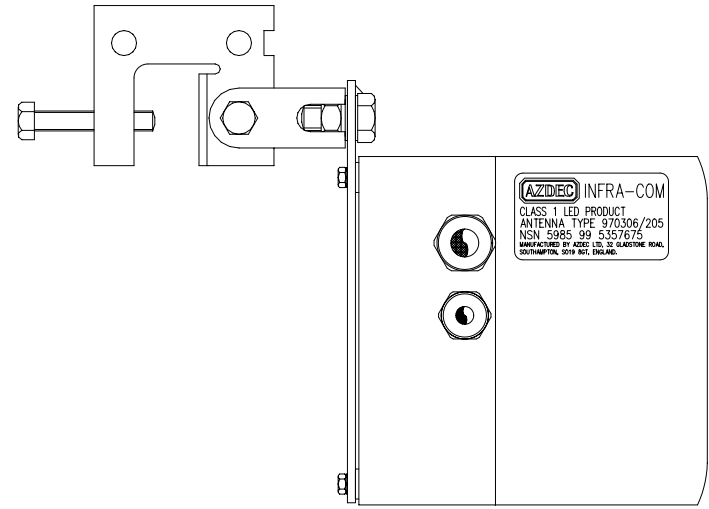
SERVICE  
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SHT 1  
OF 2

3RD ANGLE PROJECTION



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MM 10 20 30 40 50 60 70 80 90 100


WEIGHT: 2kg

NO.	
CERTIFIED	
CHECKED	
DRAWN	
C.Morris	20.05.99 1
CHANGE NO.	DATE ISSUE MP

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SURFACE TEXT.	
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DIM IN	mm
TOLERANCES	0 DEC PLACE ±0.5 1 DEC PLACE ±0.2 2 DEC PLACE ±0.05

DRAWING LOCATION H:\CAD\AUTOCAD\970306  
FILE NAME 205\_1\_1

NSN 5985 99 5357675



32 Gladstone Road,  
Southampton, England. SO19 8GT

TITLE  
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GENERAL VIEW**

NS.NO.

CLASSIFICATION  
**UNCLASSIFIED**

SERVICE  
DRG. NO. **970306/205**

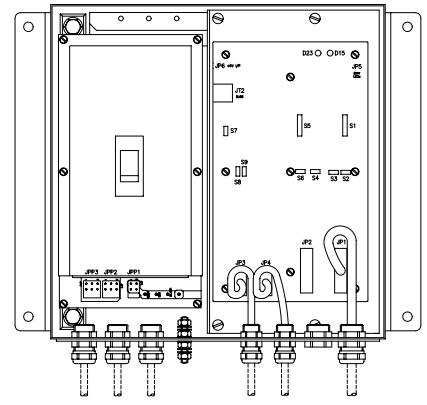
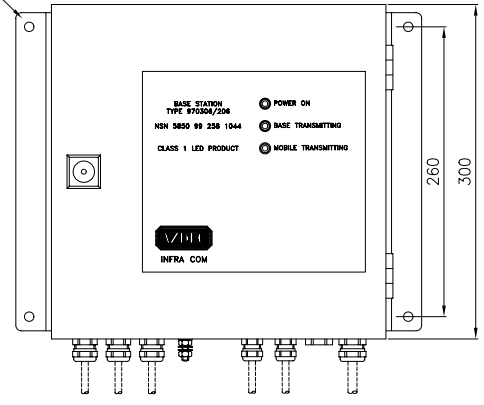
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OF 2

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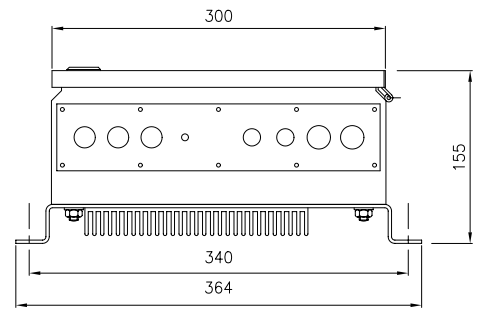
3RD ANGLE PROJECTION 

THIS DRAWING COMPLIES WITH BS.308.

4 OFF M8 FIXING POSITIONS

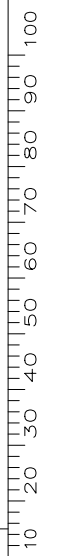


VIEW WITH DOOR REMOVED



VIEW FROM BOTTOM SHOWING REMOVABLE GLAND PLATE

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CHECKED					FINISH
DRAWN					SURFACE TEXT.
CHANGE NO.	04.02.98	1			
	DATE	ISSUE	MP		

ORIG. SCALE	0.2:1
DIM IN	mm
TOLERANCES	

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**AZDEC**

32 Gladstone Road,  
 Southampton, England. SO19 8GT

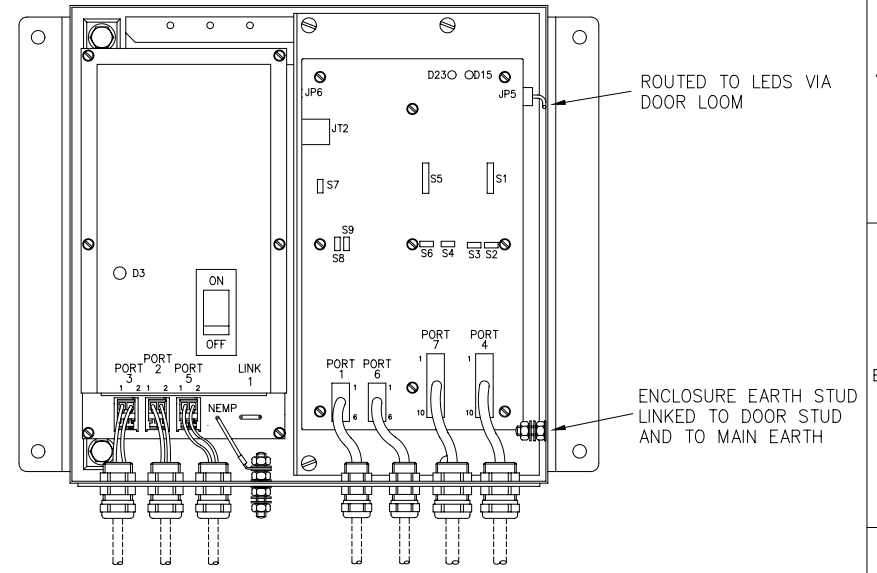
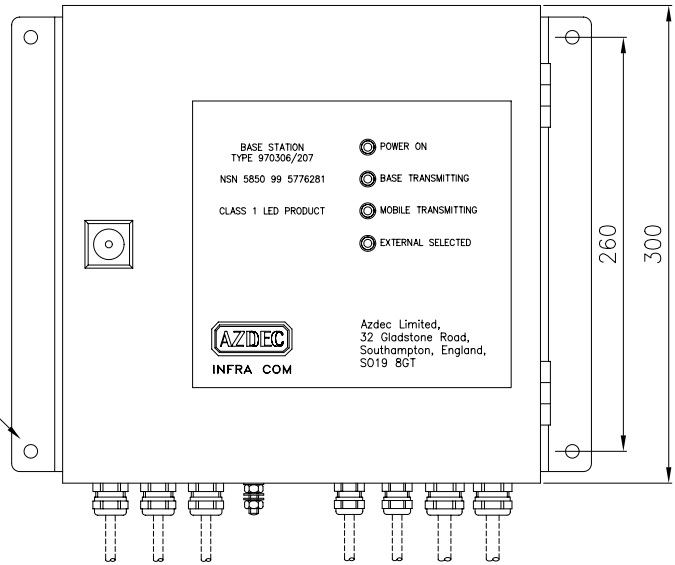
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SERVICE DRG. NO.	970306\206	SHT 1 OF 1

CLASSIFICATION <b>UNCLASSIFIED</b>			
SERVICE DRG. NO. 970306/207	SHT 1 OF 1		

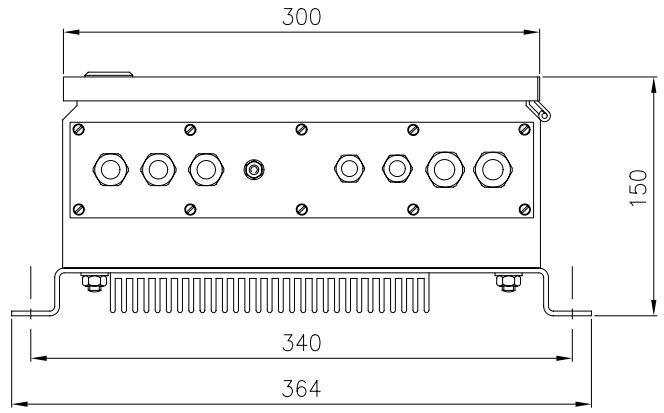
3RD ANGLE PROJECTION 

THIS DRAWING COMPLIES WITH BS.308.

4 OFF M8 FIXING POSITIONS



VIEW WITH DOOR REMOVED



VIEW ON BOTTOM SHOWING  
REMOVABLE GLAND PLATE

WEIGHT: LESS THAN 10kg


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100  
90  
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MM 10 20 30 40 50 60 70 80 90 100

CERTIFIED					
CHECKED					
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		13.03.98	B		
		25.10.97	A		
C.Morris	CHANGE NO.	DATE	ISSUE	MP	

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SURFACE TEXT.	
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DIM IN	mm
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FILE NAME	207_1_B
NSN	5850 99 5776281
	
32 Gladstone Road, Southampton, England. SO19 8GT	

TITLE	TWIRC ENHANCED BASE STATION GENERAL VIEW	
NS.NO.		
CLASSIFICATION	UNCLASSIFIED	
SERVICE DRG. NO.	970306/207	SHT 1 OF 1



CLASSIFICATION  
**UNCLASSIFIED**

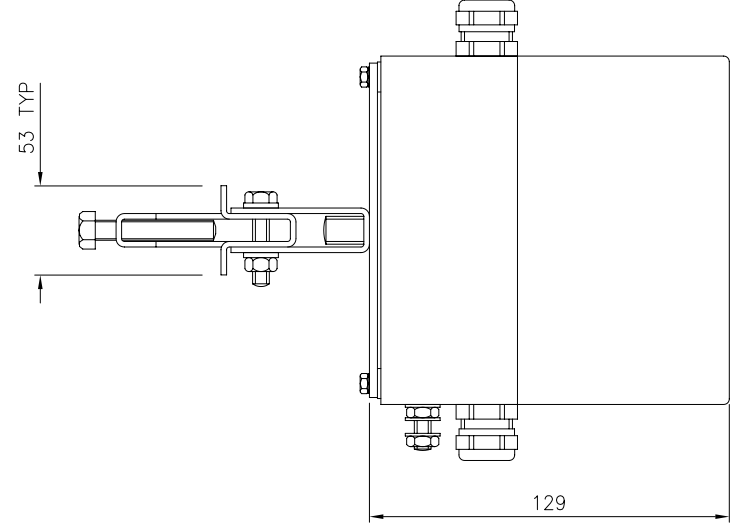
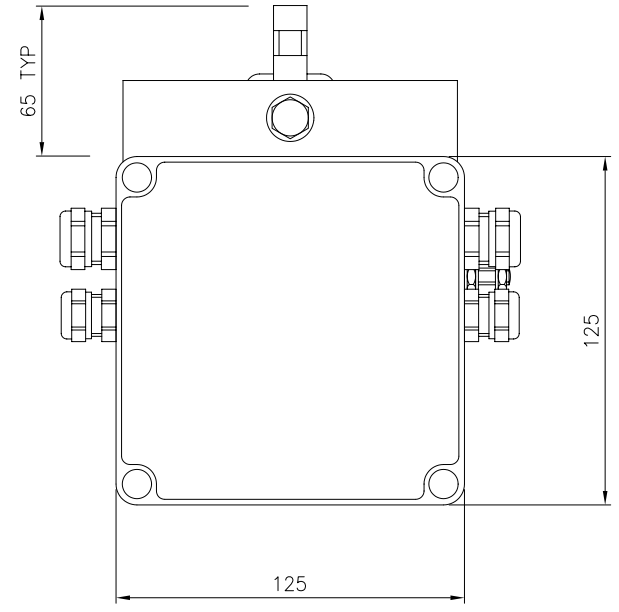
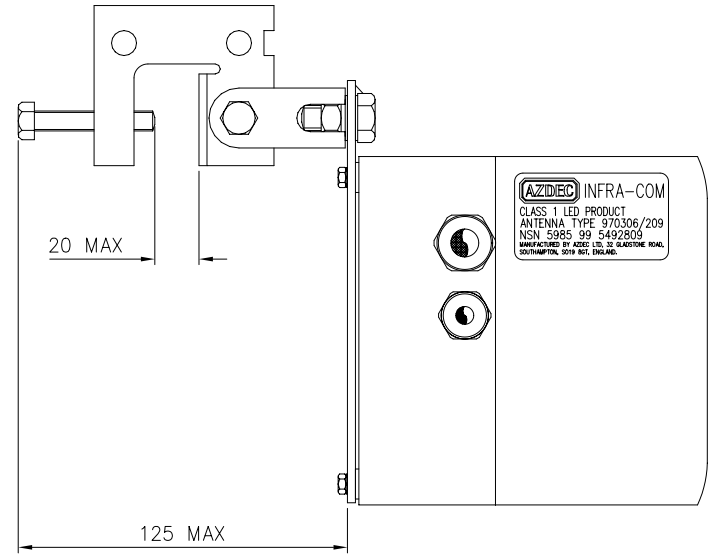
SERVICE  
DRG. NO. **970306/209**

SHT 1  
OF 2

3RD ANGLE PROJECTION



THIS DRAWING COMPLIES WITH BS.308.



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100  
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MM 10 20 30 40 50 60 70 80 90 100

CERTIFIED					
CHECKED					
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C.Morris		13.03.98	A		
CHANGE NO.	DATE	ISSUE	MP		

MATERIAL	
FINISH	
SURFACE TEXT.	
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DIM IN	mm
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FILE NAME 209\_1\_1

NSN 5985 99 5492809



32 Gladstone Road,  
Southampton, England. SO19 8GT

TITLE **TWIRC ANTENNA LONG  
CABLE - GENERAL VIEW**

NS.NO.

CLASSIFICATION **UNCLASSIFIED**

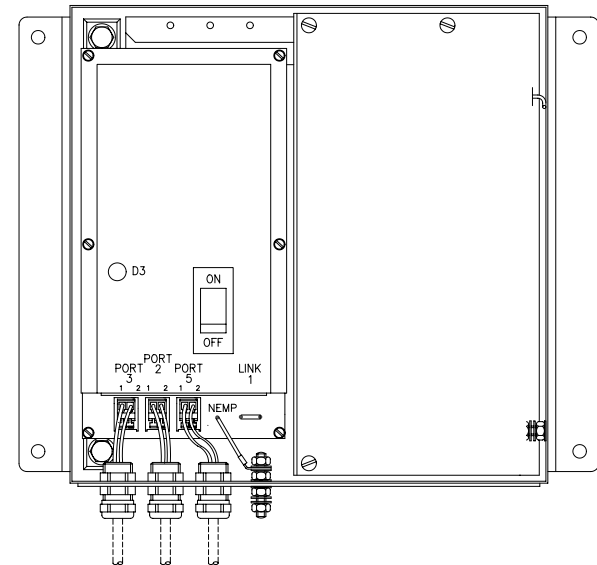
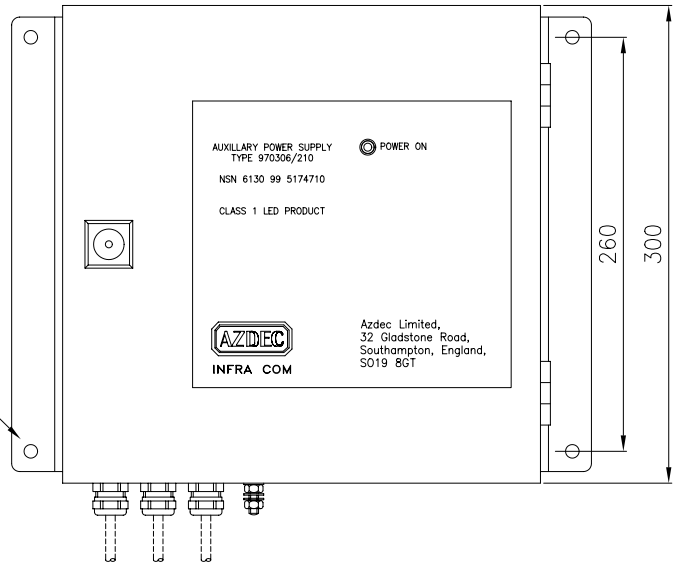
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OF 2

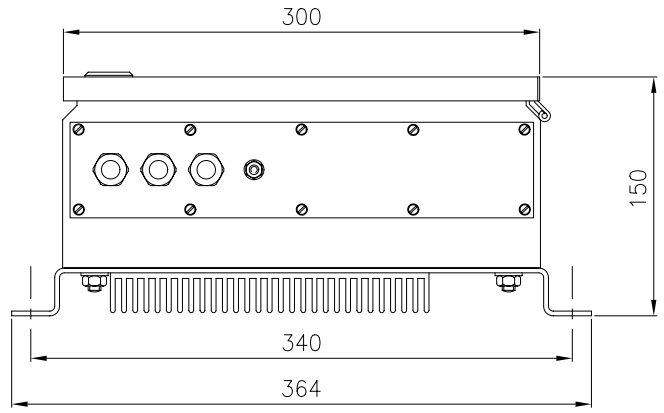
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3RD ANGLE PROJECTION 

THIS DRAWING COMPLIES WITH BS.308.



VIEW WITH DOOR REMOVED



VIEW ON BOTTOM SHOWING REMOVABLE GLAND PLATE

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100  
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MM 10 20 30 40 50 60 70 80 90 100

CERTIFIED									
CHECKED									
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A.C.H.		10.08.98	B						
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FINISH	
SURFACE TEXT.	
ORIG. SCALE	N.T.S.
DIM IN	mm
TOLERANCES	0 DEC PLACE ±0.5 1 DEC PLACE ±0.2 2 DEC PLACE ±0.05

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FILE NAME 210\_1\_1  
NSN 6130 99 5174710

 32 Gladstone Road,  
Southampton, England. SO19 8GT

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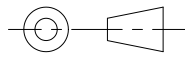




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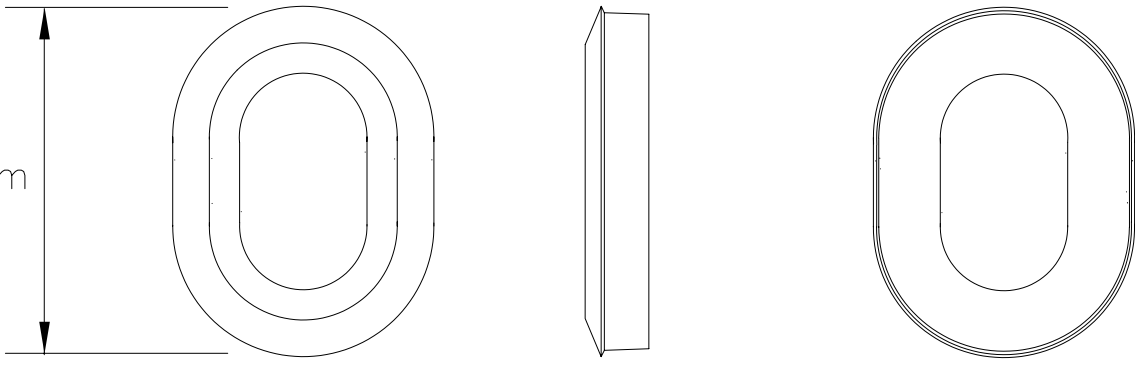
SERVICE  
DRG. NO. 970306/221

SHT 1  
OF 1



THIS DRAWING COMPLIES WITH BS.308.

APPROXIMATELY 110mm



REPLACEMENT EAR PADS FOR HEADSET 970306/201  
 SUPPLIED IN PAIRS – ONE SHOWN  
 COLOUR – BLACK

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100  
90  
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MM 10 20 30 40 50 60 70 80 90 100

NO.	
CERTIFIED	
CHECKED	
DRAWN	
A.C.H.	
CHANGE NO.	16.03.98
DATE	A
ISSUE	MP

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FINISH	
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ORIG. SCALE	N.T.S.
DIM IN	mm
TOLERANCES	0 DEC PLACE ±0.5 1 DEC PLACE ±0.2 2 DEC PLACE ±0.05

DRAWING LOCATION H:\CAD\AUTOCAD\970306  
 FILE NAME 221\_1\_A

NSN 5965 99 5624784

**AZDEC**

32 Gladstone Road,  
 Southampton, England. SO19 8GT

TITLE  
 TWIRC EAR PADS NOISE ATTENUATING  
 HEADSET – GENERAL VIEW

CLASSIFICATION  
 UNCLASSIFIED

SERVICE  
 DRG. NO. 970306/221

SHT 1  
 OF 1