

AEGIS

**INSTRUCTION MANUAL
CZ5001**

PATROL PRO

**Portable Appliance and
Leakage Current Tester**

With Internal
Function,
“Self Check”



The tests performed by
this unit conform with
AS/NZS3760:2010

CZ05090-02

Congratulations on your purchase of an Aegis Pty Ltd
PATROL PRO, Portable Appliance Tester.

We are sure you will be satisfied with its performance and reliability. Please read these instruction carefully before using your PATROL PRO and refer to these notes from time to time to ensure you are always familiar with it's operation



Safety Warning

Testing of Appliances and Extension leads must be conducted by a competent and appropriately trained person.

Care must be taken at all times to ensure personal safety.

Aegis Pty Ltd can also supply many instruments for a number of applications to support installation and maintenance of cabling for the telecommunications, Data and Electrical industries.

If you require further information on any of these instruments, please contact us by way of the phone, fax or e-mail.

WEB: www.aegis.net.au





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1. SAFETY WARNINGS

At initial start up the PATROL PRO will perform a “Self Check”. Although this self check can be performed with or without an appliance plugged into the PATROL PRO, it is considered good practice, that no appliance or leads be plugged into the PATROL PRO until the self check is completed.

Refer to the “Self Check” section, for further details on this operation.

The PATROL PRO must only be used for the purpose, and in a manner, as described in these instructions.

Failing to do so may impair the protection provided by the equipment.

There are three warnings to be noted when operating the PATROL PRO. Each relates to the connection sockets on the front panel and is highlighted by either of the following symbols on the panel label:-



1. Refer to Note in this handbook.
(Warning Note, See Section 1.1)



2. High Test Voltages may be present at this socket
(Warning High Test Voltages, See Section 1.2)

1.1. Warning Note

The **Lead/Probe Socket** is to be used only for the attachment of the Extension Lead adaptor for testing extension leads and multi-way power boards, as well as the attachment of the **Test Probe lead** when testing Class 1 & Class 2 Appliances.

Under no circumstances is live mains 240 volt power to be connected to this socket.

If live mains 240 volt power is inadvertently connected to the Active and Neutral terminals of this socket, the Red LED will light and the PATROL PRO will be isolated and inhibited from performing any further tests until the power is removed from this socket.

See Figure 1.1-1

1.2. Warning High Test Voltages

To perform the tests, appliances are plugged into the **Appliance Socket**. This allows the PATROL PRO to apply test voltages to the appliance via the connection lead. Some of the tests conducted by the PATROL PRO involve the application of up to 500 volts DC; therefore the operator must ensure only the appliance under test is plugged into the **Appliance Socket**. All appliances must be visually checked to ensure they are free from obvious defects before being electrically tested. Do not plug any other lead into this socket or tamper with it in any way other than as directed by these instructions

See Figure 1.2-1



Figure 1.1-1 Warning notice on Lead/Probe Socket



Figure 1.2-1 High Test Voltage at Appliance Socket

1.3. Warning Note

Caution

For added safety, this Leakage Current Measurement Device **MUST** be used in conjunction with a Residual Current Device (RCD), included in the mains supply. An RCD is also referred to as a “Safety Switch”.

1.4. Warning Note & Test Socket

To perform a Leakage Current test, appliances are plugged into the three pin **Appliance Socket**. This allows the PATROL PRO to apply 240 Volt AC, Max 10A, to the appliance via the connection lead. It must be remembered that appliance testing can be a hazardous task, therefore at all times the appliance must be considered live and all precautions taken to minimize the risk of electric shock to the operator.

All appliances must be visually checked to ensure they are free from obvious defects before being electrically tested. The Earth continuity must be verified as good, using a PAT (PATROL PRO).

Do not plug any other lead or appliance into this socket or tamper with it in any way other than as directed by these instructions **See Figure 1.4-1**



Figure 1.4-1 -- 240 Volt AC, 10A may be present at this Socket

2. INTRODUCTION

2.1. Intended use of the PATROL PRO

The PATROL PRO is an easy-to-use, low cost, yet effective Portable Appliance Tester. It has been designed for simple, electrical testing and verification of Portable Appliances and Extension Leads.

It performs essential insulation and conductor continuity tests on portable electrical appliances and extension leads, in particular the Earth conductor.

Insulation Tests are performed at 250Vdc & 500Vdc and the conductor continuity is tested at 200mA.

It also has Leakage Current Measurement which is used to check the insulation integrity of portable electrical equipment. It has been designed for simple, electrical testing and verification of Portable Appliances.

Verification of insulation integrity is determined by measuring the imbalance of current flowing through the active and neutral conductor whilst the appliance is operating in a normal condition. The level of the current imbalance measured on these two conductors is displayed by the LED indicators on the PATROL PRO.

All tests are designed to meet the requirements of AS/NZS 3760 : 2010

Major features of the PATROL PRO are:

- Designed to meet the requirements of AS/NZS 3760 : 2010
- Ease of use – two buttons, “Select Test” and “Start Test”
- Durable construction
- Mains and Battery Powered and Easily Portable
- Low Cost, on the spot, Test & Tag process

2.2. Abbreviations and Definitions

| | |
|--------------------|--|
| MOV | Metal Oxide Varistor |
| Class I Appliance | Earthed |
| Class II Appliance | Double Insulated |
| LED | Light Emitting Diode |
| RCD | Residual Current Device |
| LCM | Leakage Current Measurement |
| PAT | Portable Appliance Tester |
| Functional Earth | Earth connected to allow specific function operation (some RCDs) |
| Protective Earth | Earth Protection as in Class I appliances |

3. GENERAL INSPECTION AND TESTING REQUIREMENTS

3.1. The Standard AS/NZS3760:2010

The standard on “In-service Safety Inspection & Testing of Electrical Equipment”, specifies procedures to ensure the safety of electrical equipment, for full details refer to “Standards Australia, AS/NZS3760:2010. Please note, the following must not be taken as a replacement for the standard, however the essential requirements of the standard can be listed as:-

1. Inspection
2. Electrical Testing
 - a. Earth Conductor Continuity Verification
 - b. Insulation Integrity, between live operational and other normally non-energised, conductive parts of an appliance.
3. Correct Operation of safety switch devices, (RCDs)
4. Electrical Safety of Extension Leads and Power boards.

These requirements are to be applied to Portable Appliances, which are Electrical Items that can be moved during operation or can be easily relocated whilst still connected to the mains power system.

Appliances must be tested with the operational switch in the “ON” position. This is not an issue for most appliances, however, some appliances require the power to be present to actuate or hold the switch on. As stipulated in AS/NZS3760:2010, a leakage current measurement must be performed to check the insulation integrity of these appliances. Therefore standard insulation testers (Megger type units) are unsuitable. It is for this reason that products like the PATROL PRO, can check the insulation integrity by the Differential Leakage Method which measures the leakage current as a result of imbalance in current between the active and neutral conductors, are of great assistance for the testing process.

3.2. Tests Conducted by the PATROL PRO

The PATROL PRO performs three basic groups of tests; Continuity and Insulation and Leakage Current tests.

The Insulation test is performed by commoning the Active & Neutral conductors, internally within the PATROL PRO at the Appliance Socket, and then testing the insulation resistance between these, and the earth conductor of the Lead/Probe Socket, via the Probe or Clip.

To fully test an appliance, it must be switched on. This is normally a simple task, however there are some appliances that require 240Vac to allow the switch to operate or latch in the on position.

As defined in AS/NZS3760:2010 these appliances must undergo a Leakage Current Test. The PATROL PRO supports this test method.

Continuity Tests

- **Earth** – For **Extension Lead** test and **Class 1** Appliance Tests, the earth conductor is checked for continuity, (at 200mA) and conductor resistance, prior to Insulation testing. The lead must prove to be less than one ohm, (1Ω)
- **Active & Neutral** - After the Earth Continuity is checked in an extension lead, both the Active and Neutral continuity is checked at 200mA. This also verifies the polarity of the lead connections.

Insulation Tests

- 250 Volt with an accepted minimum of One Megohm (1MΩ) - this is performed for all lead and appliance tests prior to the 500volt test, to ensure a correct reading if a MOV is present in the appliance under test as per AS/NZS 3760:2010.
- 500 Volt with an accepted minimum of One Megohm, (1MΩ) as per AS/NZS3760:2010.
- 500 Volt with an accepted minimum of Ten Megohm, (10MΩ) as per NSW Code of Practice, *Electrical Practice for Construction Work*

Leakage Current Tests

Before performing any electrical testing on an appliance, a full inspection must be carried out to ensure that it is free from obvious defects that would make the unit unsafe.

If the appliance to be tested is a Class 1, then it must have the Earth Continuity verified as good (refer to Patrol Pro Earth Continuity Tests), before the leakage current test is performed.

The PATROL PRO will perform Leakage Current Measurements on Class I, and Class II appliances, as well as RCDs, with either Functional or Protective earths. **Note:** Leakage Current Tests must be performed with the PATROL PRO connected to a properly earthed GPO, and cannot be performed under battery operation.

Extension Leads and standard power boards, can be fully tested utilizing the functions of a PAT (PATROL PRO), without the need to also test them with the Leakage Current Testing, as there is no switch involved with their operation.

For additional safety for the operator, the PATROL PRO must be used in conjunction with an RCD included in the mains power supply.

Panel Layout

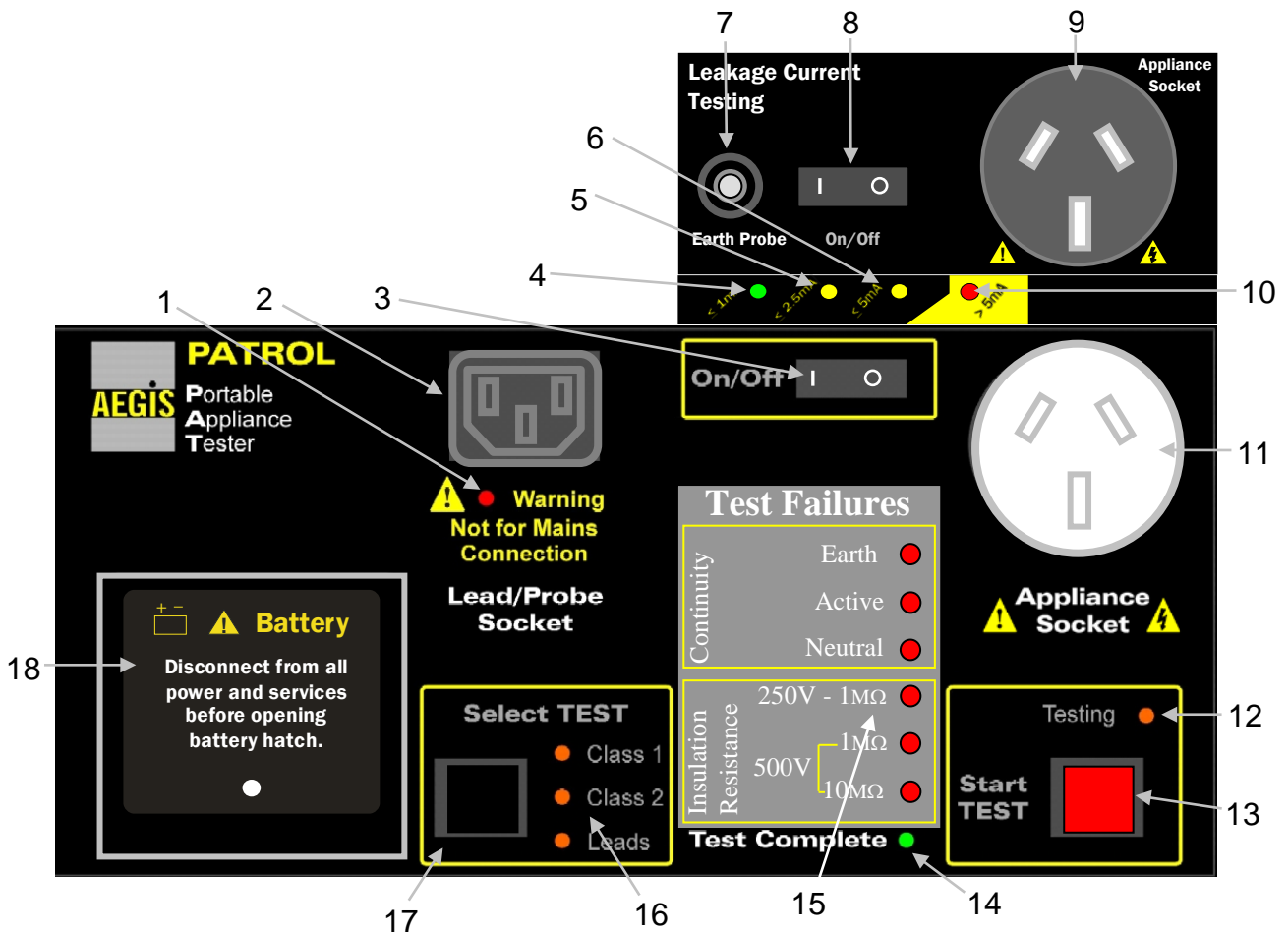


Figure 3.2-1 Controls and fittings of the PATROL PRO

1. **LED:** This lights as a warning if 240V ac is inadvertently connected to the Lead/Probe Socket.
2. **Lead/Probe Socket:** The Test clip and Probe Lead, is plugged into this socket when testing Class 1 and Class 2 Appliances. The Lead Adaptor is also plugged into this socket when testing extension leads or power boards.
3. **Appliance Test ON/OFF Switch:** The PATROL PRO will power up from the 240Vac mains if available, or the internal 9v battery pack if no mains power is available. After switching off, the unit requires a 5 – 10 second pause before being switched back on.
4. **Green LED** to indicate when the Leakage Current is **at or below 1mA**.
5. **Yellow LED** to indicate when the Leakage Current is **at or below 2.5mA, but more than 1mA**.
6. **Yellow LED** to indicate when the Leakage Current is **at or below 5mA, but more than 2.5mA**
7. **Banana Socket** for the connection of the earth test lead.
8. **Leakage Current Test ON – OFF Switch**
9. **Leakage Current Testing Appliance Socket:** Is used to connect the PATROL PRO to the Appliance under test. This socket provides power to operate the appliance; mains voltages are present at this socket during the test sequence. Refer to Section 1 Safety Warnings.



10. **Red LED** to indicate when the Leakage Current is **above 5mA**. The Red LED flashes and a buzzer sounds when the Leakage Current is measured above 5mA.
11. **Appliance Testing Appliance Socket**: Is used to connect the PATROL PRO to the Appliance under test. This socket does not provide power to operate the appliance, however high test voltages are present at this socket during the test sequence. Refer to Section 1 Safety Warnings.
12. **Testing LED**: This LED lights while a test sequence is in progress.
13. **Start Test Button**: After all the connections are made for a test, this button is pressed to start the test sequence.
14. **Test Complete LED**: This LED will light at the completion of the test sequence. It will light continually if no failures have been detected. If any one of the tests has failed this indicator will flash repeatedly.
15. **Test Failure LEDs**: This row of six LEDs indicate any failed condition of the appliance or lead under test. Refer to Section 3 & 4 for understanding test procedure and results.
16. **Selected Test LEDs**: One of these three LEDs will be lit to indicate which test the PATROL PRO is set to perform.
17. **Select Test Button**: This is used to select one of the three preset test sequences. The test selected will be shown by the LEDs, see (16) above.
18. **Internal battery compartment**: Refer to section 6, Care and Maintenance for information on changing the battery.

4. OPERATING INSTRUCTIONS

4.1. Components of the PATROL PRO



Figure 4.1-1 Components and Accessories supplied with the PATROL PRO

Patrol Pro is a Class 1 device, ensure it is connected to a correctly wired GPO with an earth

This section offers the step-by-step instructions on how to set up and use the PATROL PRO, to perform Portable Appliance and Extension Lead tests.

The user must be familiar with the Safety and self testing procedures detailed in Section 7 of this manual.



WARNING

- A. Ensure the appliance under test is removed from service and any power supply, internal or external, before connecting it to the PATROL PRO for testing.
- B. Before connection of any appliance or extension lead to the PATROL PRO, perform a visual inspection to ensure that the appliance or extension lead is not obviously faulty equipment.
- C. Do not electrically test any equipment that fails these visual tests.
- D. A Class I appliance must have the Earth Continuity verified as good before Leakage Current testing with the PATROL PRO.
- E. Ensure the operator has ready access at all times to the mains power outlet that the PATROL PRO is plugged in to, to enable any emergency shut down of the equipment. For the primary disconnection, the PATROL PRO is to be unplugged from the Power outlet.
- F. The PATROL PRO MUST only be used in a mains power outlet that is effectively connected to the building earthing system.

4.2. Appliance Test Procedure

4.2.1. Class 1 Test (Earthed Appliance)

1. Before plugging any appliance or lead in for testing, switch on the PATROL PRO , and allow it to perform the “Self Check”. Observe the results.
2. Plug the Appliance to be tested into the *Appliance Socket*, and *switch on the appliance*.
3. Attach the Test Probe or Clip to a metal section of the appliance being tested. The clip is the preferred test connection, with the probe to be used when the clip is not suitable to attach to the appliance. Ensure good contact is made with the probe, and that fingers and hands are kept well clear of all metal parts of the probe or appliance under test.
4. The probe or clip may need to be moved and the appliance retested in several additional sections to ensure that all exposed metal sections are fully tested.
5. Select the type of appliance to be tested, **Class 1**.
6. After all connections are made, press the **TEST** button.
7. The **Orange LED** will light during the Test and the **Green LED** will light when the test is complete.
8. Any failures will be shown by a **Red LED** which will light just to the right of the failed test. Also the **Green LED**, ‘Test Complete’ will flash continually.
9. Determine if the test shows as a *Pass* or *Fail*. (See Interpreting Test Results, section 4.4)
10. Enter the test results on the appropriate label and attach it to the appliance, and record the test results in the record or asset register.



Figure 4.2.1-1 Class 1 Appliance Test connections.

4.2.2. Class 2 Test (Double Insulated Appliance)

1. Before plugging any appliance or lead in for testing, switch on the PATROL PRO , and allow it to perform the “Self Check”. Observe the results
2. Plug the Appliance to be tested into the *Appliance Socket*, and *switch on the appliance*.
3. Attach the Test Probe or Clip to a metal section of the appliance being tested. The clip is the preferred test connection, with the probe to be used when the clip is not suitable to attach to the appliance. Ensure good contact is made with the probe, and that fingers and hands are kept well clear of all metal parts of the probe or appliance under test.
4. The probe or clip may need to be moved and the appliance retested in several additional sections to ensure that all exposed metal sections are fully tested.
5. Select the type of appliance to be tested, **Class 2**.
6. After all connections are made, press the **TEST** button.
7. The **Orange LED** will light during the Test and the **Green LED** will light when the test is complete.
8. Any failures will be shown by a **Red LED** which will light just to the right of the failed test. Also the **Green LED**, ‘Test Complete’, will flash continually.
9. Determine if the test shows as a *Pass* or *Fail*. (See Interpreting Test Results, section 4.4)
10. Enter the test results on the appropriate label and attach it to the appliance, and record the test results in the record or asset register.



Figure 4.2.2-1 Class 2 Appliance Test connections, using the Clip



Figure 4.2.2-2 Class 2 Appliance Test Connection using the Probe



Figure 4.2.2-3 Class 2 Appliance Test Connection using the Clip

4.3. Extension Lead Test Procedure

1. Before plugging any appliance or lead in for testing, switch on the PATROL PRO , and allow it to perform the “Self Check”. Observe the results
2. Plug the male end of the Extension Lead into the *Appliance Socket*, and the other end of the lead to the short adaptor lead, which is plugged into the *Lead/Probe Socket*
3. Press the test selection button to Select the **Lead** Test
4. Press the **TEST** button
5. The **Orange LED** will light during the Test and the **Green LED** will light when the test is complete.
6. Any failures will be shown by a **Red LED** which will light just to the right of the failed test. Also the **Green LED**, ‘Test Complete’, will flash continually.
7. Determine if the test shows as a *Pass* or *Fail*. (See Interpreting Test Results, section 4.4)
8. Enter the test results on the appropriate label and attach it to the lead, and record the test results in the record or asset register



Figure 4.3-1
Extension Lead Test Connections



Figure 4.3-2
Multi-way Power Board Test Connections

4.4. Interpreting Test Results

The PATROL PRO conducts up to three Continuity Tests, and three Insulation Resistance Tests, depending on the type of equipment being tested. The PATROL PRO performs the essential tests to comply with AS/NZS3760:2010; however appliances that operate with interlocking devices and items fitted with RCDs may require further testing, outside the scope of the PATROL PRO.

It must also be noted that there are some minor differences within Australian States “Code of Practices”, therefore, an appliance test result may indicate a Fail, however if the test result is compared to the particular Code of Practice relative to the state where the test applies, it may be determined that in fact the appliance meets the required minimum standard, and is therefore safe to return to service, complete with a “Pass” label attached.

The following is a list of the known tests results where these conditions apply.

Please note: Always ensure you refer to the latest and current Australian Standard or Code of Practice relative to the state where the appliance is being tested and intended for use.

Lead Test Results

1. Pass – No **RED** LED lit.
2. Fail – Any **RED** LED lit and ‘Test Compete’ LED continually flashing

Class 1 Appliance Test Results

1. Pass - No **RED** LED lit
2. Pass – 500 Volt (1 or 10 M Ω) LED lit, with the 250 Volt LED not lit and ‘Test Compete’ LED continually flashing. (See Note 3)
3. Fail – Any other combination of **RED** LEDs lit and ‘Test Compete’ LED continually flashing

Class 2 Appliance Test Results

1. Pass - No **RED** LED lit
2. Pass – 500 Volt (1 or 10 M Ω) LED lit, with the 250 Volt LED not lit and ‘Test Compete’ LED continually flashing. (See Note 3)
3. Pass – If **RED** LED 10 M Ω lit, all Australian states except NSW and ‘Test Compete’ LED continually flashing (See Note 2)
4. Fail – Any other combination of **RED** LEDs lit and ‘Test Compete’ LED continually flashing

Notes:

1. All tests performed by the PATROL PRO are designed to meet the requirements of the AS/NZS 3760:2010, for in service safety inspection and testing of electrical equipment. Additional Standards also apply to specific areas of work such as construction sites and film sets, etc. The requirements of these standards must be incorporated when using the PATROL PRO to assist in determining the safety of electrical equipment for these specific areas.
2. If a Class 2 Appliance is being tested for use on a construction site within NSW, then it must conform to the NSW Code of Practice “Electrical Practice for Construction Work”, which states 10 M Ω minimum Insulation Resistance.
3. As detailed in AS/NZS3760:2010, if an appliance is fitted with a MOV and it passes the 250 Volt Insulation Test but Fails the 500 Volt test, it is still considered safe and can be treated as a “PASS”.
4. If your PATROL PRO locks-up during a test, the internal battery may be low, refer to Section 6.4 Low Battery Indication, and Section 7.2, Self Check.

4.5. Leakage Current Test Procedure

To provide additional safety for the operator, the PATROL PRO must be used in conjunction with an RCD included in the main power supply.
 For disconnection of the PATROL PRO from mains power, it should be unplugged from the power outlet.

4.5.1. Class I Test (Earthed Appliance)

11. Before plugging any appliance in for testing, switch on the PATROL PRO, and allow it to perform the “Self Test”. Observe the results. For full details on the Self Test refer to Section 7.
12. Switch the PATROL PRO off again.
13. Verify the Earth Continuity is good in the appliance using a Patrol, or suitable continuity tester.
14. Plug the Appliance to be tested into the *Appliance Socket* of the PATROL PRO.
15. Keep hands free from the appliance under test, and then switch on the PATROL PRO. (*Always observe the self test when it is operating*)
16. Switch on the appliance, ensuring you only touch the ON/OFF switch when doing so.
17. Observe the LEDs to determine the state of the appliance.
18. For **Class I** appliances a “**PASS**” is indicated by either the **Green** or one of the **Yellow LEDs** which will light, indicating that the leakage Current is at or below 5mA. This is in accordance with AS/NZS3760:2010
19. A “**FAILURE**” is indicated by the **Red LED** which will flash and a buzzer will sound, pulsing with the flash rate of the Red LED.
20. If a Failure is indicated, switch off the PATROL PRO at the wall socket immediately, and then unplug the appliance. *Refer to “Warning Note E”, Page 13, for detail*
21. Tag the appliance accordingly.

*Note: A PASS can be indicated by any one of these three LEDs
 The maximum leakage allowed is 5mA. This is in accordance
 with AS/NZS3760:2010*



Figure 4.5.1-1 Class I Appliance Pass.

4.5.2. Class II Test (Double Insulated Appliance)

1. Before plugging any appliance in for testing, switch on the PATROL PRO, and allow it to perform the “Self Test”. Observe the results. For full details on the Self Test refer to Section 7.
2. Switch the PATROL PRO off again.
3. Plug the Appliance to be tested into the *Appliance Socket* of the PATROL PRO.
4. Connect the Earth probe or clip to any exposed metal section of the appliance, several sections may need to be tested. It may be possible to wrap the appliance in a metal foil or mesh to assist with this test. Remember to leave the on/off switch exposed for access.
5. Keep hands free form the appliance under test, switch on the PATROL PRO. (*Always observe the self test when it is operating*)
6. Switch on the appliance, ensuring you only touch the ON/OFF switch when doing so.
7. Observe the LEDs to determine the state of the appliance.
8. For **Class II** appliances a “**PASS**” is only indicated by the **Green LED** which will light, indicating that the leakage Current is at or below 1mA. This is in accordance with AS/NZS3760:2010
9. A “**FAILURE**” is indicated by any of the Yellow or Red LEDs lit. The **Red LED** will flash and a buzzer will sound, pulsing with the flash rate of the Red LED.
10. If a Failure is indicated, switch off the PATROL PRO at the wall socket immediately, and then unplug the appliance. Refer to “Warning Note E”, Page 13, for detail
11. Tag the appliance accordingly.

Note: A PASS can only be indicated by the Green LED, as the maximum leakage allowed is 1mA. This is in accordance with AS/NZS3760:2010

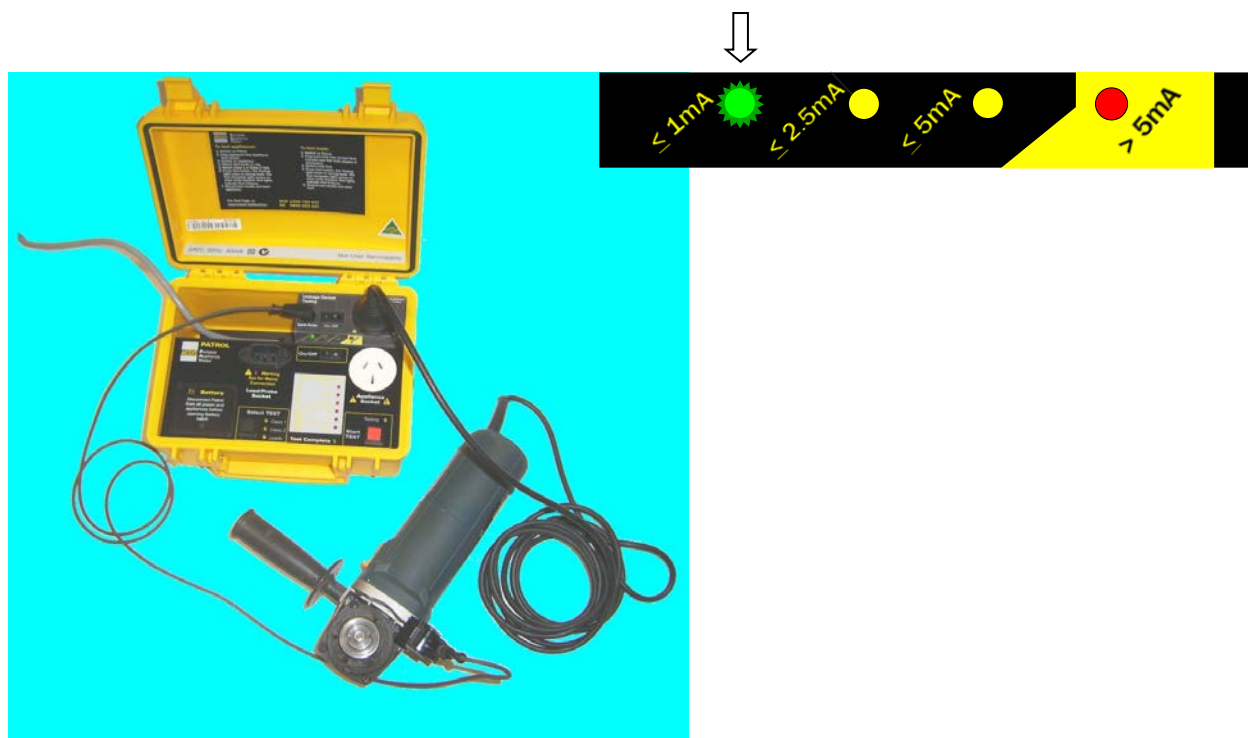


Figure 4.5.2-1 Class II Appliance Pass.

4.6. Class I & Class II - Fail Indication



Figure 4.6-1 Class I Appliance Fail.



Figure 4.6-2 Class II Appliance Fail.



4.7. Testing Residual Current Devices (RCDs)

Special Note: - The PATROL PRO will test and verify the insulation integrity of all RCDs but it must be understood that it in no way attempts to test the actuation, or operation time, of an RCD.

4.7.1. Testing RCDs.

1. Before plugging an RCD in for testing, switch on the PATROL PRO, and allow it to perform the “Self Test”. Observe the results. For full details on the Self Test refer to Section 7.
2. Switch the PATROL PRO off again.
3. Verify the Earth Continuity is good in the RCD, using a Patrol, or suitable continuity tester.
4. Plug the RCD to be tested into the *Appliance Socket* of the PATROL PRO.
5. Keep hands free of the RCD, then switch on the PATROL PRO. *(Always observe the self test when it is operating)*
6. Observe the LEDs to determine the state of the RCD.
7. For a **Functional Earth** RCD a “PASS” is indicated by either the **Green** or one of the **Yellow LEDs** which will light, indicating that the leakage Current is at or below 5mA. This is in accordance with AS/NZS3760:2010
A “FAILURE” is indicated by the **Red LED** which will flash, plus a buzzer will sound, pulsing with the flash rate of the Red LED.
8. For a **Protective Earth** RCD a “PASS” is indicated by the **Green LED** which will light, indicating that the leakage Current is at or below **1mA**, and a “FAILURE” is indicated by either of the **Yellow LEDs**, or the **Red LED** which will flash, plus a buzzer will sound, pulsing with the flash rate of the Red LED.
9. If a Failure is indicated, switch off the PATROL PRO immediately at the wall socket, then unplug the RCD. *Refer to “Warning Note E”, Page 13, for detail*
10. Tag the RCD accordingly.

Note: *Testing operation time and threshold for an RCD is outside the scope of the PATROL PRO*

4.8. Test Results Guide – Leakage Current Limits

Referenced from Table 1 of AS/NZS3760:2010

| Equipment Type | Leakage Test | Maximum Leakage, mA |
|---|---|---------------------|
| Class I | Measure the current flowing in the protective earth conductor. | 5 |
| Class II | Measure the current flowing between accessible unearthed metal and earth. | 1 |
| Portable RCDs with functional earth | Measure the current flowing in the functional earth conductor | 5 |
| Cord Extension Sets, Portable Outlets and Portable RCDs | Measure the current flowing in the protective earth conductor | 1 |

Table 4.8-1 Leakage Current Limits

5. SPECIFICATIONS

5.1. Electrical

| | |
|--------------------------------|--|
| Insulation Test Voltage: | 250Vdc $\pm 2\%$ & 500Vdc $\pm 2\%$ (Current Limited, $< 2\text{mA}$) |
| Earth Continuity Test Current: | 200mA $+0 -3\%$ |
| Earth Test: | Includes an internal functional earth connection. |
| Power Supply: | Input: 240V/50Hz, 10A, Class 1. Note: Input current consists of 40mA internal current consumption of the PATROL PRO and a 10A rating for the Leakage Current Outlet Socket Leakage Current Outlet Socket: Available Output 240V/50Hz, 10A. |
| Internal Battery type: | 6 x 1.5V size "AA" Alkaline Type IEC-LR6. |
| Battery Life: | Minimum 40 hours |

5.2. Environmental

- Indoor use
- Altitude up to 2000m
- Temperature: Operating 0°C to $+50^{\circ}\text{C}$
Storage -20°C to $+70^{\circ}\text{C}$
- Humidity 95%RH Non-condensing
- Suitable for connection to Mains supply voltage fluctuations up to $\pm 10\%$ of nominal voltage (230V)
- Suitable for connection to mains circuits rated for transient Overvoltage Category II of IEC 60364-4-443
- Suitable for use within Pollution Degree 2 environments, as defined in AS61010.1-2003

5.3. Physical

| | |
|-------------|------------------------|
| Dimensions: | 235 x 110 x 190 mm. |
| Mass: | 2.1 kg (Inc Batteries) |

5.4. Tests

| | |
|--------------------------|--|
| Earth Continuity Test: | 200mA Test Current. Pass/Fail Threshold 1 ohm $\pm 5.0\%$ |
| Active Continuity Test: | 200mA Test Current. Pass/Fail Threshold 1 ohm $\pm 5.0\%$ |
| Neutral Continuity Test: | 200mA Test Current. Pass/Fail Threshold 1 ohm $\pm 5.0\%$ |
| Insulation Test: | 250V DC Pass/Fail Threshold 1 Megohm $\pm 5.0\%$ 500V DC. Pass/Fail Threshold 1 Megohm $\pm 5.0\%$ 500V DC Pass/Fail Threshold 10 Megohm $\pm 5.0\%$ |

5.5. Test Sequence

Class 1 Earthed Appliances

- Earth Continuity Test. (*If Earth Continuity Fails, Insulation Test is not performed*)
- Insulation Test at 250Vdc
- Insulation Test at 500Vdc

Class 2 Double Insulated Appliances

- Insulation Test at 250Vdc
- Insulation Test at 500Vdc



Extension Leads and EPODs

- Earth Continuity Test. *(If Earth Continuity Fails, Insulation Test is not performed)*
- Active Continuity Test
- Neutral Continuity Test
- Insulation Test at 250Vdc
- Insulation Test at 500Vdc

Leakage Current Tests

The LEDs will light at the following thresholds, indicating the result of the measurement of the return leakage current in the Earth conductor. Level of accuracy of the measurement is $\pm 250\mu\text{A}$

| | | |
|--------------|---------------------------|------------------------------------|
| Threshold 1: | 0 to 1mA | Green LED will light |
| Threshold 2: | Greater than 1mA to 2.5mA | First Yellow LED will light |
| Threshold 3: | Greater than 2.5mA to 5mA | Second Yellow LED will light |
| Threshold 4: | Greater than 5mA | Red LED will light & Buzzer sounds |

These thresholds are in line with the requirements of AS/NZS3760:2010.

5.6. Applicable Standards

Tested and certified to the full requirements of AS61010.1-2003
 Manufactured under a Quality System complying to ISO9001:2000 (QEC Lic.5948)

5.7. Standard Accessories

| <i>Accessory</i> | <i>Qty</i> | <i>Part No</i> |
|-------------------------|------------|-------------------|
| Extension Lead Adaptor | 1 | (CZ5094) |
| Lead Test IEC Banana | 1 | (2311IECSPFC100N) |
| Clip Test | 1 | (5004/LM-IEC-N) |
| Probe Test | 1 | (402-IEC-N) |
| Instruction Manual | 1 | (CZ05090) |
| Pass Test Tags | 10 | (CZ5071) |
| Fail Test Tags (Danger) | 2 | (DTGEN) |
| Test Lead | 1 | (2350-IEC-100-N) |

5.8. Optional Accessories

| <i>Accessory</i> | <i>Qty</i> | <i>Part No</i> |
|-------------------------|------------|----------------|
| Pass Test Tags | 100 | (CZ5072) |
| Fail Test Tags (Danger) | 50 | (CZ5073) |

*** These specifications and part numbers are subject to change without notice***

6. CARE AND MAINTENANCE

6.1. Safety

The user must be familiar with the Safety and self testing procedures detailed in Section 7 & 8 of this manual

6.2. Warranty

The PATROL PRO is warranted against defects in materials and workmanship for a period of 12 months from the date of purchase. If AEGIS PTY LTD receives notice of such defects within the warranty period, AEGIS shall, at its discretion, either repair or replace the defective unit. For purposes of warranty repair or replacement, the user is required to return the defective item together with proof of purchase to AEGIS at the address given in this section below. The warranty does not apply for defects or damage arising from abuse, accident, misapplication, misuse or as a result of service or modification by anyone other than Aegis.

Aegis is not responsible for any incidental or consequential damages resulting from the breach of any express or implied warranty including damage to property and to the extent permitted by law damages for personal injury. Aegis does not assume liability or responsibility for any loss or damage resulting from the use of this device.

6.3. Maintenance and Servicing

Apart from routine battery replacement, the PATROL PRO contains no user-serviceable parts, and damaged or failed instruments should be returned to the manufacturer for repair. Such units should be suitably packaged and sent by pre-paid parcel post or courier to:

Aegis Pty Ltd.

200 Rooks Rd, Vermont, Victoria, Australia, 3133

The sender's name and return address must naturally be supplied, together with a description of the fault. If different from the return address, an invoicing address should also be given.

6.4. Low Battery Indication

When the internal 9V battery pack reaches a predetermined low level, after which the test results will no longer be reliable, all the Test result LEDs will light, plus the Class 2 and Lead LEDs. The PATROL PRO will also lock in this condition, not allowing further testing.

When this condition occurs, simply replace the six "AA" Alkaline Type IEC-LR6, batteries, or plug the PATROL PRO into a 240Vac mains outlet, then switch on, observe the Self Check, and resume testing.

6.5. Cleaning

Do Not immerse the PATROL PRO in water.

To clean, simply wipe over with a damp cloth.

Do Not use any harsh detergents or solvents on the PATROL PRO.

7. SAFETY APPLIANCE TESTING

7.1. Testing Procedures

Due to the potentially severe consequences of incorrect testing, Aegis recommends regular testing of the PATROL PRO. Aegis has built a number of test features into the PATROL PRO, and there is also a manual procedure that Aegis recommends be performed regularly to check the correct operation of the PATROL PRO.

Aegis recommends these tests should be performed at the start and finish of any test session as a minimum requirement.

It must be noted that these tests are functional tests only. No attempt is made to calibrate the instrument during these tests. The instrument should still be calibrated at regular intervals by the manufacturer. See Section 8.5 for Calibration details.

7.2. Self Check - Electrical

The PATROL PRO performs a Self Check both on power up, and before each test sequence as the start test button is pressed. The 500V insulation fail measurement functionality is tested along with the fail measurement functionality of the continuity tests. All LEDs are lit during this process to allow the operator to ensure they are all operating. This ensures the instrument is capable of identifying a fail condition.

Although this self check can be performed with or without an appliance plugged into the PATROL PRO, it is considered good practice, that no appliance or leads be plugged into the PATROL PRO at power-up until that self check is completed.

Note: The Mains Power Warning LED located near the Lead/Probe Socket, is separate to the internal operation of the PATROL PRO and is not included in this Self Check.

During the self check, firstly, the six test result, Testing, Test Complete, Class 2, and Lead LEDs light momentarily. The PATROL PRO then performs internal tests on the 500V insulation measurement and the continuity measurements circuits. The operator must observe the lighting of the LEDs to confirm operation is satisfactory. If any one of these LEDs does not light the unit must be returned to Aegis for repair.

If the internal tests are successful all LEDs will turn off and the PATROL PRO will default to Class 1 indicating the PATROL PRO is now ready for use.

In the event of one or more of the internal tests failing all LEDs will commence to flash. The PATROL PRO will lock in this condition and no further testing can be performed, even if the Test button is pressed during this failure state. Contact Aegis and return the PATROL PRO for immediate repair. The self check fail must not be confused with a “Low Battery” indication, which is all LEDs remaining lit without flashing, refer to Section 6.4 for details on Low Battery indication.

Note: If operating on batteries and a failure occurs the self check should be repeated using Mains power. It is possible under low battery conditions for the self check to indicate a failure due to the power requirement of the self check. If the self check using Mains power indicates a pass, then the batteries should be replaced and the self check repeated under battery power. When Switching the PATROL PRO Off & On, ensure a delay of 5 – 10 sec is observed. See Section 3.2. Panel Layout, bullet point 3.

7.3. Self Check - Manual

Wiring to the Appliance Socket and the Lead/Probe Socket cannot be confirmed without attaching an external lead. To do this, connect the Extension Lead Adaptor between the two sockets. Put the PATROL PRO into Leads mode and push the Test button. If a Pass is registered the sockets are functioning correctly. If a Fail is registered either a socket is faulty or the Extension Lead Adaptor is faulty. To determine the faulty component attach a known good lead between the sockets and repeat the test. A Pass indicates the Extension Lead Adaptor is faulty, a Fail indicates a socket on the PATROL PRO is faulty. In this instance return the unit to Aegis for repair.

Aegis recommends these tests should be performed at the start and finish of any test session as a minimum requirement.

7.4. Test Failure Indicators

Aegis has incorporated a dual failure indication system into the PATROL PRO to ensure a failure will always be noted by the instrument.

If the PATROL PRO detects a failure on any one of the tests performed, that particular test failure indicator will light at the end of the test. In conjunction with this the Test Complete indicator will flash repeatedly at the end of the test, indicating the instrument has detected a failure.

It is essential that both of these are lit in the event of a failure. If at any stage your instrument only lights a test failure indicator or the Test Complete indicator flashes at the end of the test without a test failure indicator being lit, you must return your unit for repair. This will indicate that one of the two failure recognition systems has failed.

7.5. Stored Electrical Charge within Appliances

Due to the nature of the components within some appliances, it is possible that when the appliance is unplugged from its power source, it can maintain a considerable amount of stored electrical charge. For safety these appliances are required to discharge a certain amount of this energy within a given time, after disconnection. Historically these limits have varied and generally been greater than what is currently permitted. In some cases it is possible that an amount of energy large enough to cause serious injury or even death could be present. AS 61010:2003 addresses the safety and insulation requirements for test and measurement equipment, and Aegis has aligned the PATROL PRO to this standard.

The PATROL PRO is set at a limit, beyond which the unit will halt any testing functions and display a warning indicating the instrument under test continues to provide hazardous energy levels from what would be expected to be non-energised lead pins.

As a test is commenced, the PATROL PRO measures the level of stored energy within the appliance, within the first two seconds, and if there is too much energy present on the pins at this point, the test will cease and the **Active and Neutral** LEDs flash alternately with the **Test Complete** LED. This fault mode alerts the tester that the appliance appears to be holding a charge and exhibiting excessive amounts of stored energy.

The tester must be wary of this piece of equipment, and if testing is to continue, ensure the appliance is discharged before re-connection.

Upon retesting, if the discharge is below the safe level the test will continue, otherwise the PATROL PRO will again halt the test and display a warning.

It is recommended that any appliance that exhibits this type of fault condition should be fully checked to ensure it meets the relevant standards applicable.

However once discharged, these appliances can be safely tested with a PATROL PRO and may pass the requirements of AS3760:2010 testing. *** Please note it is not expected that many appliances fall into this category.*

8. SAFETY LEAKAGE CURRENT TESTING

8.1. General

The user must be familiar with the safety and self testing procedures detailed in this manual.

8.2. Testing Procedures

Due to the potentially severe consequences of incorrect testing, Aegis recommends regular checking of the self test of the PATROL PRO. In particular the PATROL PRO should be allowed to run a full Self Test sequence at the start of any test session. This must be allowed to run without any appliance plugged into the PATROL PRO outlet/test socket.

8.3. Self Test - Electrical

The PATROL PRO automatically performs a Self Test on power up and then attempts to retest every 10 minutes thereafter. If an appliance, which has some leakage, is plugged in at the time a Self Test is attempted, the PATROL PRO will default to a Function Test only and will wait until the appliance is removed from the test socket. Once the appliance is removed the PATROL PRO will perform a full Self Test. If either the Function or Full Self Test fails the LEDs will flash as indicated below under Self Test Results.

During these test processes, all LEDs are lit in the following sequence to alert the operator that Self Test is in progress and to allow the operator to ensure all LEDs are operating.

Self Test, or Function Test, will be evident as the unit will step through the LEDs using the following sequence:

- Green
- First Yellow
- Second Yellow
- Red

The sequence will run twice and will take approximately 4 seconds to run.

During the test, a 1mA leakage is introduced internally to the PATROL PRO, which if detected by the measurement circuit indicates a Pass.

8.4. Self Test Results

Pass:

When the Function or Self Test passes, the device will resume normal operation.

Failure Modes:

- a. If the Function or Self Test fails, the unit will alternately flash both the Red and Green LEDs. It will do this continuously and not provide further leakage current measurements. The power will need to be turned off & on to resume normal operation.

- b. If the PATROL PRO fails self test several times in succession when no other device is connected to it, then it must be returned to Aegis Pty Ltd for service. This type of failure indicates that it is no longer able to accurately detect earth leakage currents.
- c. If a PATROL PRO fails Function test but only when a particular piece of equipment is connected to it, then that piece of equipment should be considered suspect and tagged accordingly as the PATROL PRO was not able to verify that its leakage current was within the requirements of the standard.

8.5. Calibration

All safety test equipment should be calibrated at a regular interval, to ensure operation at peak performance. **It is recommended that the PATROL PRO is returned to Aegis for calibration every 12 months.**

8.6. Changing Batteries

Ensure the PATROL PRO is disconnected from the mains power and all other appliances, before opening the Battery Hatch.

Remove the Battery Hatch by loosening the retaining screw with a screw driver. Remove the connector from the battery pack, then lift the Battery pack out and change the batteries.

Reverse the process to replace the battery pack.

Note carefully the direction of the batteries when placing them into the battery holder.

Use only: - AA Alkaline Type IEC-LR6 or equivalent batteries



Figure 8.6-1 PATROL PRO Battery Replacement

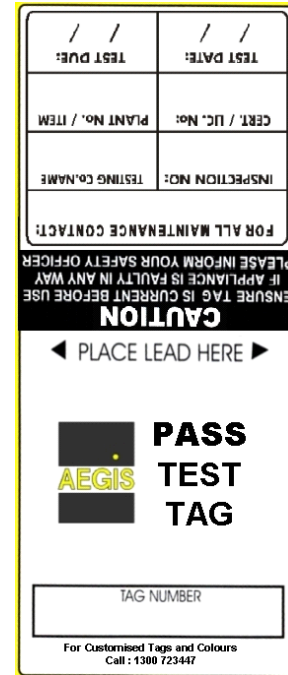
9. TEST TAGS

9.1. Pass Test Tags

There are ten “PASS” Tags supplied with the PATROL PRO, from the factory, to allow an immediate start to testing your appliances. These are for attaching to the tested electrical appliance or lead to indicate a Pass.

If the Appliance Passes the test and is considered safe to return to service, then a “PASS” tag is filled out with the appropriate information and attached to the lead of the appliance (or the Male end of an Extension Lead).

Additional or replacement “PASS” Tags can be purchased from Aegis Pty Ltd by phoning 1300 723447



The image shows a rectangular 'PASS TEST TAG' form. At the top, there are two columns for 'TEST DATE:' with slashes for day, month, and year. Below this are fields for 'PLANT No. / ITEM', 'CERT / U.C. No.', and 'INSPECTION NO: TESTING CO. NAME'. A section in the middle contains safety instructions: 'FOR ALL MAINTENANCE CONTACT: ENSURE TAG IS CURRENT BEFORE USE IF APPLIANCE IS FAULTY IN ANY WAY PLEASE INFORM YOUR SAFETY OFFICER'. Below this is a 'CAUTION' header and a 'PLACE LEAD HERE' instruction with arrows. The center features the AEGIS logo and the text 'PASS TEST TAG'. At the bottom, there is a 'TAG NUMBER' field and contact information: 'For Customised Tags and Colours Call : 1300 723447'.

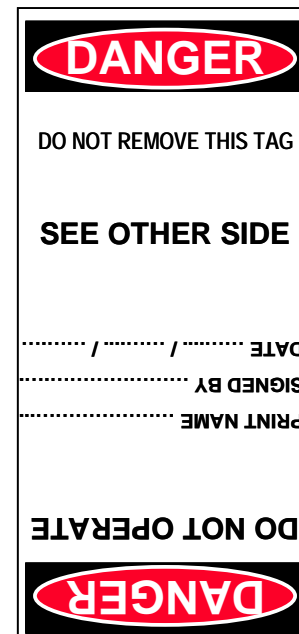
Figure 9.1-1 PASS Test Tag, Part No CZ5072 (100 tags)

9.2. Fail Test Tags

There are two (2) “FAIL” (Danger) Tags supplied with the PATROL PRO, from the factory, to allow an immediate start to testing your appliances. These are for attaching to the tested electrical appliance or lead, should these items fail the test.

If the Appliance Fails the test and is not considered safe to return to service, then a “DANGER” tag is filled out with the appropriate information and attached to the lead of the appliance (or the Male end of an Extension Lead).

Additional or replacement “FAIL” (Danger) Tags can be purchased from Aegis Pty Ltd by phoning 1300 723447



The image shows a vertical 'DANGER' tag. It features a red oval with the word 'DANGER' in white at the top. Below this, it says 'DO NOT REMOVE THIS TAG' and 'SEE OTHER SIDE'. There are fields for 'DATE', 'SIGNED BY', and 'PRINT NAME'. At the bottom, it says 'DO NOT OPERATE' and has another red oval with 'DANGER' in white.

Figure 9.2-1 Fail Test Tag (Danger), Part No CZ5073 (50 tags)