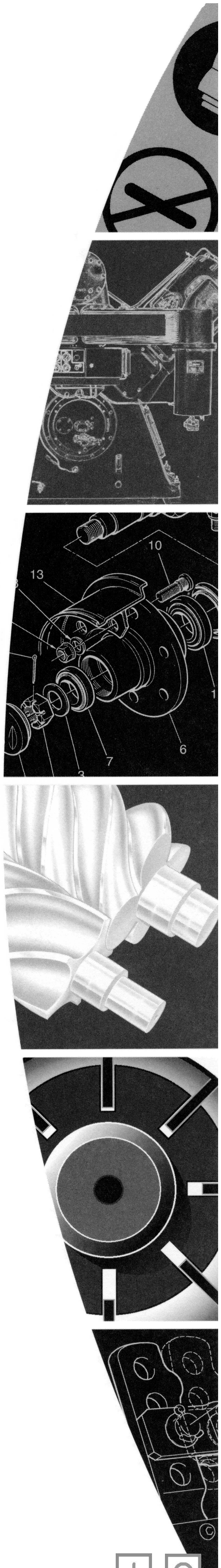
CompAir



SR Power Converter
Fault Investigation Manual

Delcos 3100

GB DL0087AA - Draft 1 - 04/2008

WARNING

Some of the test procedures within this manual involve working with **LETHAL VOLTAGES**. These procedures should only be carried out by a professionally qualified and trained electrical engineer.

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Contents

1 Safety

1.1 General

1.1.1 Most accidents which occur during the operation and maintenance of machinery are the result of failure to observe basic safety rules or precautions. An accident can often be avoided by recognising a situation that is potentially hazardous.

1.1.2 When handling, operating or carrying out maintenance on the unit, personnel must use safe engineering practices and observe all relevant local health and safety requirements and regulations. The attention of users in the UK is drawn to the Health and Safety at Work Act, 1974, the Regulations of the Institution of Electrical Engineers and the Pressure Systems and Transportable Gas Container Regulations 1989.

1.1.3 CompAir cannot anticipate every possible circumstance which might represent a potential hazard. The WARNINGS in this manual are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by CompAir he must ensure that the unit will not be damaged or made unsafe and that there is no risk to persons or property.

1.1.4 The standard builds of all CompAir products are not intended for use in either explosive or potentially explosive atmospheres as defined in Directive 94/9/EC. An explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable gases, vapours, hazes or dust in which, after ignition has occurred, combustion propagates to the entire unburned mixture and may cause a hazard. A potentially explosive atmosphere is an atmosphere which could become explosive due to local conditions.

1.1.5 Failure to observe the precautions given under ‘Safety Procedures’ may be considered dangerous practice or misuse of the compressor unit.

1.2 Warnings, Cautions And Notes

1.2.1 Warnings

Warnings call attention to operations or procedures involving specific hazards which could cause injury or death and are identified by the following symbols on the unit and in the text of the manual.

WARNING: RISK OF DANGER

WARNING: RISK OF ELECTRIC SHOCK

WARNING: RISK OF HOT SURFACES

WARNING: CONSULT MANUAL

WARNING: RISK OF HIGH PRESSURE

WARNING:
ENTRY DELAY – ENERGISED CAPACITORS

1.2.2 Cautions

Incorrect operational procedures causing possible damage to the compressor unit are identified by a ‘CAUTION’ in the text of this manual.

1.2.3 Notes

Methods to make the job easier and points which require particular attention are identified by a ‘Note’ in the text of the manual.

1.3 General Safety Precautions

If using compressed air for cleaning purposes, ensure safety regulations are complied with and appropriate clothing and eye protection is worn.

Never direct compressed air onto your skin or at other people.

Never use compressed air to clean loose dirt from clothing.

Before releasing compressed air through a hose make sure that the free end is held securely so that it cannot whip and cause injury.

Avoid injury by using a hoist to lift heavy loads. Check that all chains, hooks, shackles and slings are in good condition and are of the correct capacity. They must be tested and approved according to local safety regulations.

Cables, chains or ropes must never be applied directly to lifting eyes. Always use an appropriate shackle or hook, properly positioned. Arrange lifting cables so that there are no sharp bends.

Use a spreader bar to avoid side loads on hooks, eyes and shackles.

When a load is on a hoist stay clear of the danger area beneath and around it. Keep lifting acceleration and speed within safe limits and never leave a load hanging on a hoist for longer than is necessary.

1.4 Installation Precautions

Installation work must only be carried out by competent personnel under a qualified supervisor.

A fused isolating switch must be fitted between the main power supply and the compressor.

Ensure that air drawn into the air intake will not be contaminated with flammable fumes or vapours, since this could cause an internal fire or explosion.

Precautions must be taken to ensure that no injury is caused to passers-by through loose clothing being sucked into the air intake.

Ensure that the air delivery pipe from the compressor to the user's pipework or receiver is free to expand and that no flammable material is within the vicinity.

A shut-off valve must be fitted in the delivery air line to enable the compressor unit to be isolated. This is particularly important if more than one unit is to be coupled in parallel or connected to an existing air supply system.

The minimum pressure/non-return valve is not intended as an isolating valve and should not be relied upon for this purpose. In addition, it may be necessary to install shut-off valves elsewhere in the system to allow a dryer or other equipment to be by-passed.

A pressure relief valve must be installed between any compressor unit and the shut-off valve/s. A pressure relief valve is fitted on the reclaimer vessel as standard equipment.

A pressure relieving device must be fitted to every pressure vessel, or equipment containing air at above atmospheric pressure, when installed downstream of the unit.

1.5 Operational Precautions

The compressor unit must only be operated by competent personnel under a qualified supervisor.

Do not run the compressor with doors open or covers removed except when checking reclaimer operation.

Never remove or tamper with the safety devices, guards or insulation materials fitted to the unit.

The compressor must only be operated at the supply voltage and/or frequency for which it is designed

On a unit equipped with an Automatic Start/Stop system, attach a sign stating **'THIS UNIT MAY START WITHOUT WARNING'** next to the display panel.

On a unit equipped with an Automatic Restart device, attach a warning notice stating **'THIS UNIT HAS BEEN MODIFIED AND WILL START AUTOMATICALLY ON APPLICATION OF POWER'** next to the display panel and on the inside of the unit next to the starter contactors.

If the unit is equipped with a Remote Control device, attach warning notices stating **'THIS UNIT CAN BE STARTED REMOTELY'** in prominent locations, one on the outside of the unit, the other inside the control compartment.

As a further safeguard, take adequate precautions to make sure there is no one checking or working on the unit before attempting to switch on remotely controlled equipment. Attach a **'CHECK THAT ALL PERSONNEL ARE CLEAR OF THE unit BEFORE STARTING'** or similar warning notice to the remote start equipment.

During normal operation no internal part of the compressor unit should reach a temperature above 120°C and protection devices are fitted to prevent excessive temperatures occurring.

If there is any indication that the compressor is overheating it must be shut down and the cause investigated. Beware of burns from hot metal parts or hot oil when working on a unit which has recently been shut down.

The compressor must not be operated at pressures above the nominal pressure given on the data plate.

The compressor must not be operated in ambient temperatures outside of those given under 'Leading Particulars'.

The 'Noise at Work Regulations 1989' suggest that ear protectors should be worn where noise levels are 85 dB(A) or higher. With all covers in place, the noise levels of the compressors described in the manual are substantially lower than this figure unless installed in an already noisy environment.

Be aware that high noise levels can interfere with communication.

1.6 Maintenance and Repair Precautions

WARNING

- Before opening the door of the power converter compartment, switch the power supply OFF at isolator and wait for 12 minutes to allow the dc link capacitors to discharge to a safe level. Check that the dc link capacitors have fully discharged before starting work on the compressor.

Maintenance, repairs or modifications must only be carried out by competent personnel under a qualified supervisor

Lethal voltages are present in the electrical circuits and extreme caution must be exercised whenever it is necessary to carry out any work on the electrical system.

If replacement parts are needed use only CompAir Genuine Parts.

Do not open the starter compartment or touch electrical components while voltage is applied unless it is necessary for measurements, tests or adjustments. Such work should be carried out only by a qualified electrician equipped with the proper tools and wearing appropriate body protection against electrical hazards.

Before removing any panels from the enclosure, if fitted, or dismantling any part of the unit, carry out the following preparatory operations:-

a) Isolate the compressor unit from the main electrical power supply. Lock the isolator in the 'OFF' position and remove the fuses.

b) Attach a label to the isolator switch and display panel carrying the warning **'WORK IN PROGRESS – DO NOT APPLY VOLTAGE'** Do not switch on electrical power or attempt to start the unit if a warning label is attached.

c) Close the isolating valve between the compressor unit and the user's pipework. Attach a label to each valve carrying the warning **'WORK IN PROGRESS – DO NOT OPEN'**

d) **Ensure that the blowdown system has operated to release all pressure from the reclaimer.**

e) Check that the pressure gauge registers zero. Release any remaining pressure from the delivery side of the reclaimer element by slackening a pipe connection to the differential pressure indicator. Release any residual pressure from the upstream side of the reclaimer element by slowly slackening the oil filler plug on the reclaimer. Release any pressure in the aftercooler by slackening the pipe at the bottom of the moisture separator. Tighten the plug and pipe connections.

Use only lubricating oils and greases approved by CompAir. Make sure that the selected lubricants comply with all relevant safety regulations, especially with regard to the risk of explosion or fire and the possibility of decomposition or the generation of hazardous gases.

Always clean up oil spills from both the inside and outside of the compressor unit before and after maintenance work.

Make sure that all instructions concerning operation and maintenance are strictly followed and that the complete unit, with all accessories and safety devices, is kept in good running order.

The accuracy of pressure and temperature gauges and switching thermometers must be regularly checked. They must be renewed when acceptable tolerances are exceeded.

Protection devices must be tested as described in the ‘Maintenance’ section of this manual.

Keep the compressor unit clean at all times. Protect components and exposed openings by covering with clean cloth or tape during maintenance and repair work.

Protect the motor, air intake, electrical and regulation components against the entry of moisture, e.g. when steam cleaning.

Precautions must be taken when carrying out welding or any repair operation which generates heat, flames or sparks. The adjacent components must always be screened with non-flammable material and if the operation is to be carried out near any part of the oil system, or close to a component which may contain oil, the system must first be thoroughly purged, preferably by steam cleaning.

Never use a light source with an open flame to inspect any part of the unit.

In no circumstances must any welding work or other modification be carried out on the reclaimer or any other pressure vessel.

Before dismantling of any part of the compressor unit ensure that all heavy movable parts are secured.

After completion of repair or maintenance work ensure that no tools, loose items or rags are left on or inside any part of the machine.

Check the direction of rotation of the motor when starting up the compressor initially and after any work on the electrical connections or switchgear.

Do not use any flammable liquid to clean valves, filter elements, cooler air passages, air pipes or any component carrying a flow of air during normal operation. If chlorinated hydrocarbon non- flammable fluids are used for cleaning, safety precautions must be taken against any toxic vapours which may be released.

Do not use carbon tetrachloride.

Precautions must be taken when using acids, alkalis and chemical detergents for cleaning machine parts and components. These materials cause irritation and are corrosive to the skin, eyes, nose and throat. Avoid splashes and wear suitable protective clothing and goggles. Do not breathe mists. Ensure that water and soap are readily available.

When disposing of condensate, old oil, used filter elements and other parts and waste material of any kind make sure that there is no pollution of any drain or natural water-course and that no burning of waste takes place which could cause pollution of the air. Protect the environment by using only approved methods of disposal.

1.7 Precautions In The Event Of Fire

1.7.1 Use extreme caution when handling components that have been subjected to fire or very high temperatures. Some components may contain fluoroelastomer materials which decompose under these conditions to form highly corrosive residues. Skin contact can cause painful and penetrating burns resulting in permanent skin and tissue damage.

1.8 Disposal

When items of equipment are taken out of service for disposal it is recommended that the following instructions are adhered to:

a) In order to prohibit the ‘bringing back into service’ of of equipment by persons unknown, it should be rendered unusable in order to avoid improper re-use.

b) Alternatively all such items of equipment should be stripped into their component form for ‘material composition disposal’ e.g. base metals, plastics, fabrics etc and be subject to normal industrial waste re-cycling processes.

c) Bio-degradable items should be subject to normal industrial waste disposal processes. Ensure that no plastic, rubber or composite materials are disposed of by incineration.

d) Ensure that all fluid waste e.g. lubricating oils and greases, anti-freeze agents, refrigerant fluids or corrosive inhibitors should be separated and disposed of by authorised salvage disposal or recycling systems ensuring that none is permitted to enter a waste water system.

2 Delcos 3100 SR – Fault Summary

2.1 Fault Summary Table

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Fault Number	Fault Name	See Page
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3 Delcos 3100 SR – Fault Descriptions

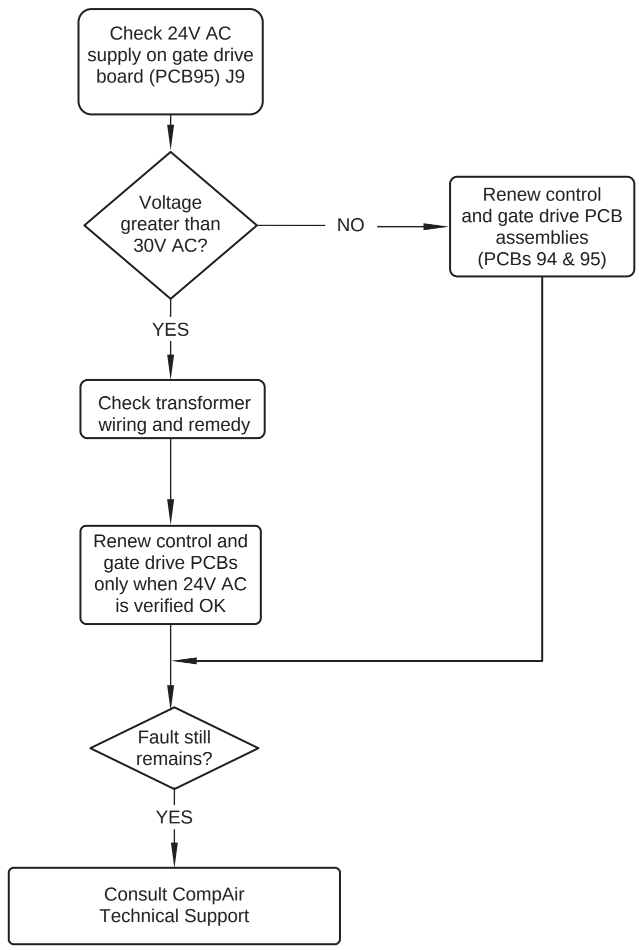
3.1 Fault Descriptions and Investigative Flowcharts

Fault 1: +15v Control Board Supply Over-Voltage

Fault Description

Indicates that the voltage on the nominally +15V main power supply rail on the control PCB (PCB94) is abnormally high. This supply is locally regulated on the control PCB from a 17.5V supply generated on the gate drive PCB. It is not available to power external circuitry.

Corrective Action

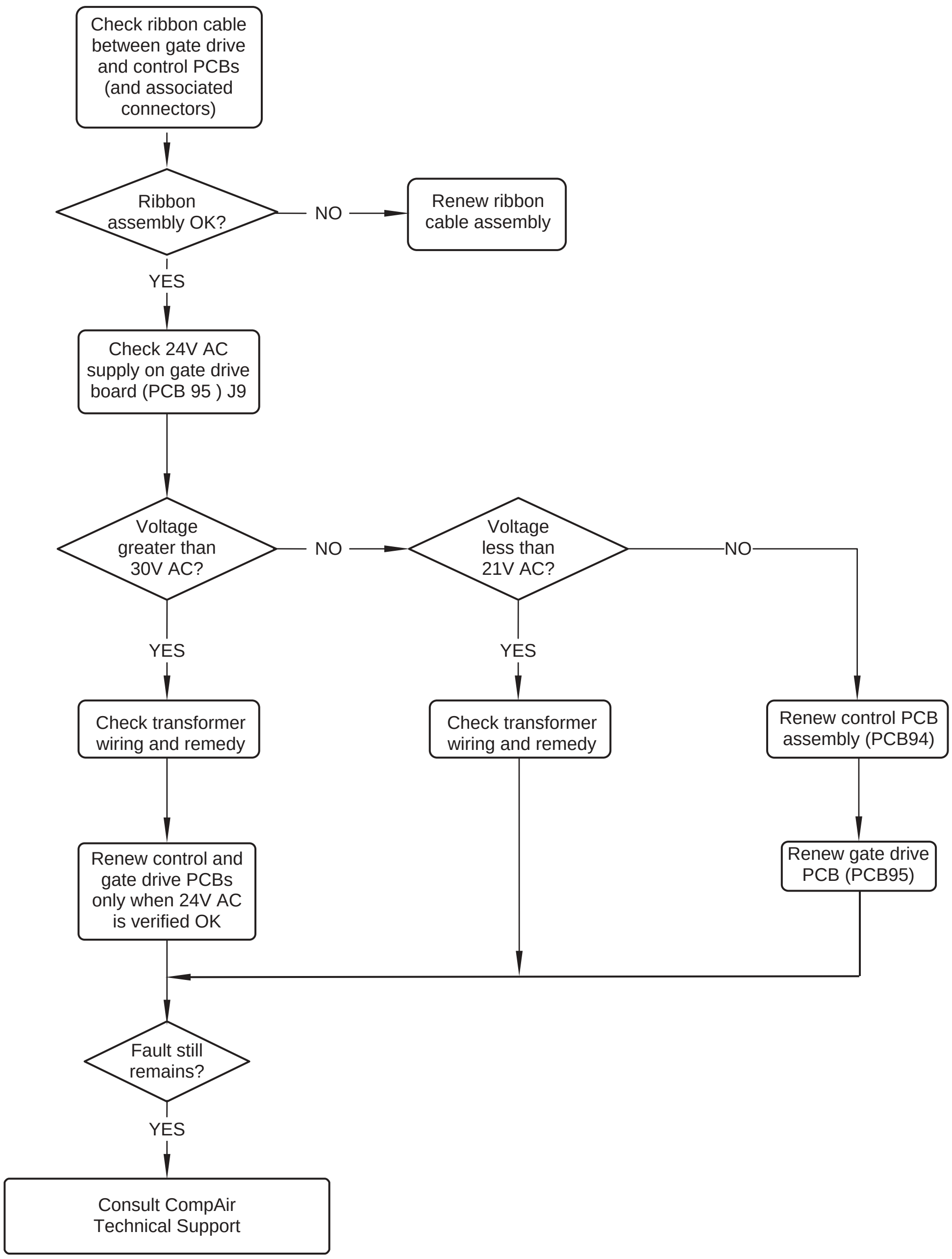


Fault 2: +15v Control Board Supply Under-Voltage

Fault Description

Indicates that the voltage on the nominally -15V main power supply rail on the control PCB (PCB94) is abnormally low. This supply is locally regulated on the control PCB from a 17.5V supply generated on the gate drive PCB.

Corrective Action



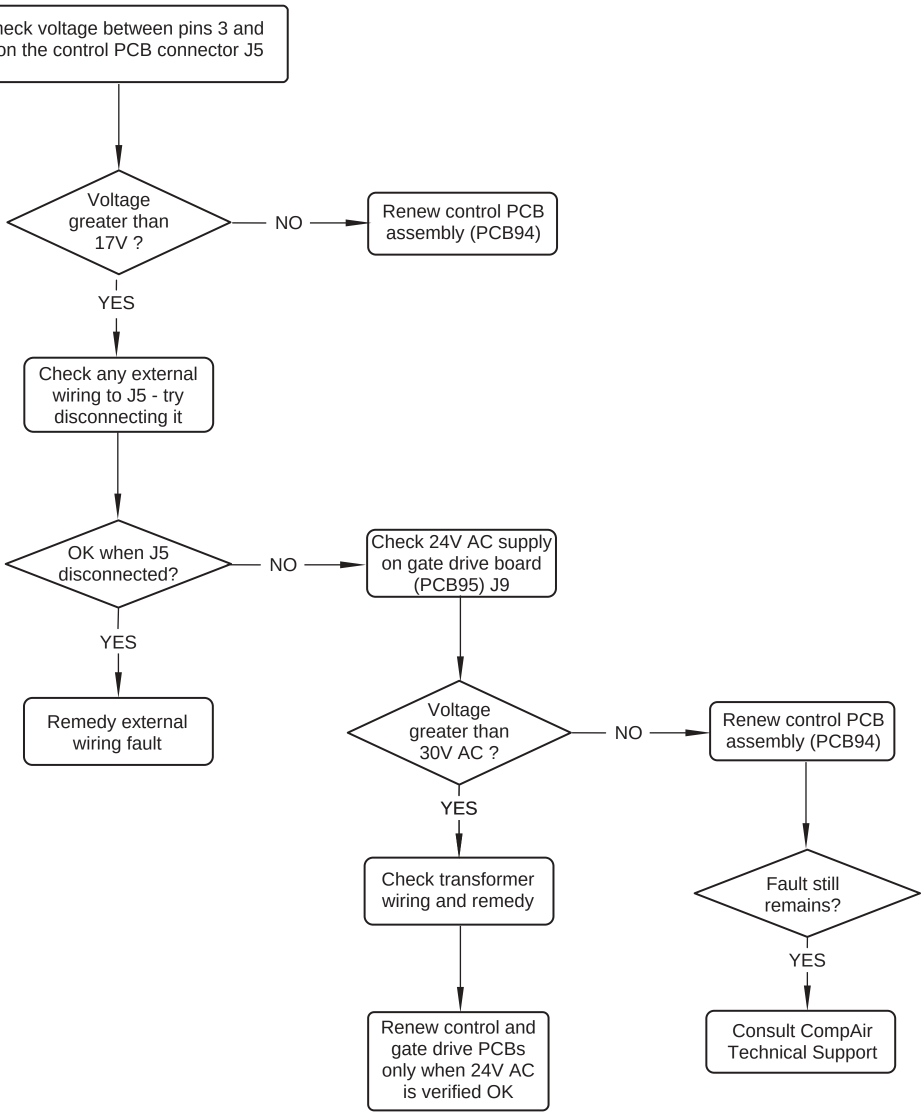
Fault 3: "User" +15v Supply Over-Voltage

Fault Description

Indicates that the voltage on the nominally +15V main power supply rail available from the control PCB to power external circuitry at J5 pin 3 of the control PCB (PCB94) is too high. This power supply output is not normally used in CompAir applications but is made available on control PCB connector J5 for use in conjunction with analogue inputs to the control PCB, or for other purposes where a +15V supply is needed.

Because this output is not normally used in CompAir applications, this fault is unusual and will generally be indicative of a control PCB fault.

Corrective Action



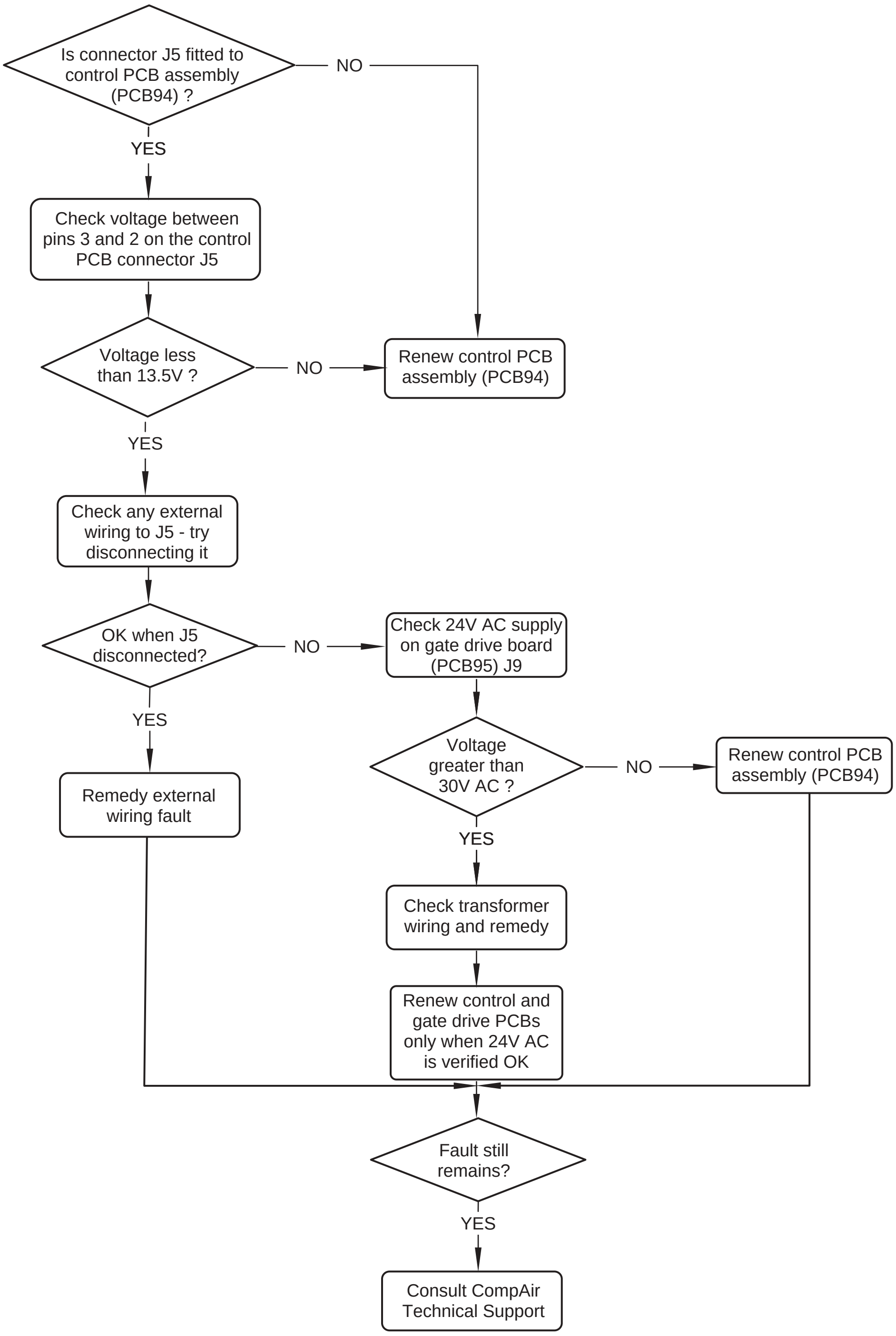
Fault 4: "User" +15V Supply Under-Voltage

Fault Description

Indicates that the voltage on the nominally +15V main power supply rail available from the control PCB to power external circuitry at J5 pin 3 (0V to pin 2) is too low. This power supply output is not normally used in CompAir applications but is made available on control PCB connector J5 for use in conjunction with analogue inputs to the control PCB, or for other purposes where a +15V supply is needed.

Because this output is not normally used in CompAir applications, this fault is unusual and will generally be indicative of a control PCB fault.

Corrective Action

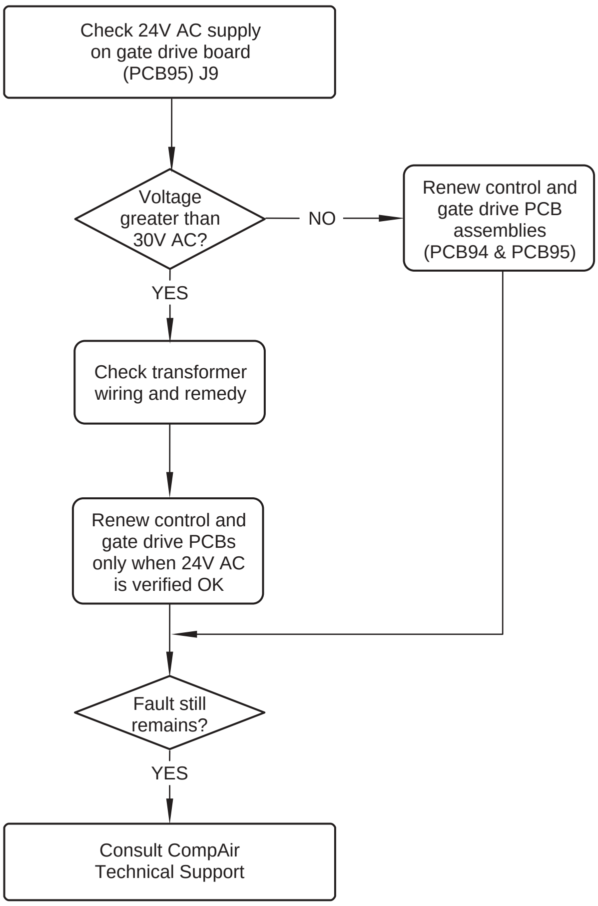


Fault 5: -15v Control Board Supply Over-Voltage

Fault Description

Indicates that the voltage on the nominally -15V main power supply rail on the control PCB (PCB94) is abnormally high. This supply is locally regulated on the control PCB from a 17.5V supply generated on the gate drive PCB.

Corrective Action

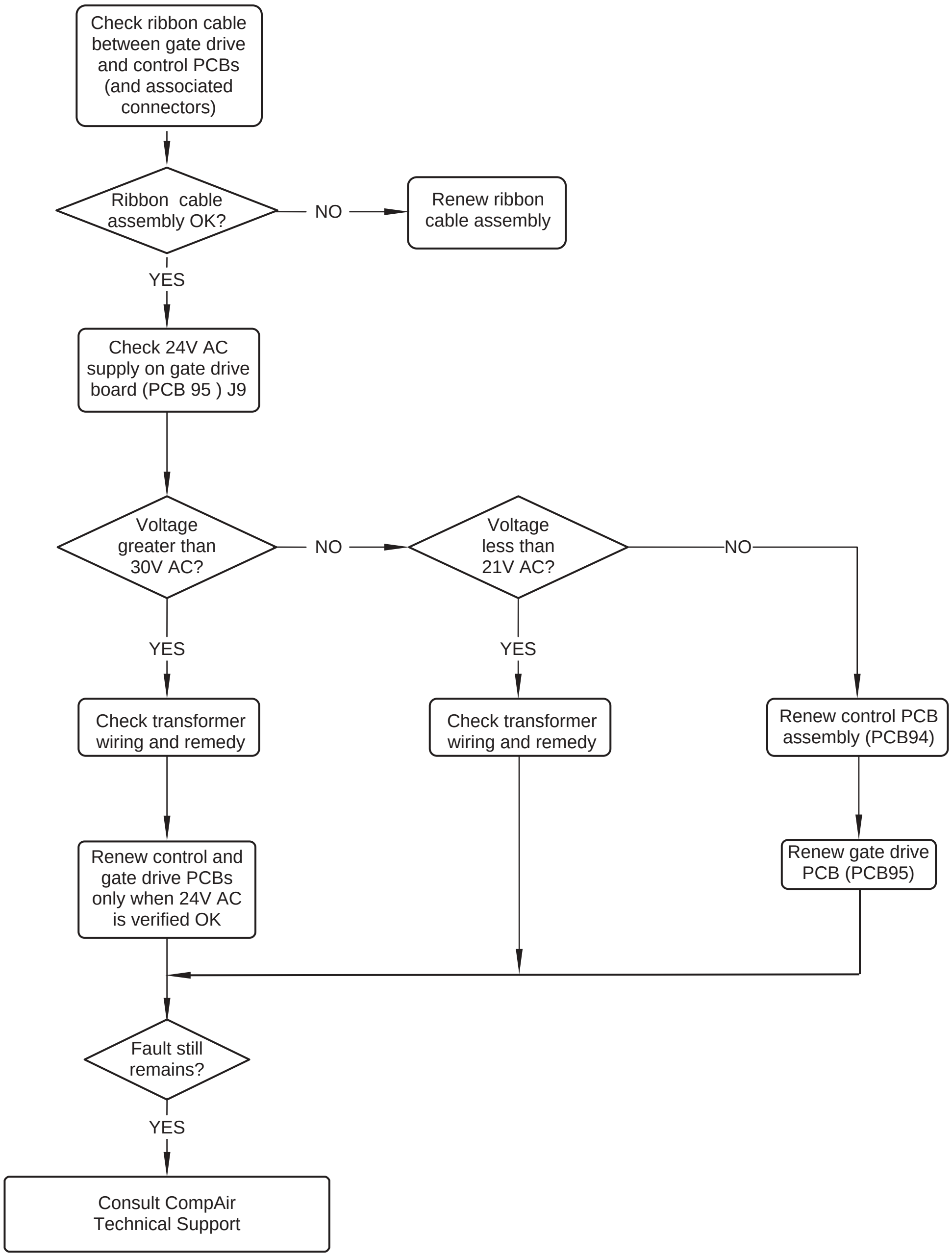


Fault 6: -15v Control Board Supply Under-Voltage

Fault Description

Indicates that the voltage on the nominally -15V main power supply rail on the control PCB (PCB94) is abnormally low. This supply is locally regulated on the control PCB from a 17.5V supply generated on the gate drive PCB.

Corrective Action



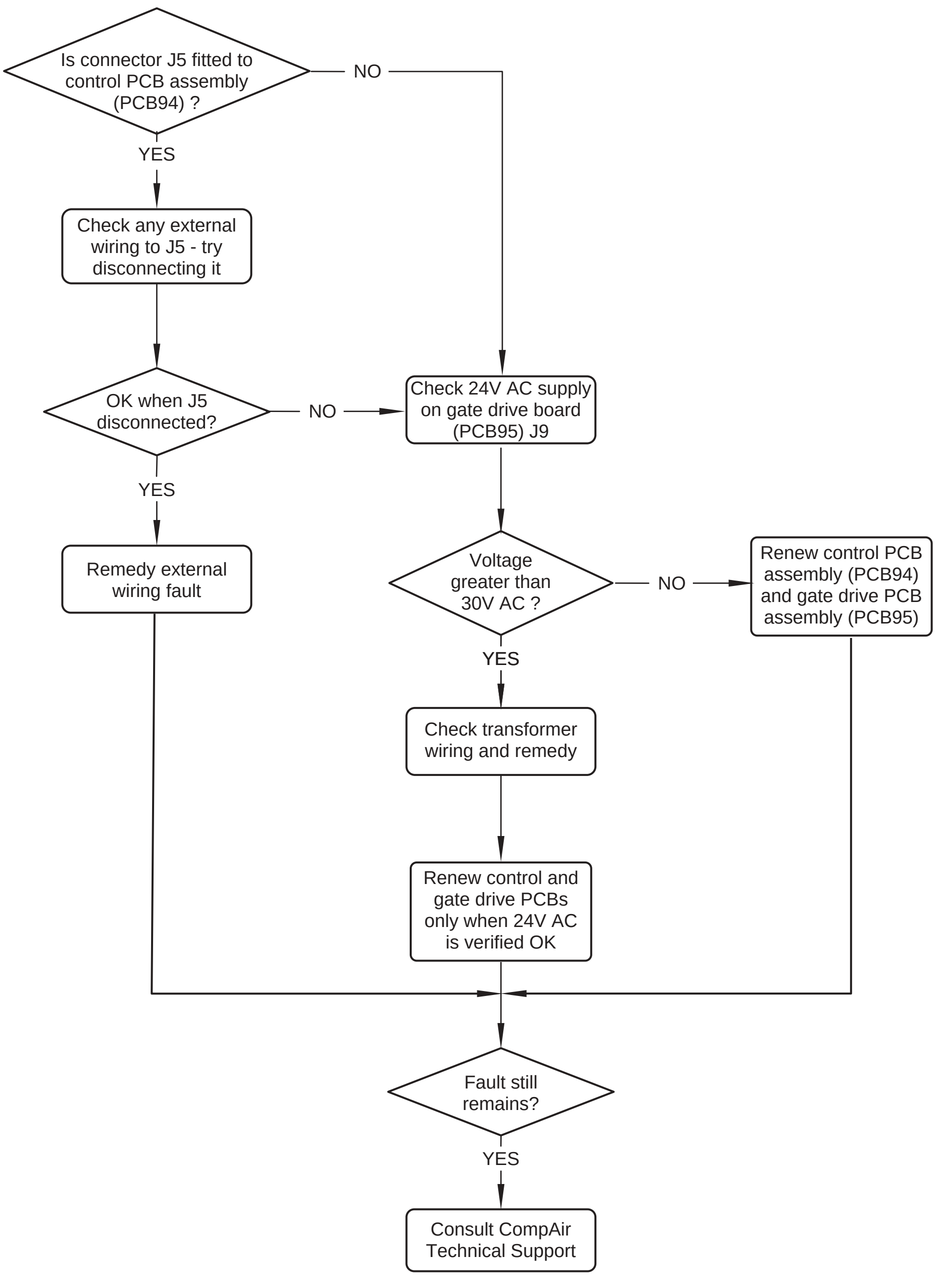
Fault 7: “User” -15v Supply Over-Voltage

Fault Description

Indicates that the voltage on the nominally -15V main power supply rail available on the control PCB to power external circuitry is too high.

In CompAir applications, this voltage is not normally available at the control PCB's connectors, and this fault would therefore normally arise only in the event of a defect in PCB94.

Corrective Action



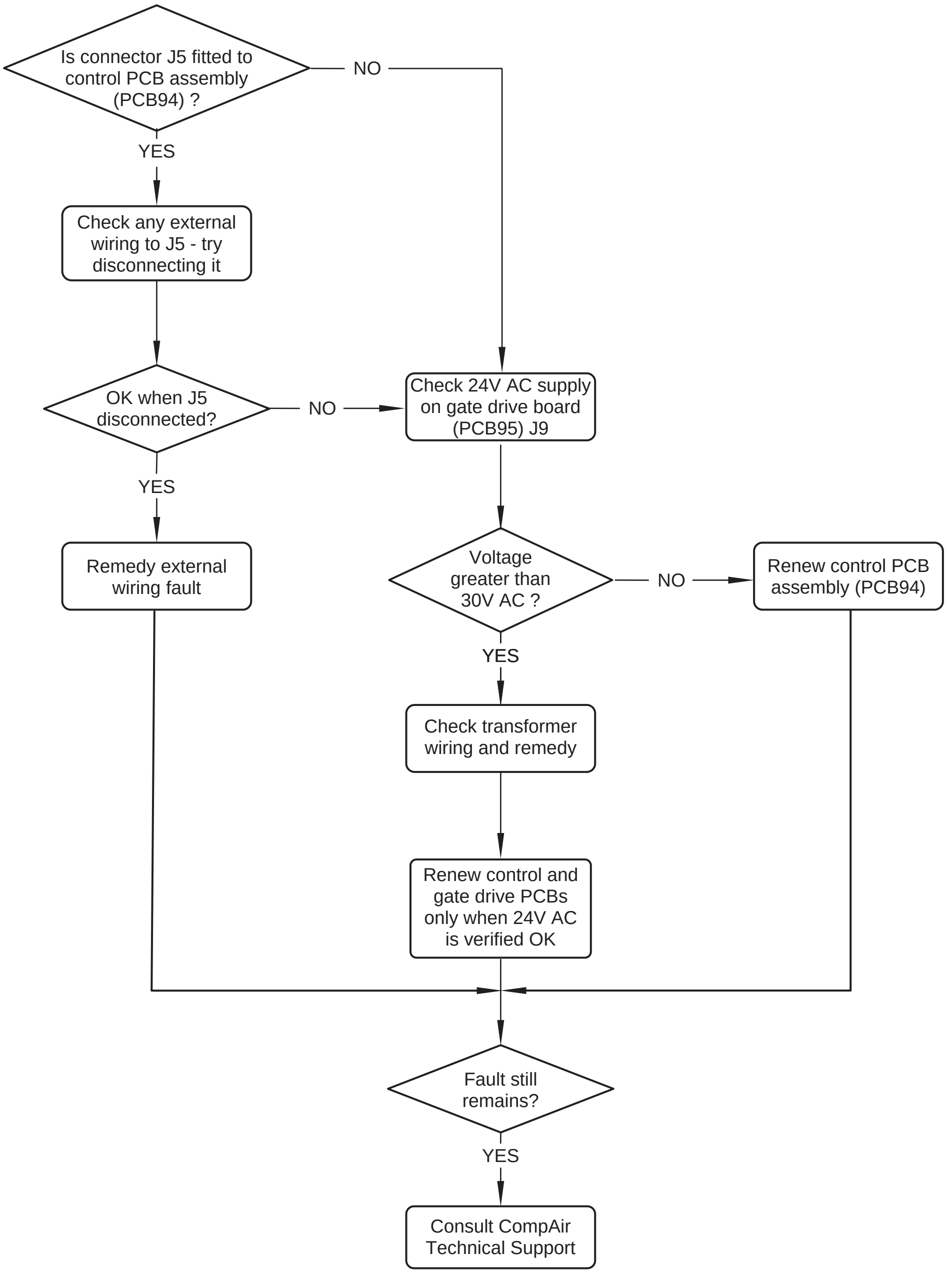
Fault 8: “User” -15v Supply Under-Voltage

Fault Description

Indicates that the voltage on the nominally -15V main power supply rail available on the control PCB to power external circuitry is too low.

In CompAir applications, this voltage is not normally available at the control PCB's connectors, and this fault would therefore normally arise only in the event of a PCB defect.

Corrective Action

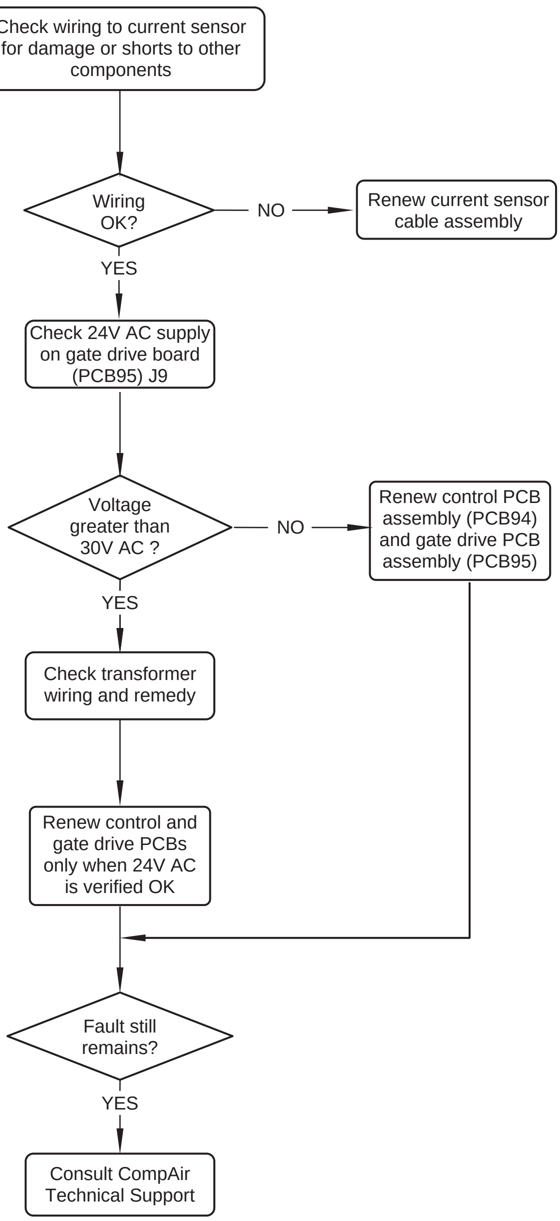


Fault 9: +15v Current Sensor Supply Over-Voltage

Fault Description

Indicates that the nominally +15V supply voltage provided to power the current sensor(s) from the control PCB, via J10, is abnormally high.

Corrective Action

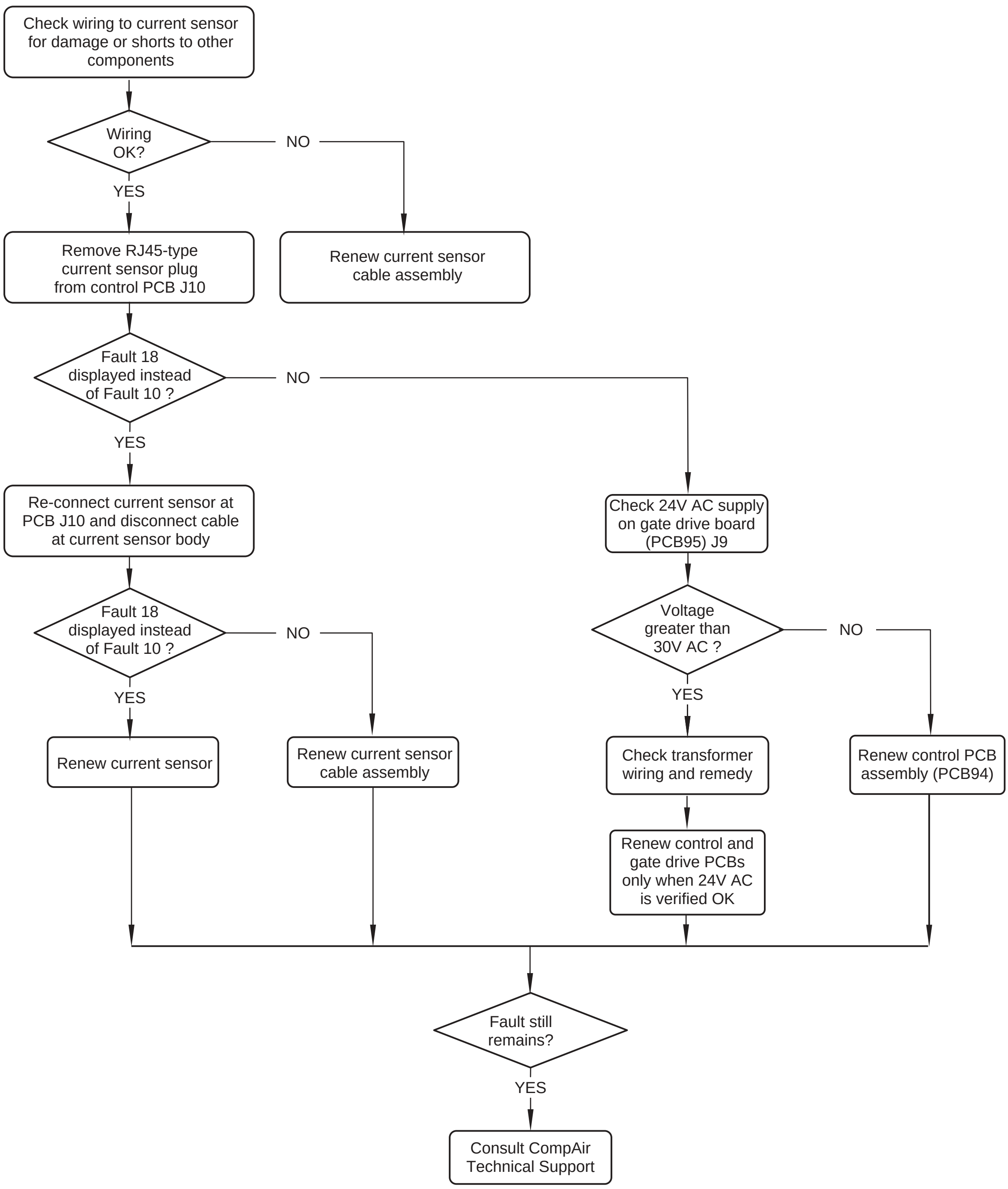


Fault 10: +15v Current Sensor Supply Under-Voltage

Fault Description

Indicates that the nominally +15V supply voltage provided to power the current sensor(s) from the control PCB, via J10, is abnormally low.

Corrective Action

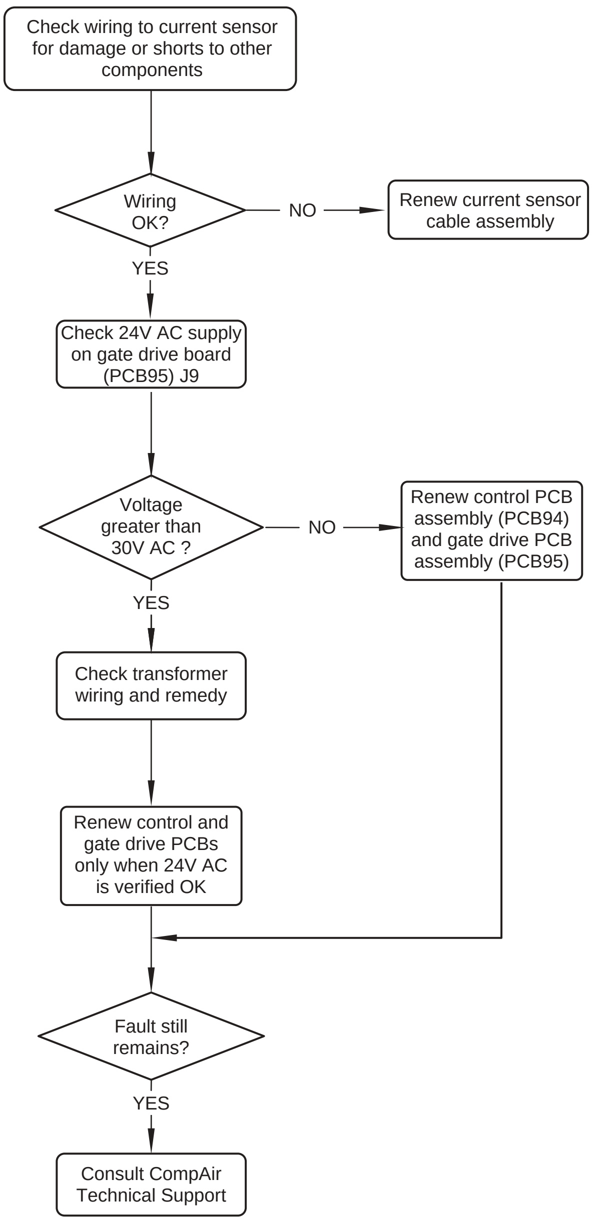


Fault 11: -15v Current Sensor Supply Over-Voltage

Fault Description

Indicates that the nominally -15V supply voltage provided to power the current sensor from the control PCB, via J10, is abnormally high.

Corrective Action

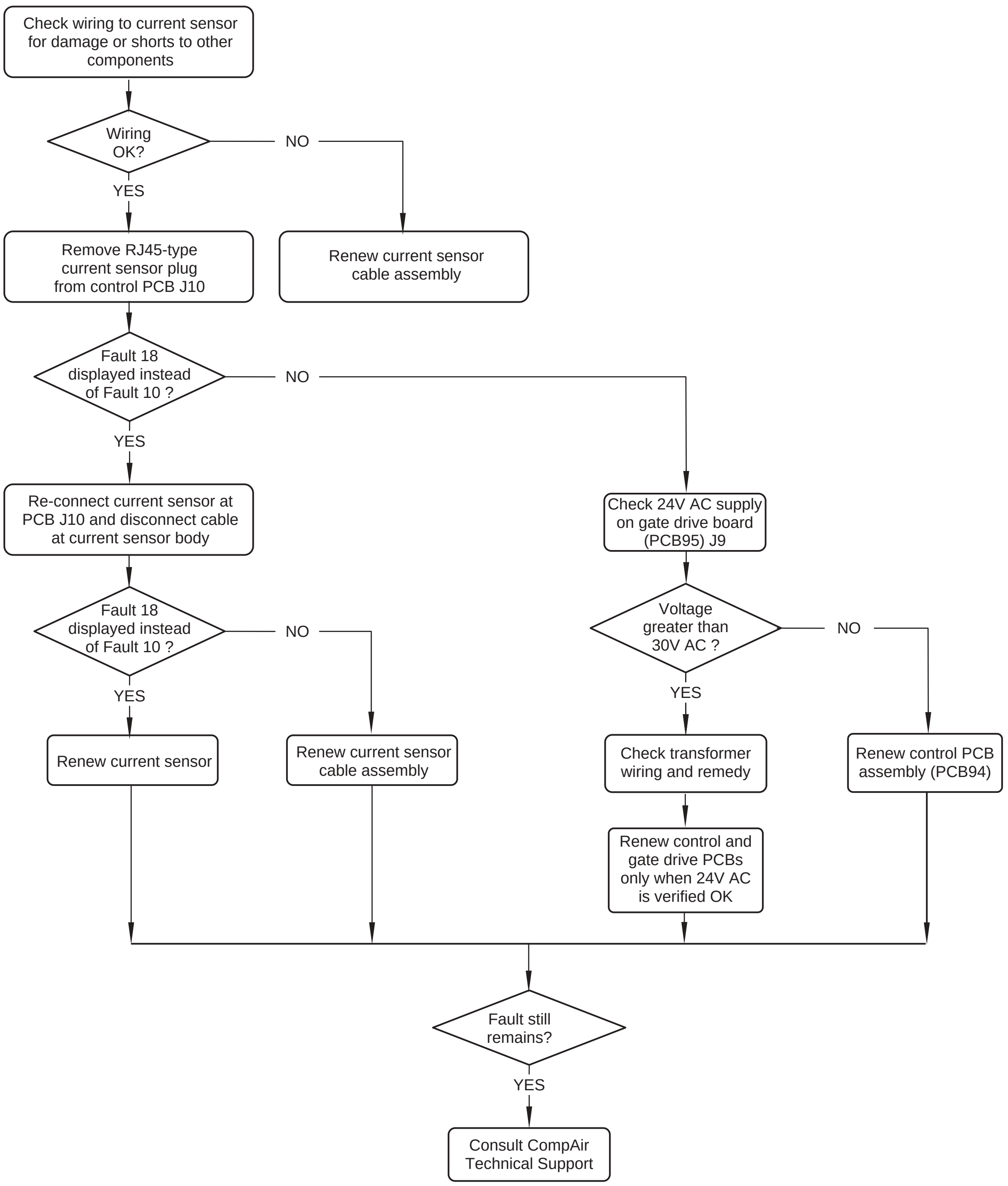


Fault 12: -15v Current Sensor Supply Under-Voltage

Fault Description

Indicates that the nominally -15V supply voltage provided to power the current sensor(s) from the control PCB, via J10, is abnormally low.

Corrective Action

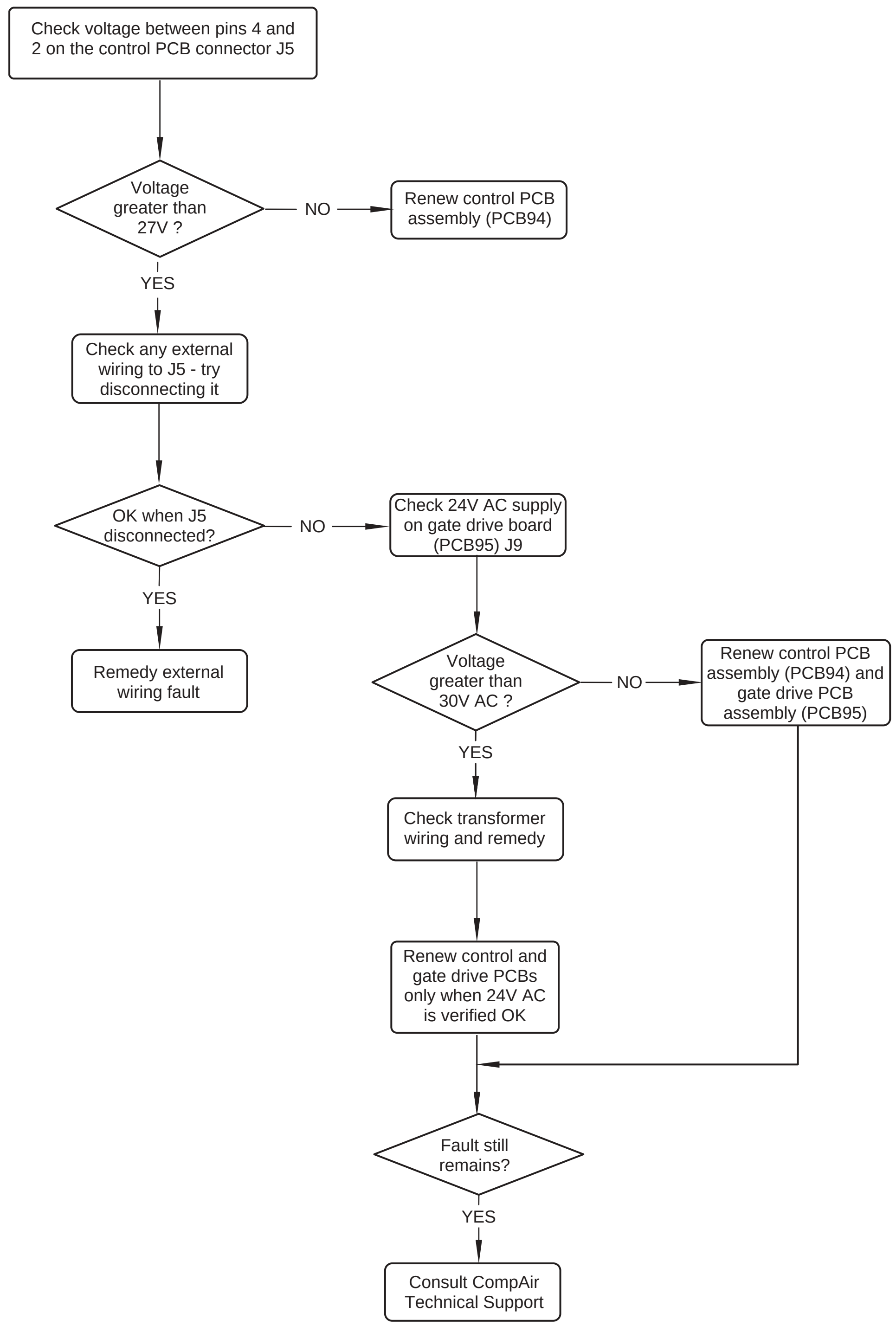


Fault 13: +24v Supply Over-Voltage

Fault Description

Indicates that the voltage on the nominally +24V main power supply rail to the control electronics is abnormally high. This supply is used for digital inputs and outputs to/from the control PCB and is available on connector J5.

Corrective Action

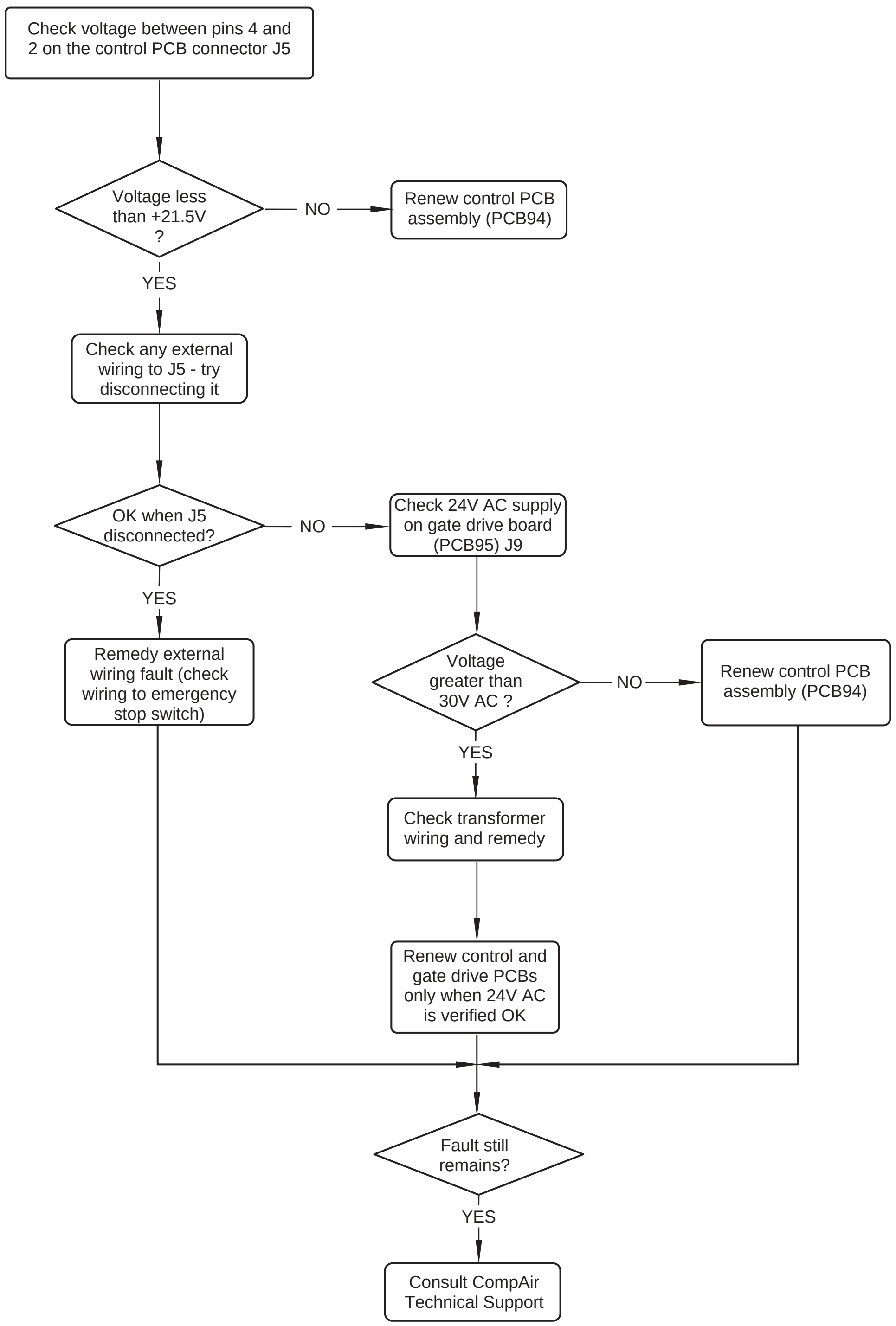


Fault 14: +24v Supply Under-Voltage

Fault Description

Indicates that the voltage on the nominally +24V main power supply rail to the control electronics is abnormally low.This supply is used for digital inputs and outputs to/from the control PCB and is available on connector J5.

Corrective Action



Fault 15: Motor Phase Over-Current (Or, Where Multiple Current Sensors Are Used, Phase A Over-Current)

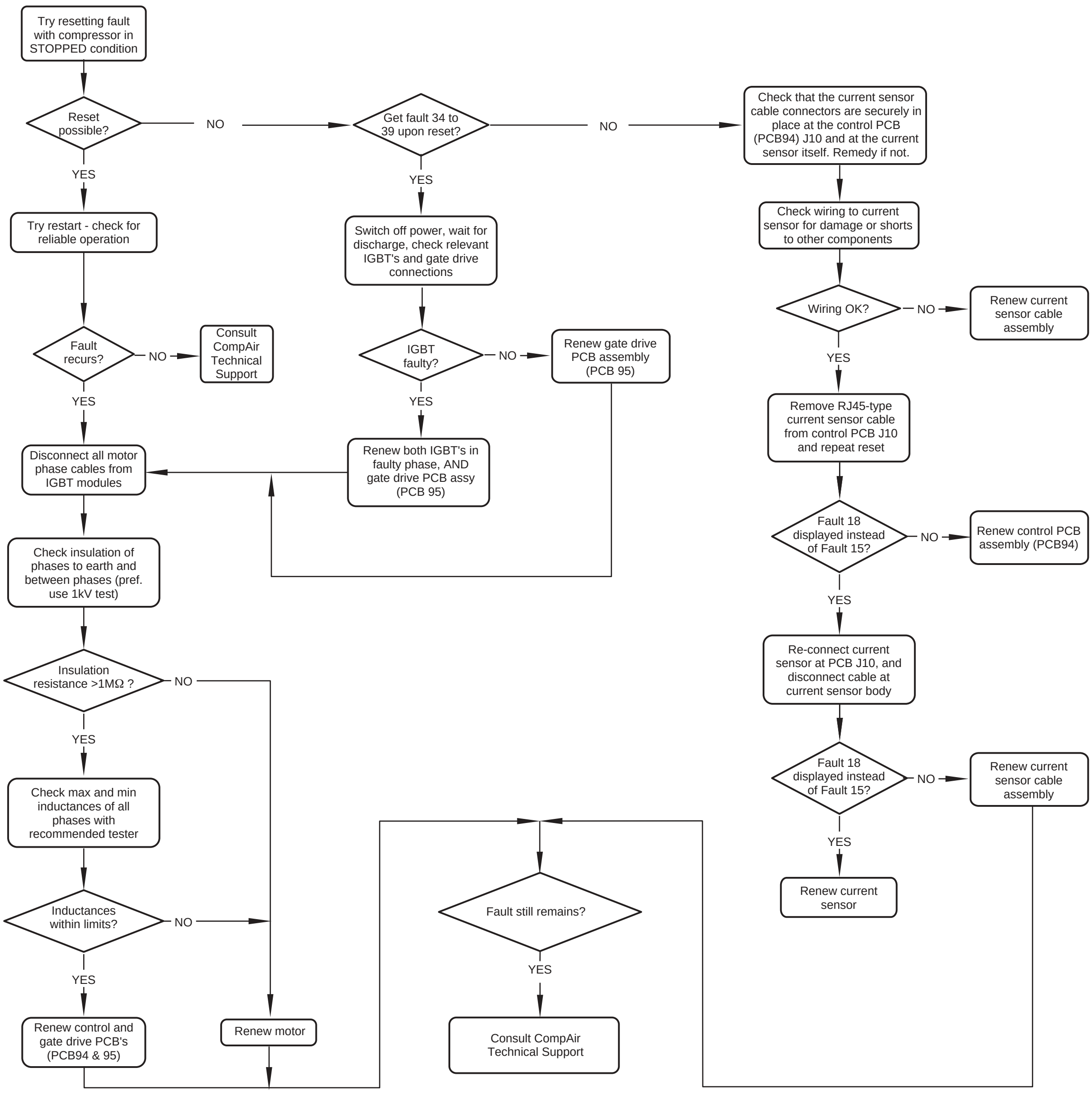
Fault Description

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor and this sensor is routed to "channel A" of the current feedback circuitry on the motor control PCB (PCB94). Because a single current sensor serves all motor phases, it is not possible to discriminate between phases and to directly determine from this fault indication which phase actually caused the over-current condition. Fault 15 will, under these circumstances, be flagged up regardless of which motor phase caused the over-current.

In all but early production control PCB's, only one socket is made available at J10 on the control PCB. Where multiple RJ45 sockets are present at J10, and where single current sensor only is provided, this sensor must be plugged into the "Phase A" channel of current feedback on the control PCB.

Where multiple current sensors are employed, each must be plugged into the appropriate port of J10. Faults 15, 16 and 17 are then available to indicate over-current in Phases A, B and (where a three-phase SR motor is used) Phase C.

Corrective Action



Fault 16: Motor Phase B Over-Current

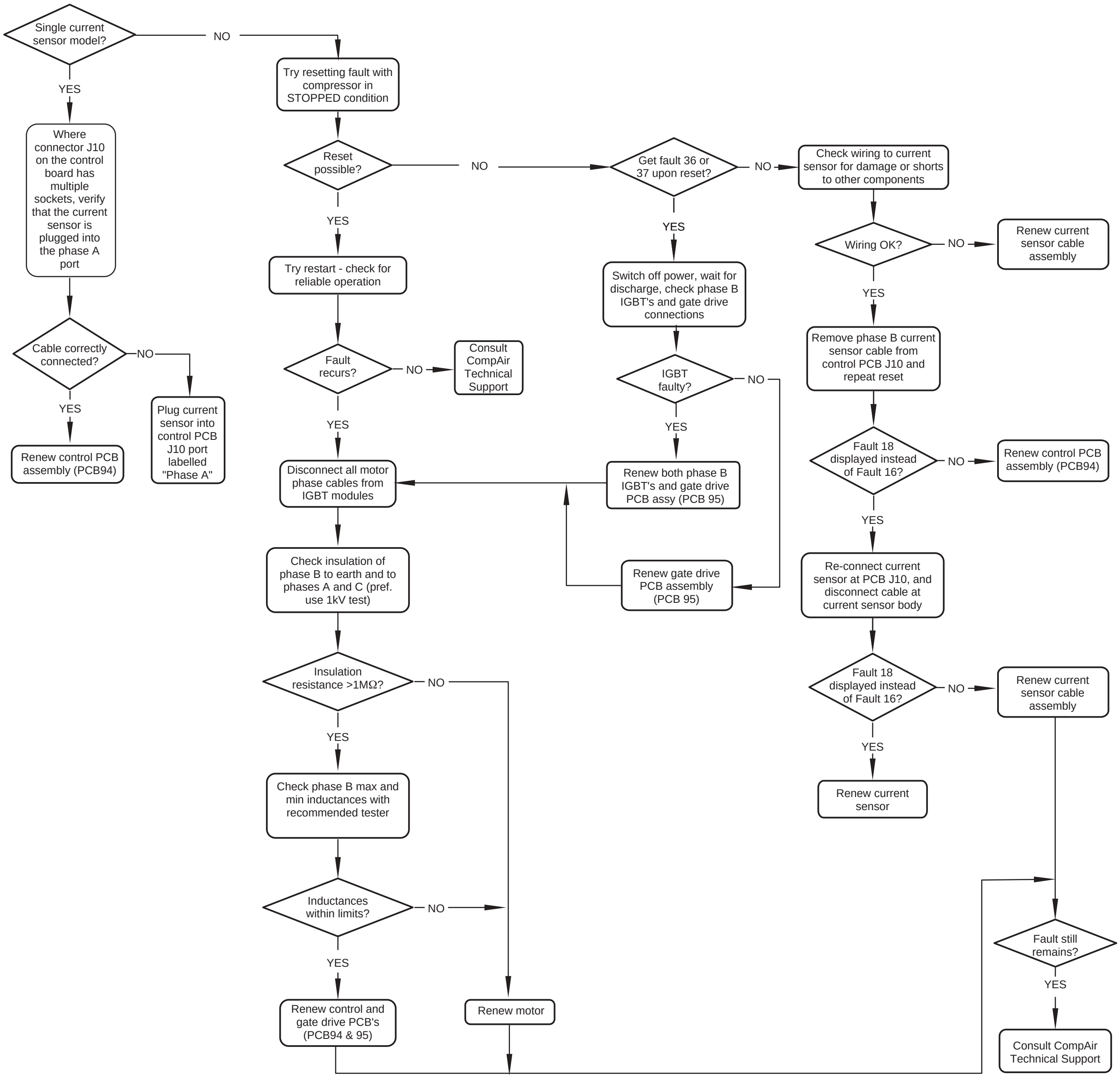
Fault Description

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor and this sensor is routed to "channel A" of the current feedback circuitry on the motor control PCB (PCB94).

In these circumstances, channel B of the current controller is not normally used in the CompAir application, therefore this fault should never normally be seen. In the highly unlikely event that this fault does appear, it is likely to be indicative of a control PCB fault, or possibly that the current sensor is plugged into the wrong channel of current feedback on the control board (where multiple socket ports are available on the control PCB's current sensor connector, J10).

Where multiple current sensors are used, this fault indicates excess current in motor phase B.

Corrective Action



Fault 17: Motor Phase C Over-Current

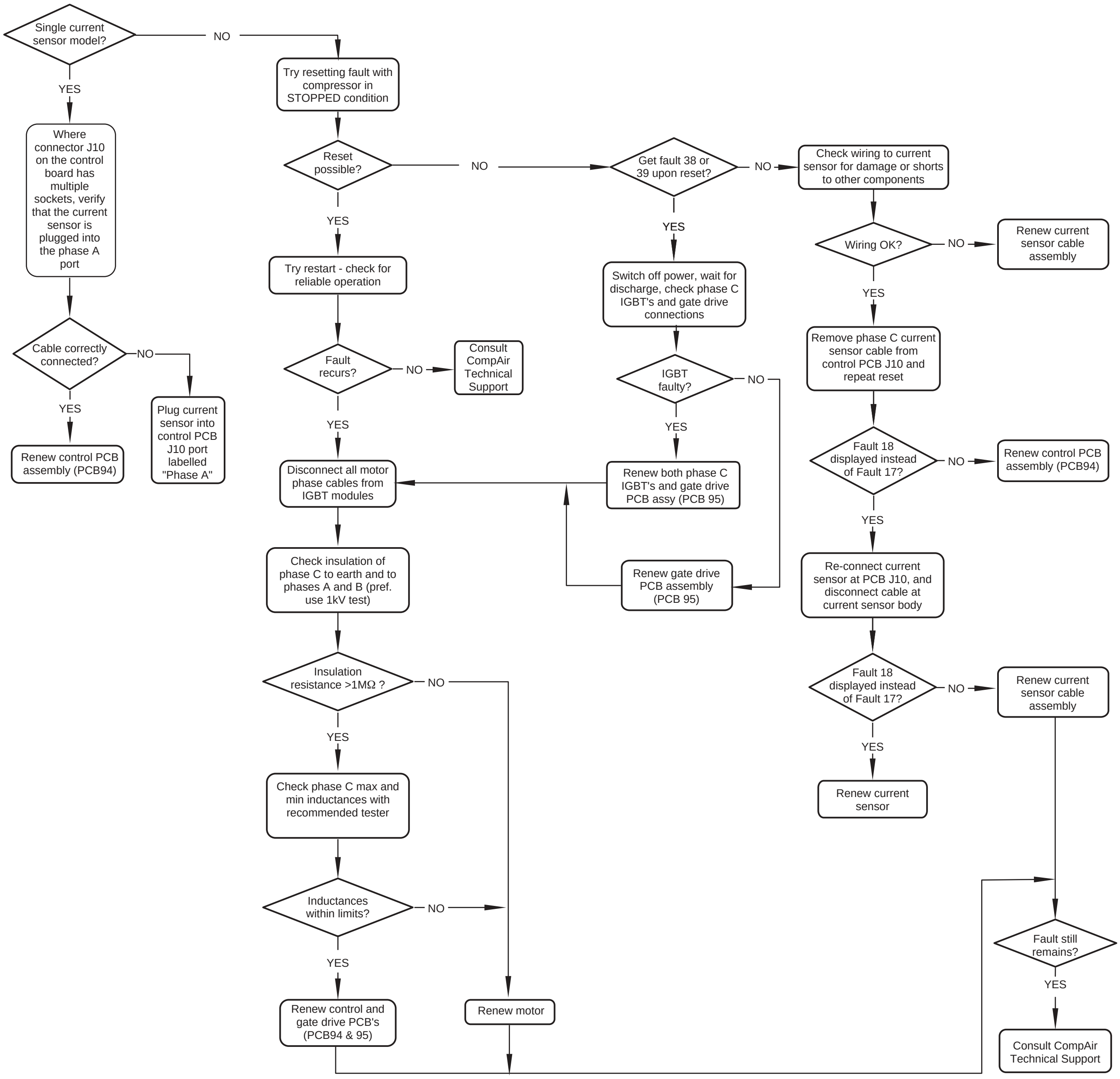
Fault Description

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor and this sensor is routed to "channel A" of the current feedback circuitry on the motor control PCB (PCB94).

In these circumstances, channel C of the current controller is not normally used in the CompAir application, therefore this fault should never normally be seen. In the highly unlikely event that this fault does appear, it is likely to be indicative of a control PCB fault, or possibly that the current sensor is plugged into the wrong channel of current feedback on the control board (where multiple socket ports are available on the control PCB's current sensor connector, J10).

Where multiple current sensors are used, this fault indicates excess current in motor phase C.

Corrective Action



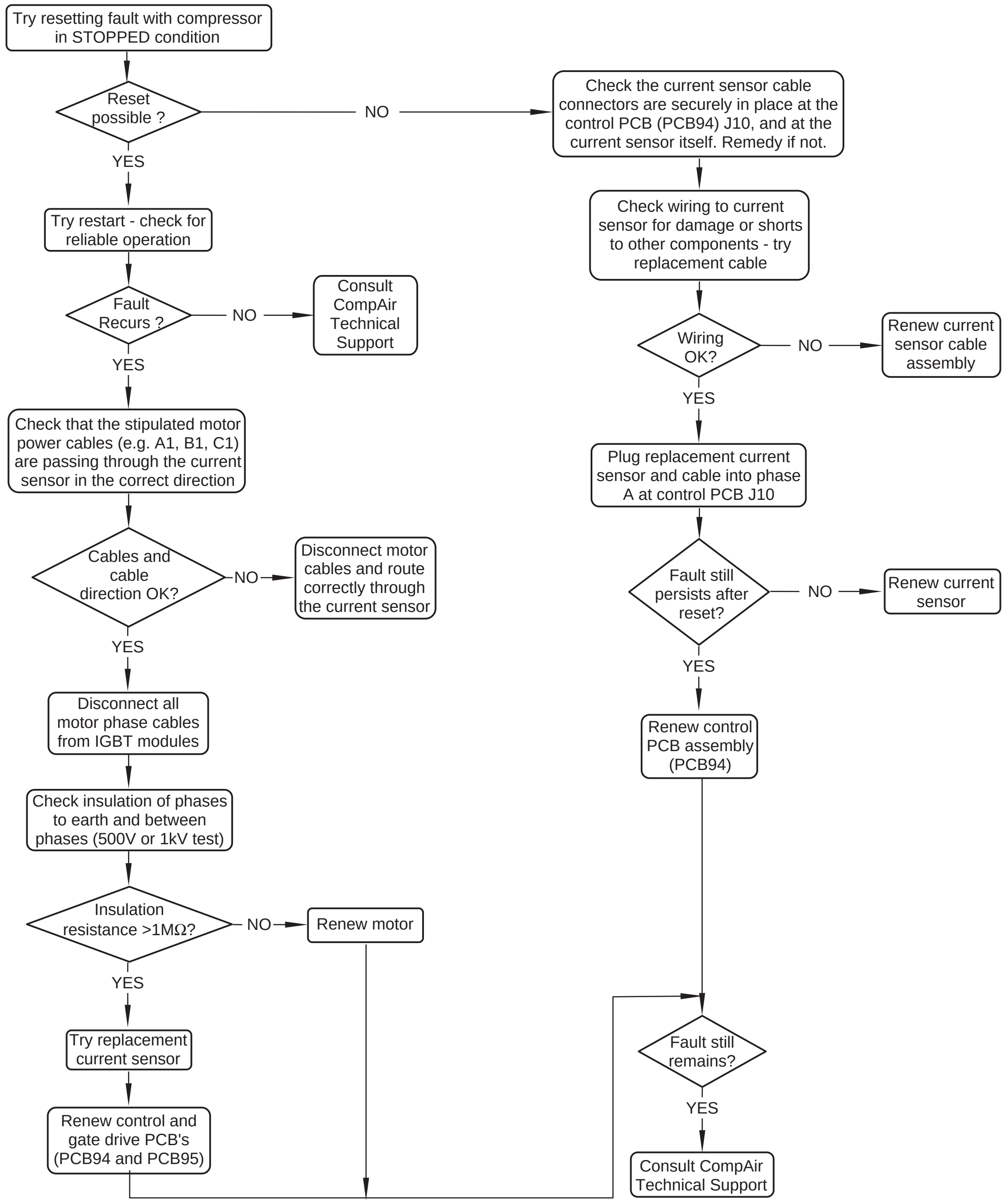
Fault 18: Negative Motor Current Fault

Fault Description

"Negative Current" indicates that the sensed current flow through the motor windings is in the opposite direction to that required. This fault applies equally to single or multiple current sensor models.

Typically this fault occurs if, during installation, the wrong motor phase connections are passing through the current sensor. The fault can also be indicative of a missing or faulty connection between the current sensor and gate drive PCB (PCB95), i.e. a cable or connector problem, or a defect in the current sensor itself. It is also possible to see this fault if there is a motor winding insulation failure.

Corrective Action

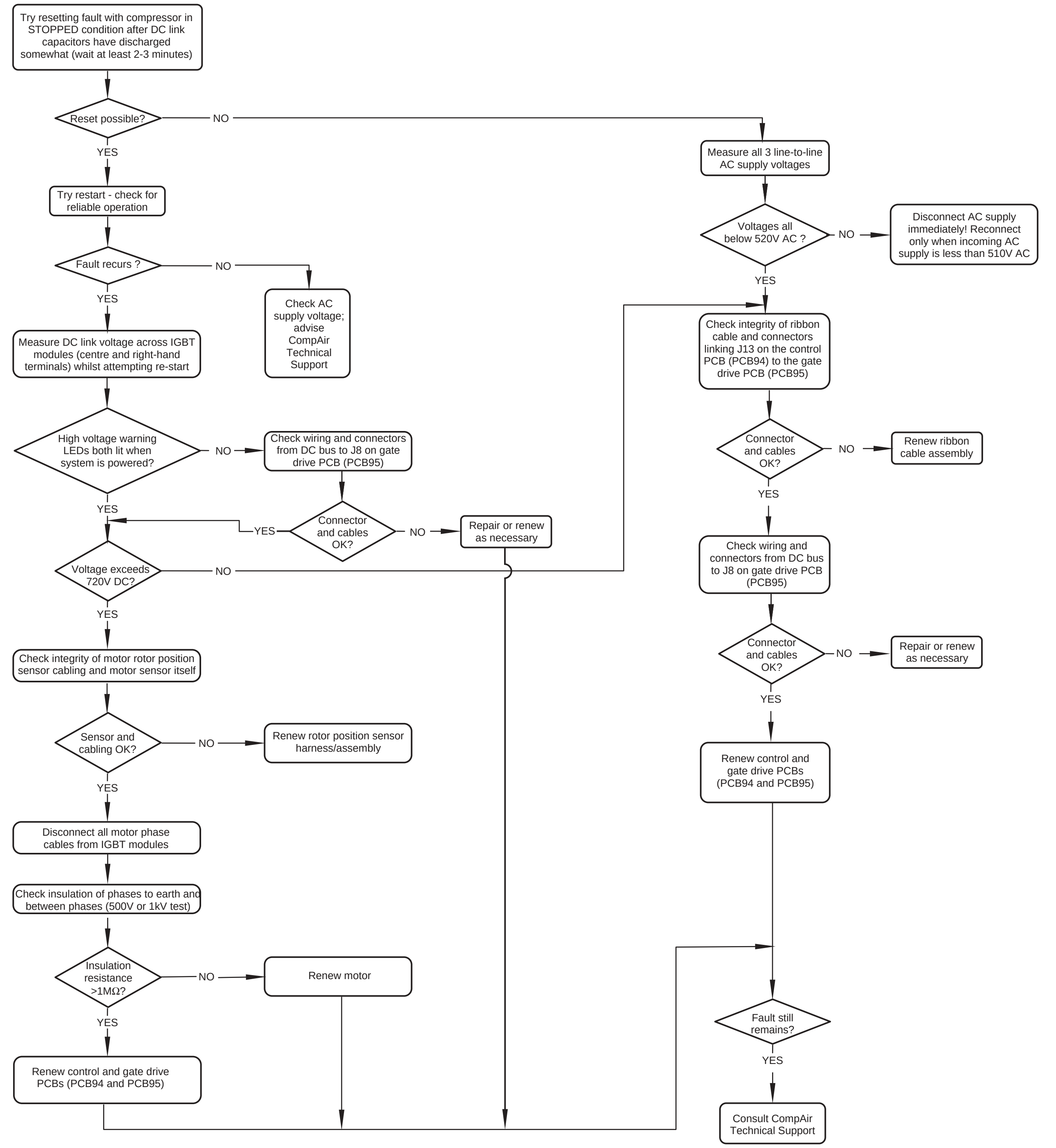


Fault 19: DC Link Over-Voltage

Fault Description

Indicates that the DC link ("DC bus") voltage has exceeded the maximum safe and acceptable value of around 750 V. The DC link voltage is sensed by the gate drive PCB (PCB95) at J8 and the resulting measurement passed back to the control PCB (PCB94). If the measured DC link (or "DC bus") voltage is excessive, typically > 750V DC, then this over-voltage fault condition will be registered.

Corrective Action



Fault 20: System Mode Setting Error

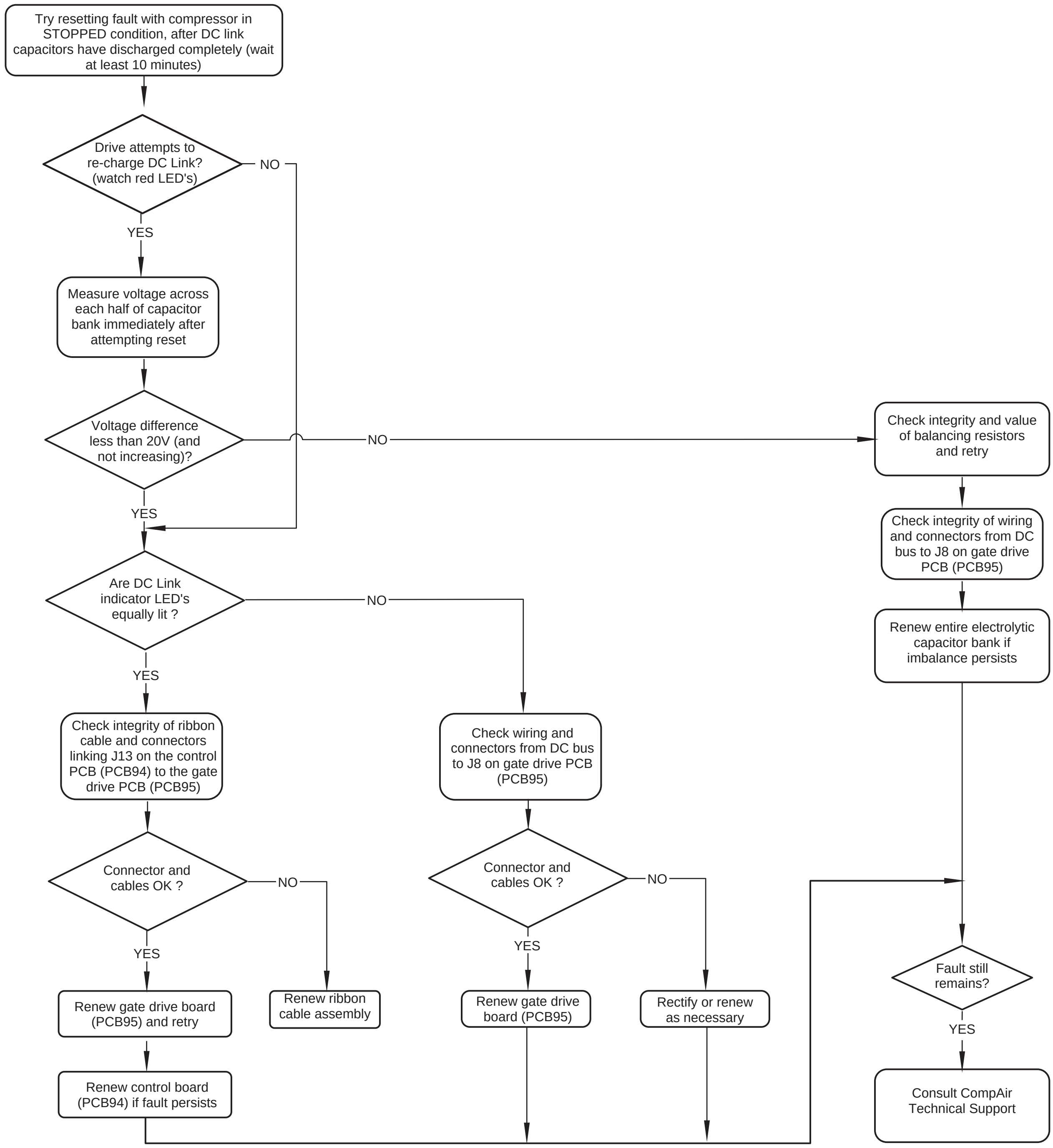
Description of Fault System Mode Setting Indicates that the variables stored in EEPROM that determine the systems mode (e.g. L90SR) have not been set up correctly.
Corrective action Re-initialise the motor control parameters by forcing a re-configuration from the Delcos 3100 compressor controller. If the fault persists, renew the control PCB sub-assembly (PCB94).

Fault 21: Voltage Imbalance At DC Link Capacitor Bank

Fault Description

The voltage across the two series-connected halves of the DC link capacitor bank should be approximately equal; normally this is assured by the balancing/discharge resistors, and also by good matching between the leakage currents due to individual capacitor cans. Should the voltage discrepancy between each "half" of the capacitor bank exceed approx. ± 30V (that is to say, a total difference of 60V - e.g. voltages of 270V and 330V) then this fault will be indicated.

Corrective Action

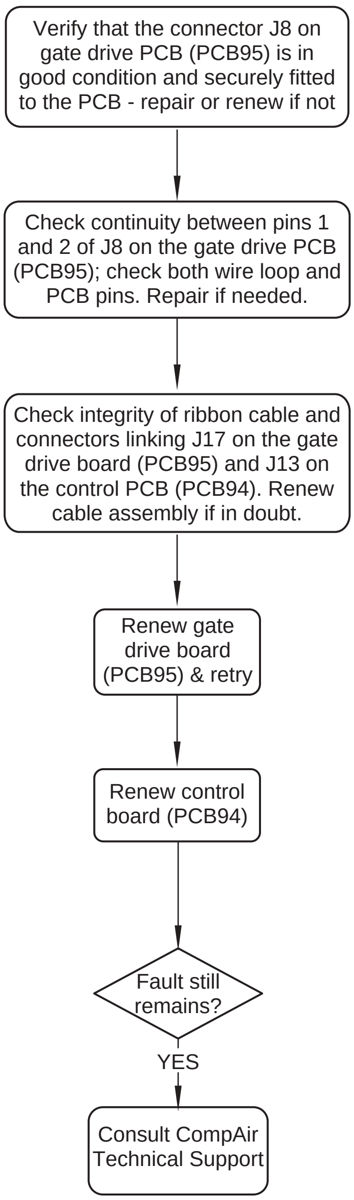


Fault 22: Missing DC Link Voltage Measurement Interlock

Fault Description

A measurement of DC link (or "DC bus") voltage is important to the safe and secure operation of the drive system. This measurement is used to control the charging of the DC link capacitors and to guard against under-voltage and (especially) over-voltage conditions. In order to ensure the integrity of the DC link voltage measurement, an interlock loop is provided at pins 1 and 2 of J8 on the gate drive PCB (PCB95). This is routed back to the control PCB (PCB94) via J17 on PCB95, through the ribbon cable to J13 on PCB94. If this interlock loop is broken at any point, or if the control PCB (PCB94) fails to "see" continuity of this loop because of a malfunction within the PCB, then Fault 22 is flagged.

Corrective Action

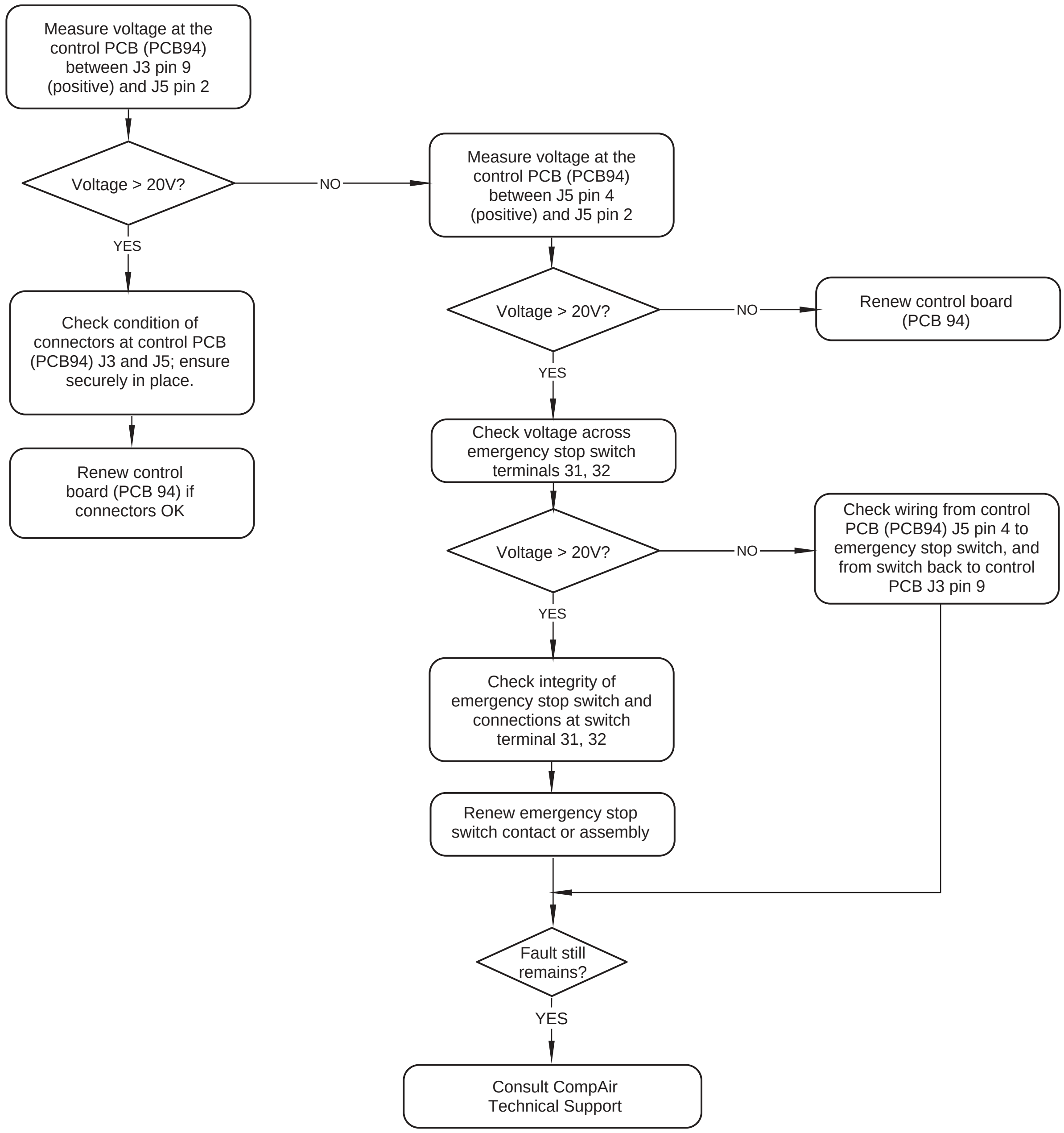


Fault 23: Safety Interlock Signal Missing

Fault Description

The control PCB (PCB94) has a digital input at J3 pin 9, which is used as a safety interlock and which must be connected to +24V DC for the drive to run. The necessary +24V supply is obtained from J5 pin 4, also on the control PCB (PCB94), and is wired through one normallyclosed contact on the "emergency stop" switch, and then back to PCB94 J3 pin 9. Normally, operation of the emergency stop switch will be indicated by the Delcos 3100 explicitly as an "emergency stop". However if there is a fault in the wiring between the emergency stop switch and the control PCB (PCB94), or in part of the emergency stop switch itself (e.g. breaking only some but not all contacts), then Fault 23 may be indicated.

Corrective Action



Fault 24: FPGA WDT (“Watchdog” Timer) Fault

Description of Fault
The control PCB (PCB94) implements much of the motor control algorithms and control logic within a microprocessor (U16) and FPGA (Field Programmable Gate Array) (U27). The latter is a vital component within the control PCB, and whilst ordinarily very reliable, as a programmable device it is possible in principle for its internal memory to be corrupted. Fault 24 is indicative of a hardware fault, firmware or programming error in the FPGA.
Corrective Action
This fault is uncommon and indicates that the control subassembly (PCB94) has been damaged, possibly as a result of static electricity if it has recently been removed or handled. Cycle the system power. If the fault persists or recurs even intermittently, renew the control PCB sub-assembly (PCB94).

Fault 25: Main Contactor Interlock Fault

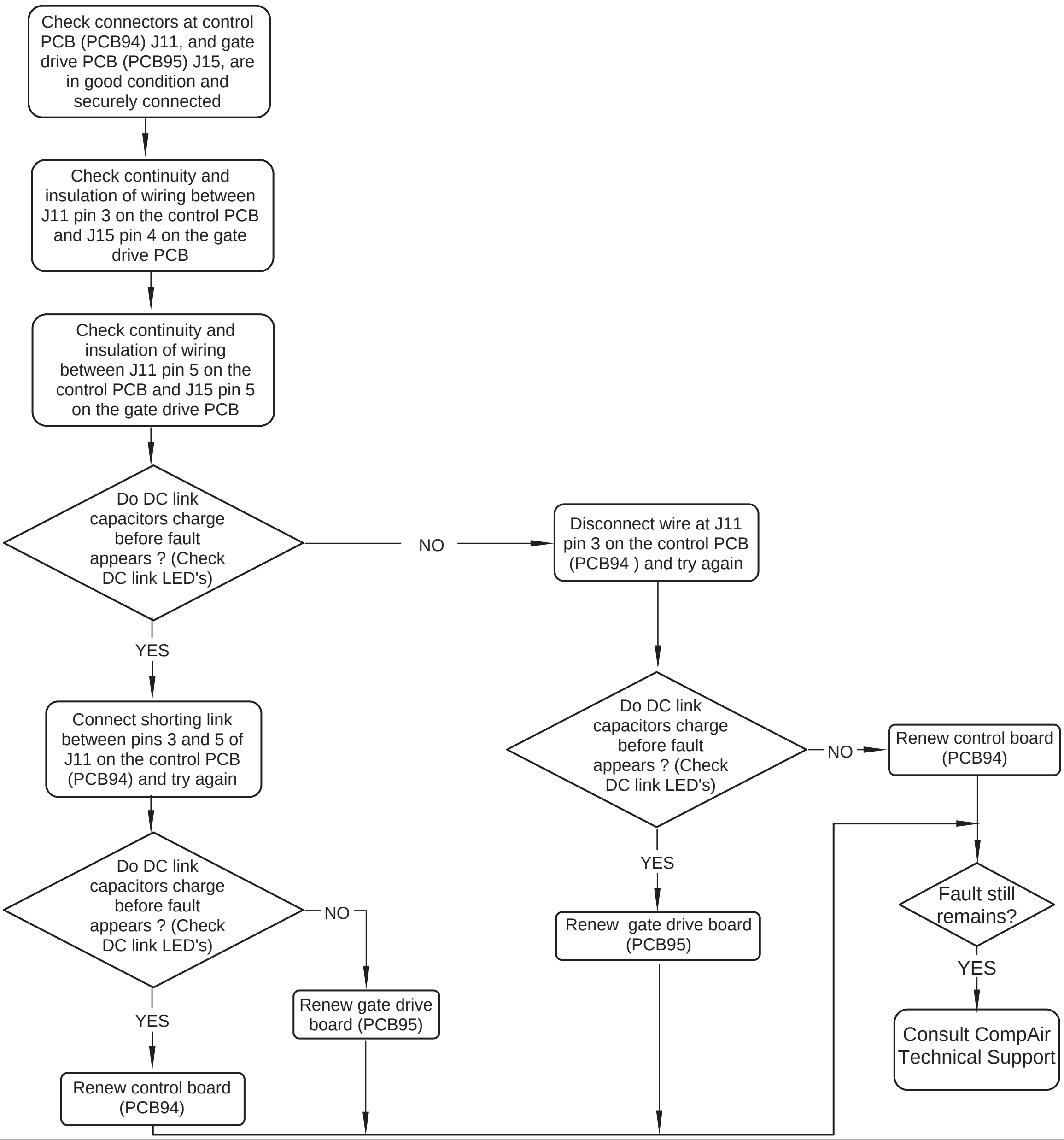
Fault Description

The control PCB set (PCB94 and PCB95) provides - *in principle* - for the inclusion of a contactor to break the three-phase AC mains supply feed to the rectifier. This approach was used in the Mark 1 "Cyclon SR" compressors (with SureScan controller), but a contactor is NOT in practice employed in the Mark 2 SR compressors (with Delcos 3100 controller).

The relay to operate the contactor still however exists on the gate drive PCB (PCB95), and for versions of software up to and including v.1.27, this relay is required to close an interlock circuit on the control PCB (PCB94). This simulates the normal closing and opening of the power contactor so far as the software is concerned. If the relay on PCB95 fails to operate, or if the interlock circuit wiring is defective, then Fault 25 will be seen.

The requirement to complete this interlock "loop" will be removed in future version of software. Fault 25 will then be redundant (and will not be seen at all).

Corrective Action



Fault 26: Dynamic Brake Circuit Over-Current

Description of Fault The control PCB set (PCB94 and PCB95) provides – in principle – for the inclusion of a dynamic braking resistor in the power electronics, in order to provide active braking capability in the drive. Early versions of the control PCB (PCB94) were equipped with a socket for a braking circuit current sensor, to which nothing should be connected Dynamic braking is not employed in the CompAir applications, and this fault should therefore never normally be seen.
Corrective Action *This functionality is disabled in this application.* Where a “Brake” current sensor socket is provided on the control PCB (PCB94) J10, verify, as a precaution only, that nothing is plugged into this. (This will apply only to early versions of the control PCB; the “Brake” current sensor socket is not fitted at all in later production control PCB’s.) Otherwise renew the control sub-assembly, PCB94.

Fault 27: Control PCB Hardware Fault Latch

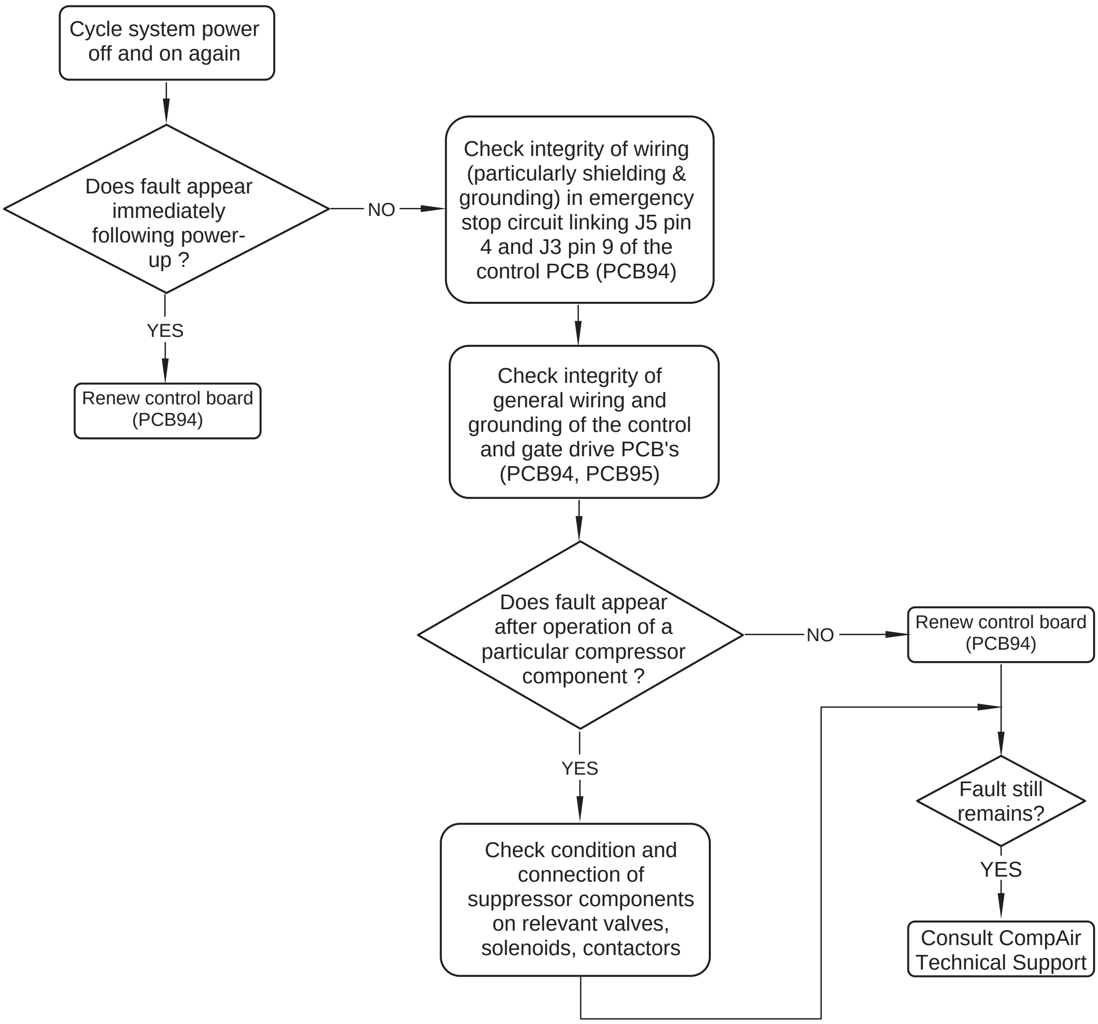
Fault Description

Within the control PCB the event of a serious and urgent fault condition. This circuit is intended to shut down the drive immediately, and for safety's sake, independently of the drive's software and firmware. Examples of faults which cause this latch to be "set" are over-current and over-voltage faults.

In practice, the drive's "firmware" logic (i.e. logic gates and latches within the Altera FPGA) should always register the fault which caused the hardware latch to be set, and will relay this information to the drive's microprocessor. Consequently, this fault message should always be accompanied by another fault message indicating the true source of the fault, which will be preferentially displayed by the Delcos instead of fault 27.

Fault 27 appearing on its own is indicative of an extremely brief transient (apparent) fault condition, too brief to be registered by the firmware, or a hardware defect on the control PCB (PCB94). It can be caused by unusually high levels of local radio-frequency interference, within the motor control cabinet, though suppression components should normally prevent this.

Corrective Action



Fault 28: Mains Phase Sequence (“Rotation”) Incorrect

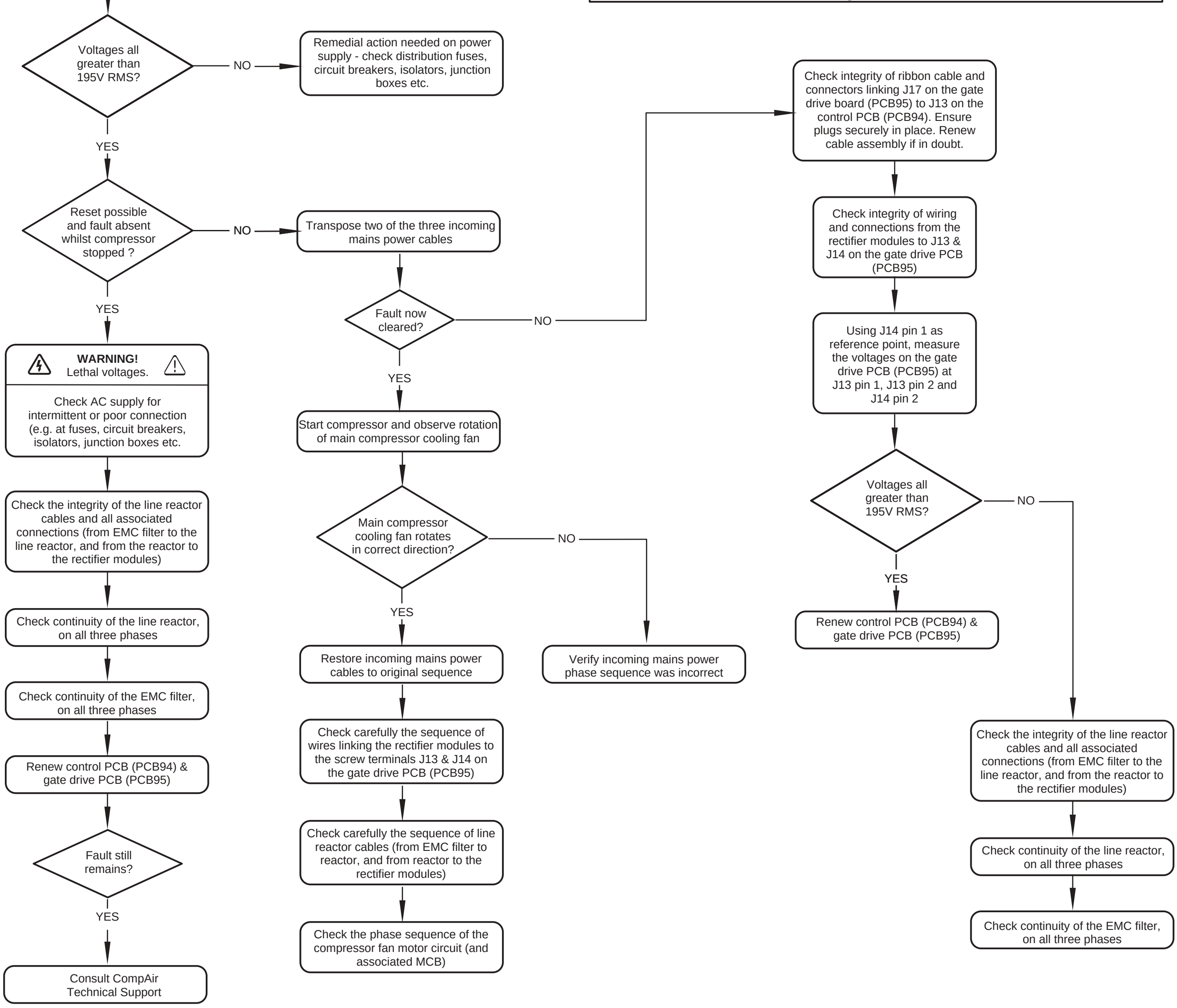
Fault Description

Correct direction of rotation - and hence phase sequence - is important for the compressor's main cooling fan. The Mark 1 "Cyclon SR" compressors incorporated a separate phase sequence relay to detect incorrect sequencing of the three-phase mains supply; this functionality is now incorporated into the gate drive PCB (PCB95). Incorrect sequencing of the AC mains is detected by PCB95 and the fault signal passed to the microprocessor control PCB (PCB94), where it is registered as Fault 28.

This fault may also be seen where one phase voltage is very low or missing entirely (e.g. due to blown fuse). In this case Fault 29 will also be triggered, but since Fault 28 is higher in the priority list, Fault 28 is the one which will be displayed by the Delcos 3100.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 29: Mains Supply Voltage Low

Fault Description

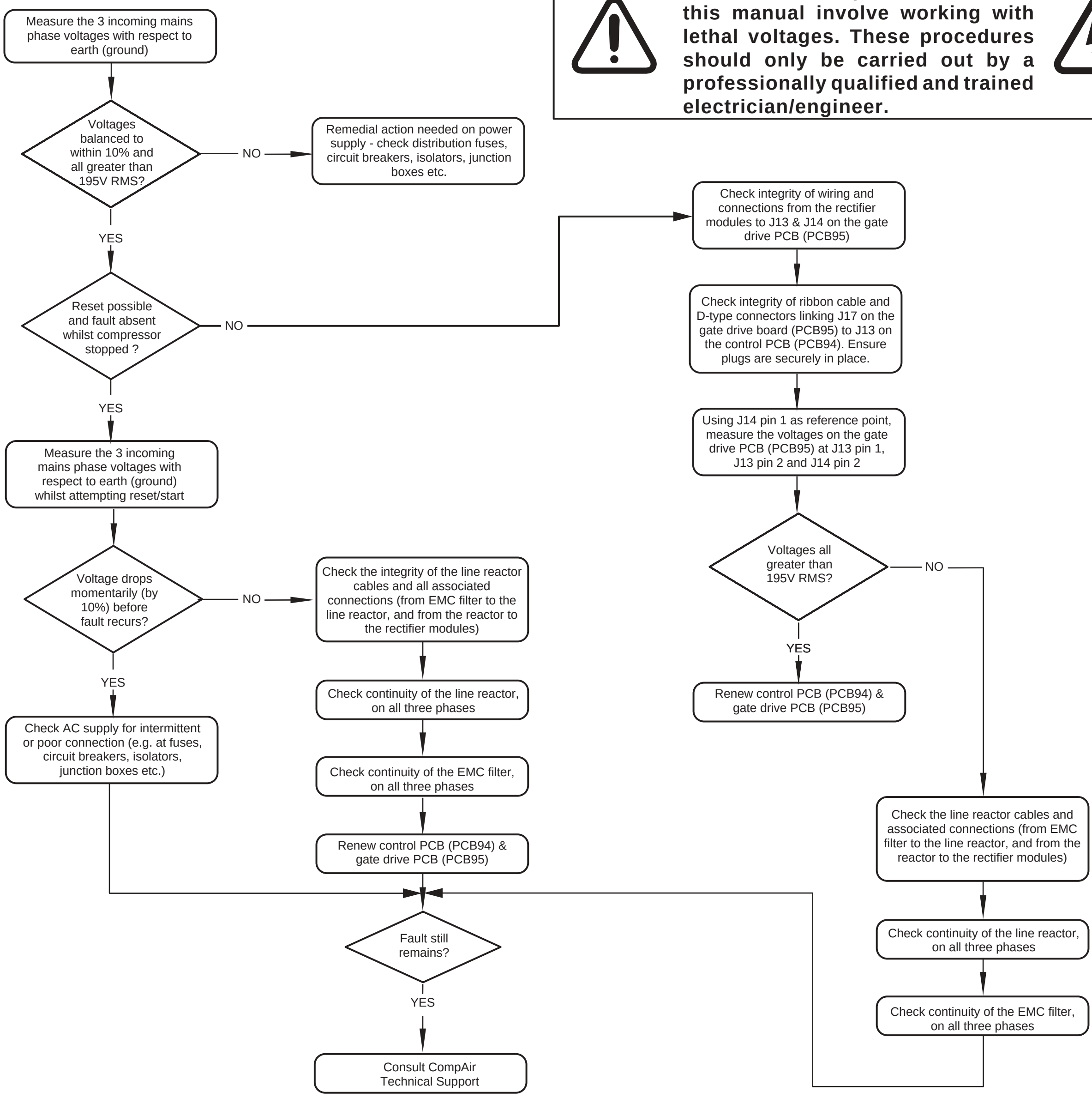
In order to avoid overloading of one AC supply phase, it is important that the supply voltages remain reasonably well balanced. This avoids potential problems of overheating power components (EMC filter, line reactor and rectifier) within the motor control cabinet, as well as preventing cable over-heating and/or fuse failure in the external AC supply.

The incoming AC voltages are monitored on the gate drive PCB (PCB95) and Fault 29 is flagged under either of the following circumstances: (i) one phase voltage is persistently >10% lower than the others; or (ii) the incoming mains line voltages are persistently less than approx. 330V AC rms.

Some supply fault conditions (such as a missing phase - e.g. due to blown fuse) may also cause the "phase rotation fault" (Fault 28) to be indicated. Since Fault 28 has a higher priority in the fault listing, the Delcos 3100 will display Fault 28 in preference to Fault 29, where both fault conditions arise simultaneously.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 30: DC Link Under-Voltage

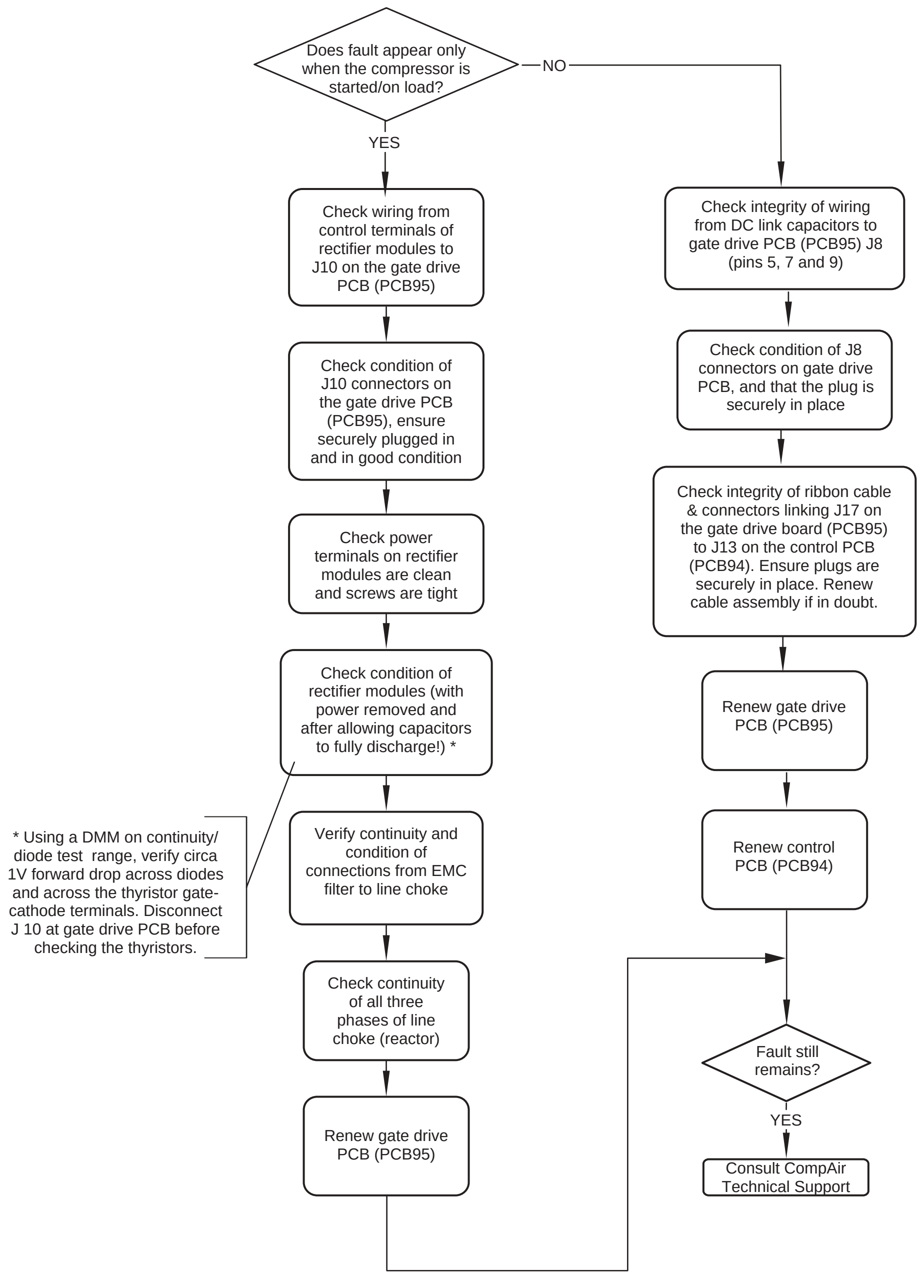
Fault Description

This indicates that the DC link voltage has dropped below the acceptable minimum threshold of around 450V either repeatedly but briefly, or for a prolonged period (>5 seconds).

This fault will arise if one or more mains phase voltages 'sag' when under load; however under these circumstances the 'Low mains voltage' fault (Fault 29) will normally also occur and will be preferentially displayed by the Delcos 3100 due to its higher priority in the faults list.

Fault 30, when displayed by the Delcos, therefore typically indicates a fault in either the controlled rectifier or in the DC link measuring circuit (or their associated cables/connections).

Corrective Action



Fault 31: Phase A Motor Connection Fault

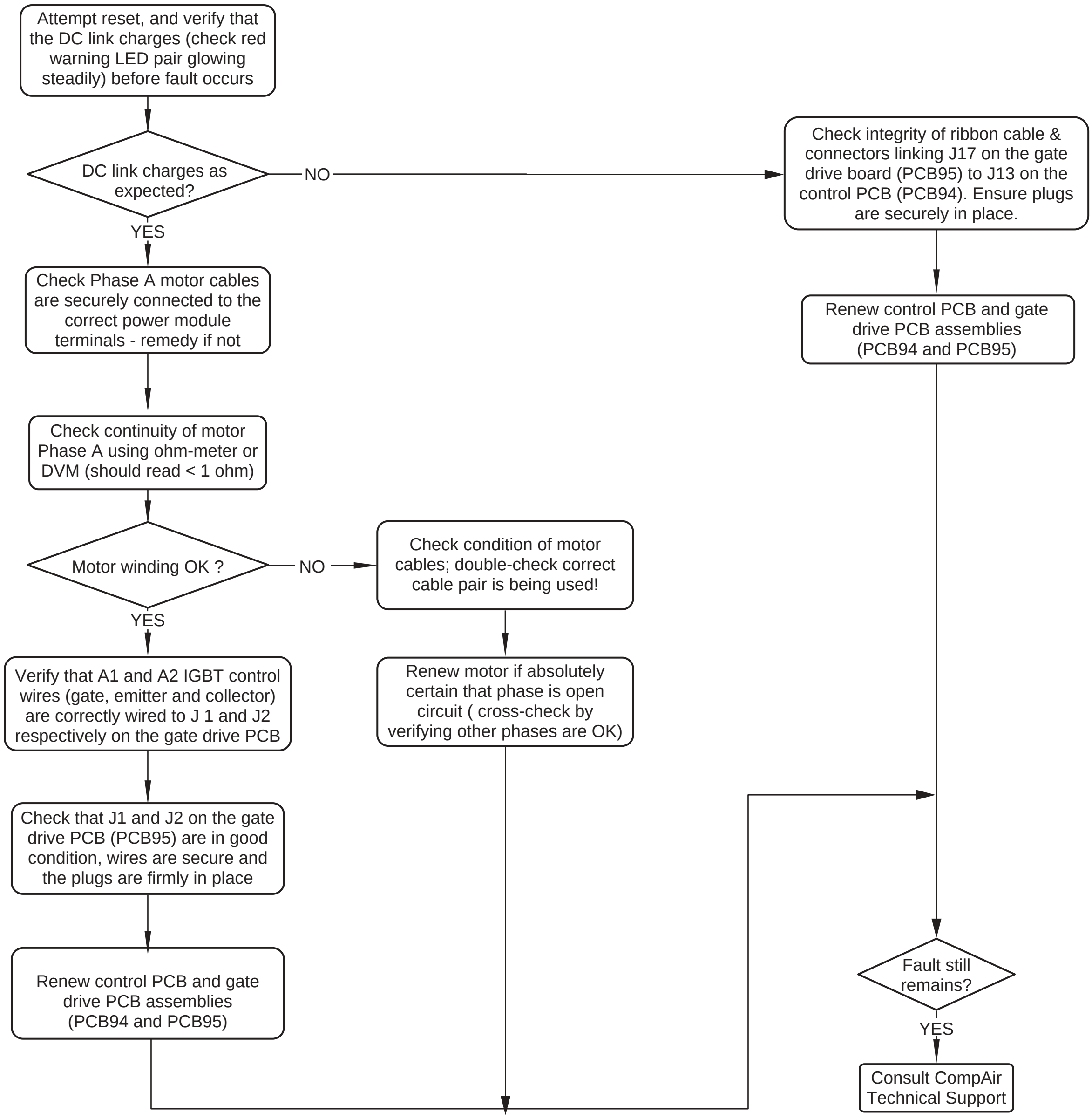
Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of gate drive is fed back to the control PCB via an optical safety isolator.

If both gate drive channels of a given phase lack power, then this may be because there is an open-circuit either in the motor winding or in the connections between the IGBT's and gate drive board. Alternatively it may arise due to a defect in the gate drive PCB itself, or in the control PCB incorrectly perceiving a fault.

Lack of DC link voltage will of course also deprive the gate drive circuits of power, but this will cause faults of higher priority to be displayed (e.g. mains low, DC link low etc.), and Fault 31 although strictly speaking present will be masked out by the controller.

Corrective Action



Fault 32: Phase B Motor Connection Fault

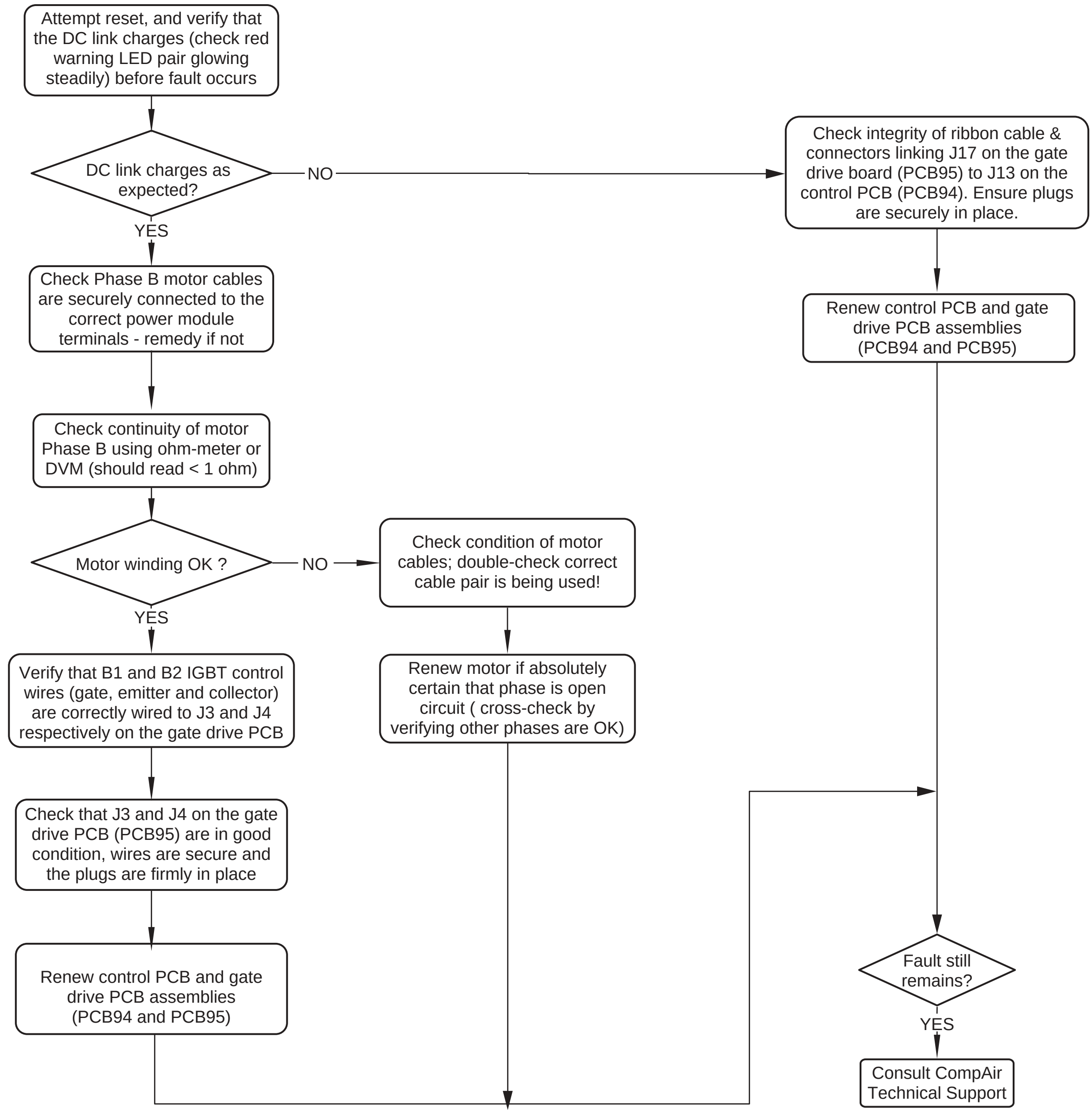
Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of gate drive is fed back to the control PCB via an optical safety isolator.

If both gate drive channels of a given phase lack power, then this may be because there is an open-circuit either in the motor winding or in the connections between the IGBT's and gate drive board. Alternatively it may arise due to a defect in the gate drive PCB itself, or in the control PCB incorrectly perceiving a fault.

Lack of DC link voltage will of course also deprive the gate drive circuits of power, but this will cause faults of higher priority to be displayed (e.g. mains low, DC link low etc.), and Fault 31 although strictly speaking present will be masked out by the controller.

Corrective Action



Fault 33: Phase C Motor Connection Fault

Fault Description

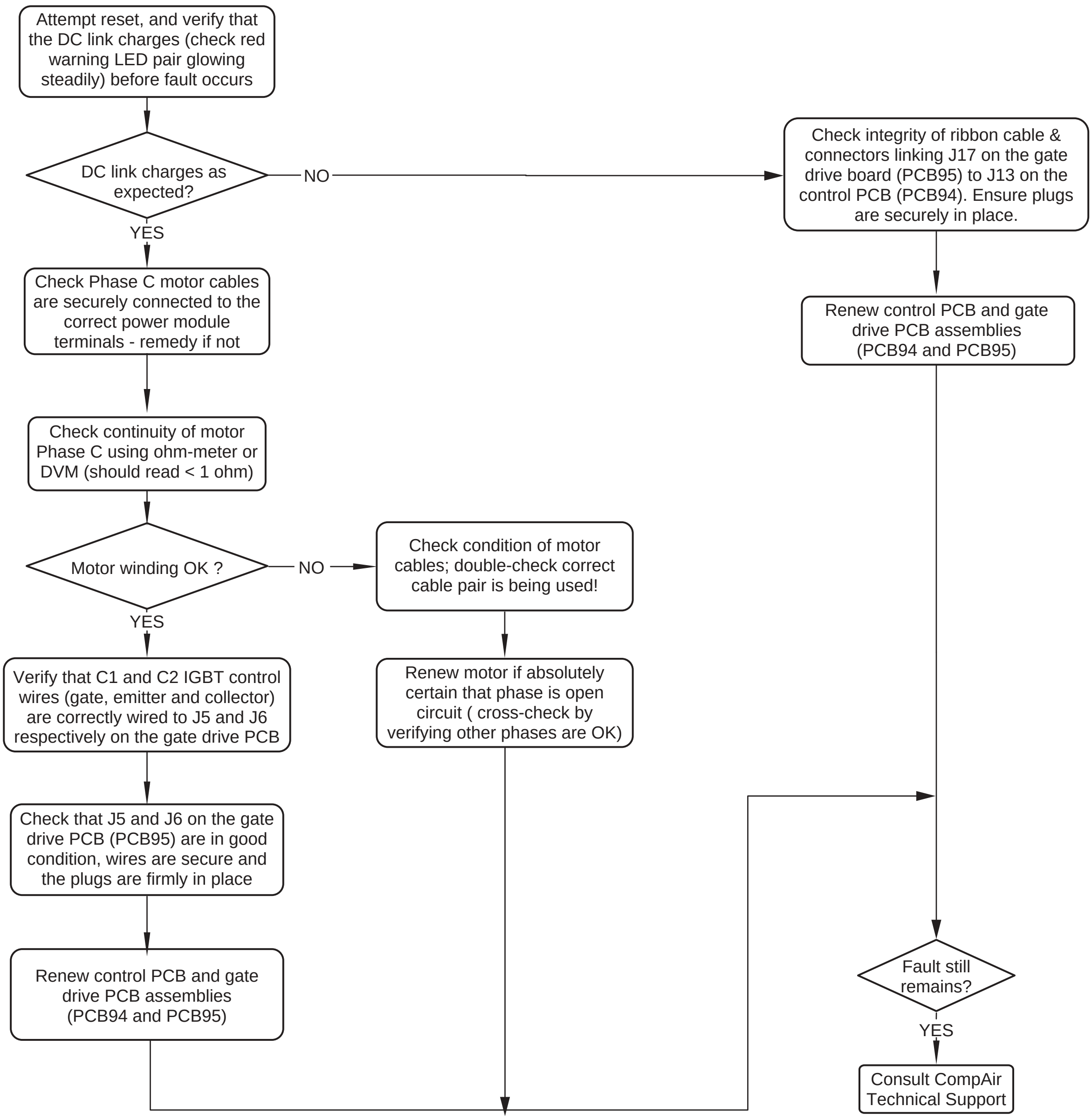
The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of gate drive is fed back to the control PCB via an optical safety isolator.

If both gate drive channels of a given phase lack power, then this may be because there is an open-circuit either in the motor winding or in the connections between the IGBT's and gate drive board. Alternatively it may arise due to a defect in the gate drive PCB itself, or in the control PCB incorrectly perceiving a fault.

Lack of DC link voltage will of course also deprive the gate drive circuits of power, but this will cause faults of higher priority to be displayed (e.g. mains low, DC link low etc.), and Fault 31 although strictly speaking present will be masked out by the controller.

Note that two-phase drives use only phases A and B of the control system. If this fault is seen in a 2-phase system, check the programming of the Delcos; in particular, check that it is programmed with the correct compressor model and motor type.

Corrective Action



Fault 34: IGBT Fault - A1 Module

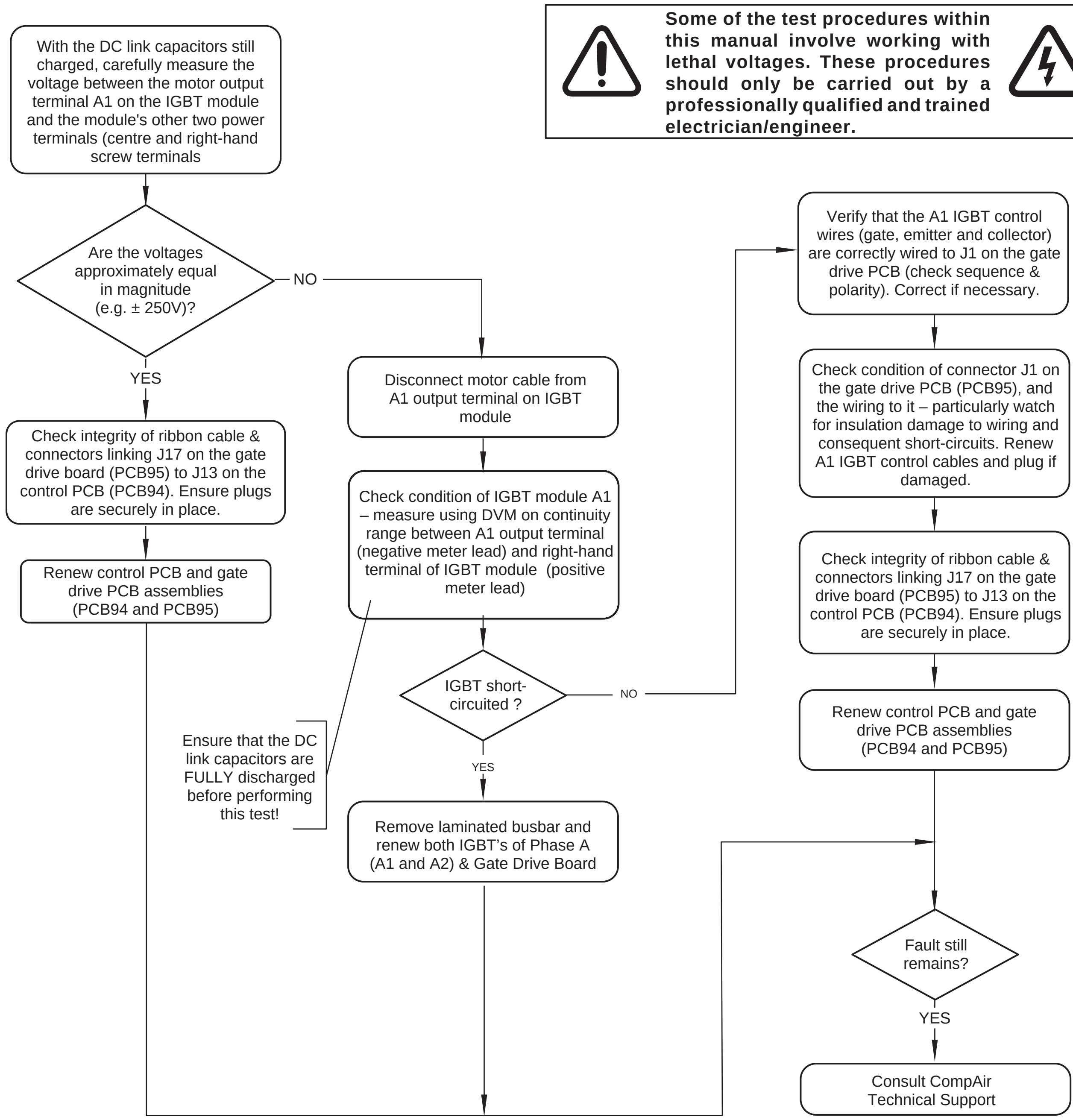
Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 35: IGBT Fault - A2 Module

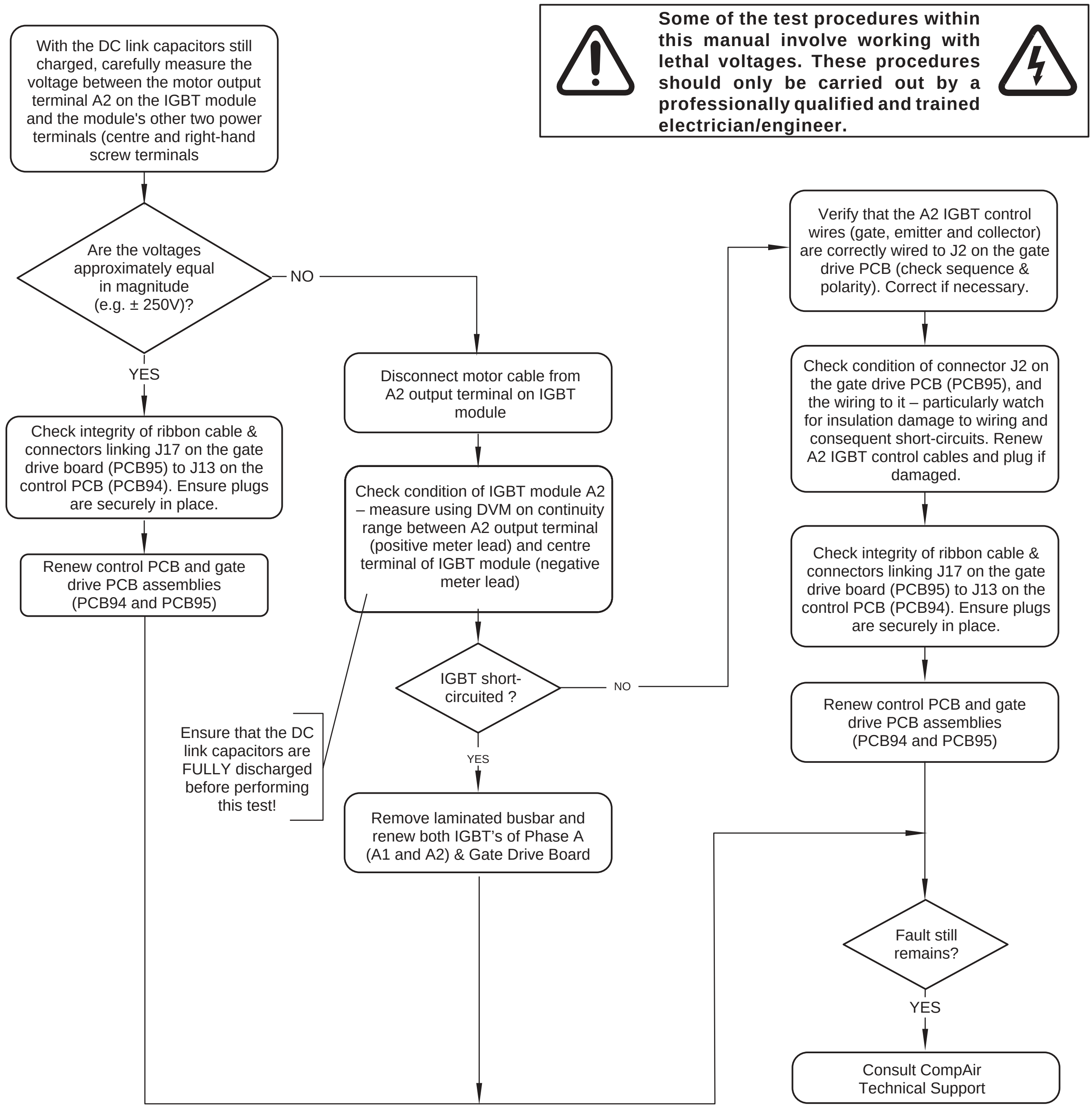
Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



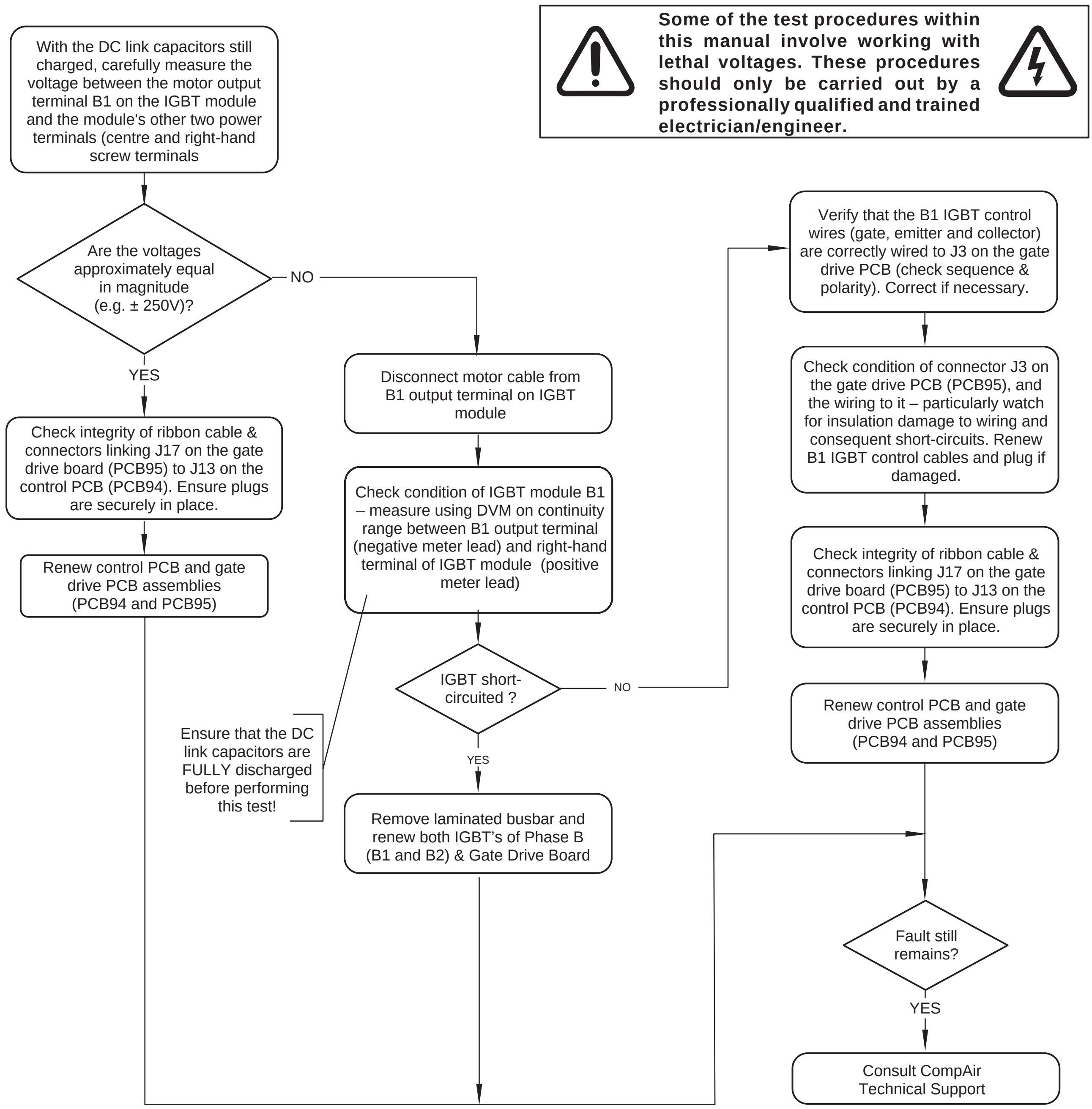
Fault 36: IGBT Fault - B1 Module

Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Corrective Action



Fault 37: IGBT Fault – B2 Module

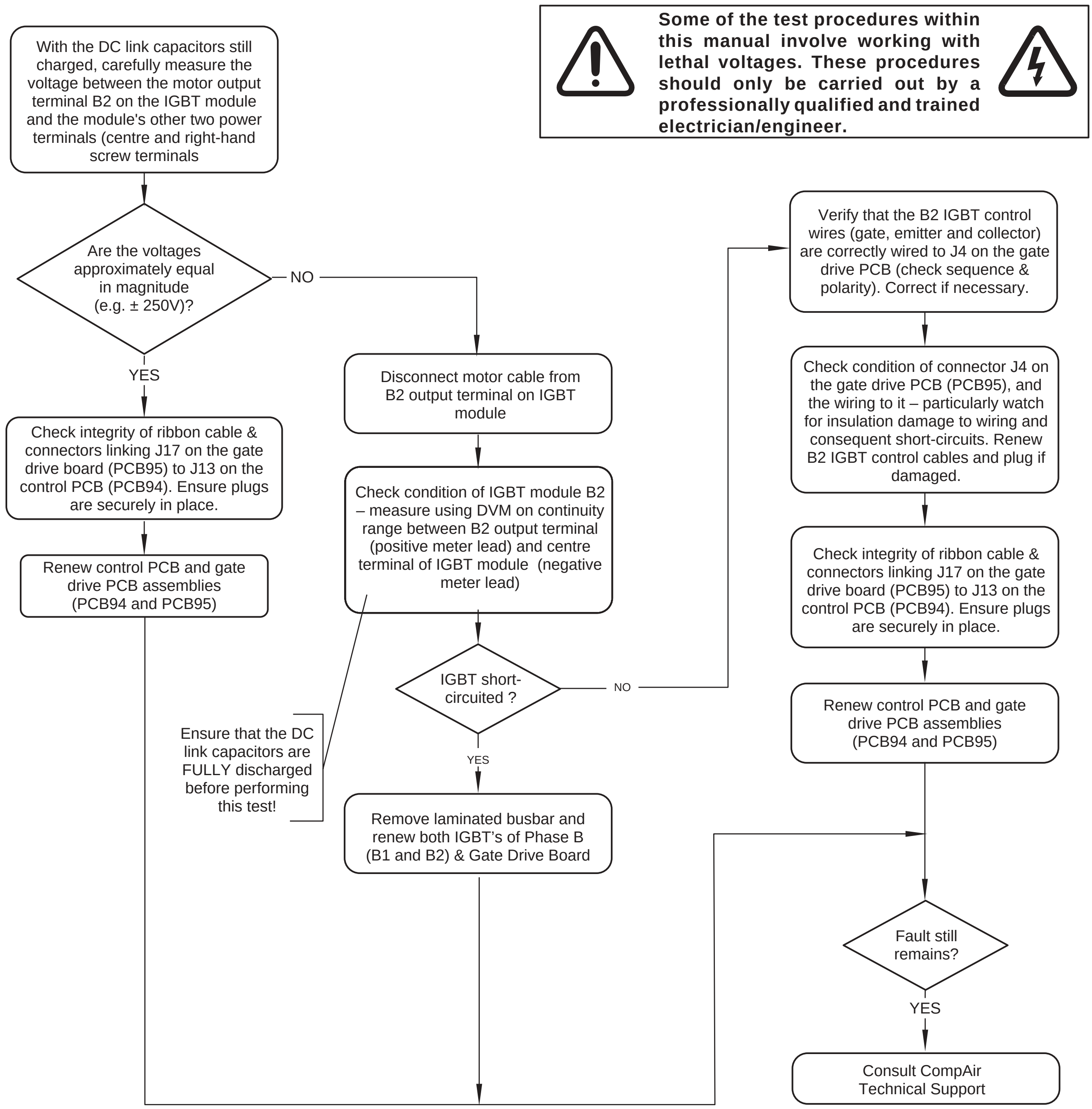
Fault Description

The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 38: IGBT Fault - C1 Module

Fault Description

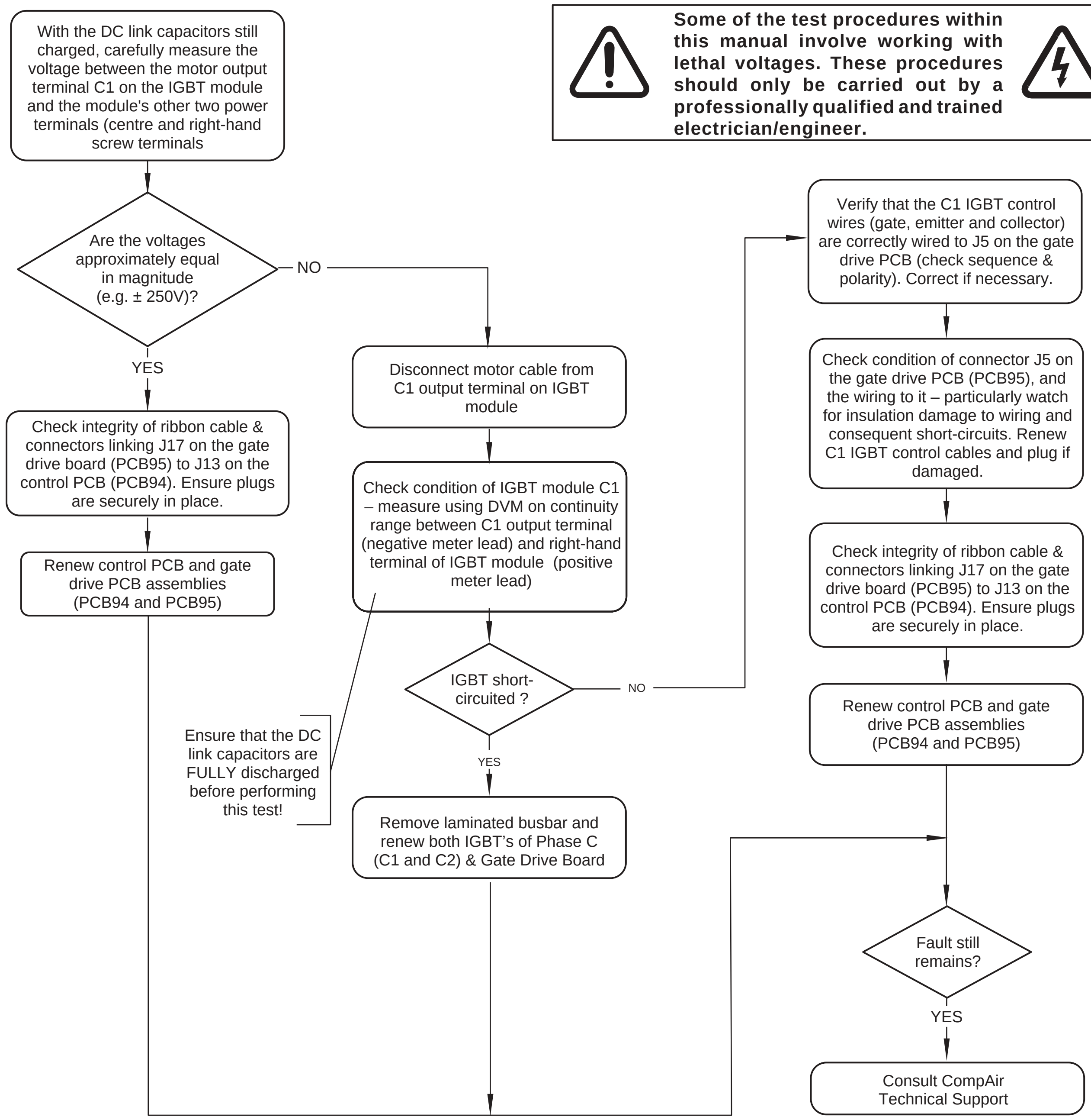
The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Note that two-phase drives use only phases A and B of the control system. If this fault is seen in a 2-phase system, check the programming of the Delcos; in particular, check that it is programmed with the correct compressor model and motor type.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 39: IGBT Fault – C2 Module

Fault Description

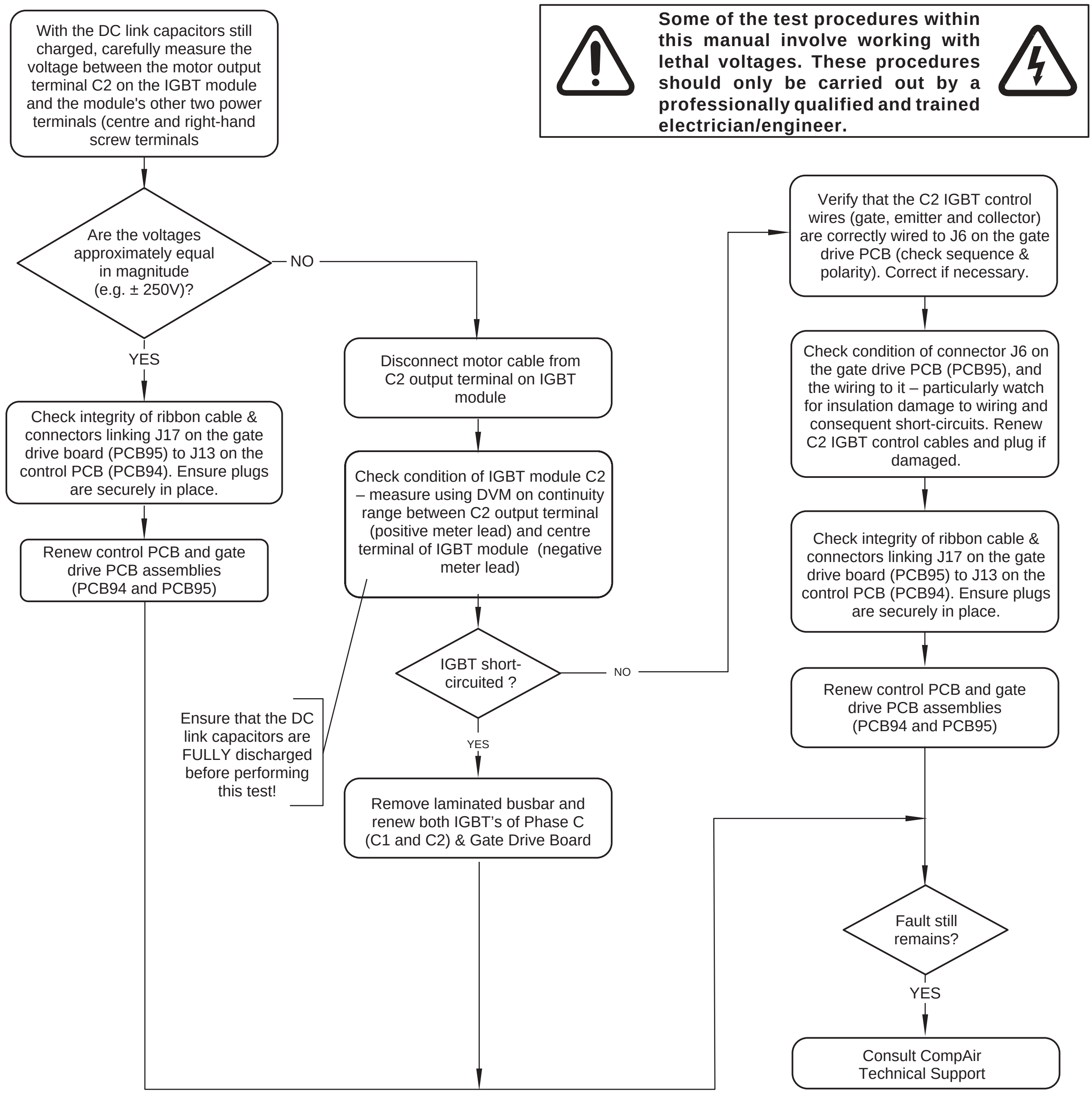
The gate drive PCB (PCB95) derives power for each IGBT gate drive circuit from the average collector-emitter voltage normally present across each IGBT. The health of the power supply to each channel of the gate drive is fed back to the control PCB via an optical safety isolator.

If a single gate drive channel within a given phase lacks power (rather than both), then this implies that either the associated IGBT is short-circuited between its collector and emitter terminals, or possibly incorrectly connected, or that the gate drive circuitry itself is defective.

Note that two-phase drives use only phases A and B of the control system. If this fault is seen in a 2-phase system, check the programming of the Delcos; in particular, check that it is programmed with the correct compressor model and motor type.

Corrective Action

Some of the test procedures within this manual involve working with lethal voltages. These procedures should only be carried out by a professionally qualified and trained electrician/engineer.



Fault 40: Dynamic Braking IGBT Fault
(not applicable to CompAir applications)

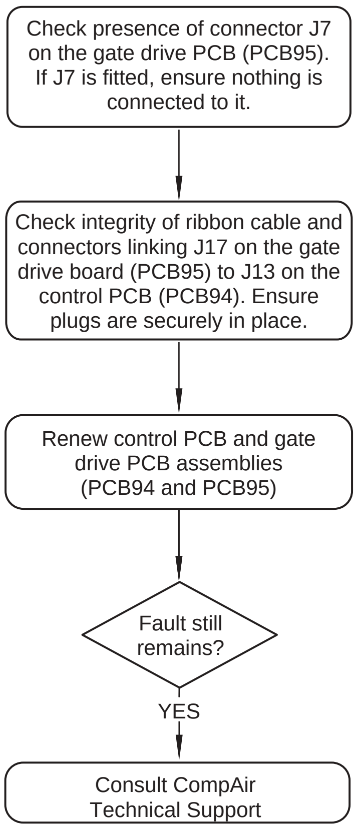
Fault Description

A measurement of DC link (or "DC bus") voltage is important to the safe and secure operation of the drive system. This measurement is used to control the charging of the DC link capacitors and to guard against under-voltage and (especially) over-voltage conditions. In order to ensure the integrity of the DC link voltage measurement, an interlock loop is provided at pins 1 and 2 of J8 on the gate drive PCB (PCB95). This is routed back to the control PCB (PCB94) via J17 on PCB95, through the ribbon cable to J13 on PCB94. If this interlock loop is broken at any point, or if the control PCB (PCB94) fails to "see" continuity of this loop because of a malfunction within the PCB, then Fault 22 is flagged.

Dynamic braking is not employed in CompAir applications and where J7 is fitted to the gate drive PCB, nothing should be connected to it. This fault should not normally be seen in CompAir applications.

Corrective Action

This functionality is disabled in this application. In the highly unlikely event of Fault 40 arising in a CompAir application, follow steps as below:



Fault 41: RS232 communications fault
(not applicable to CompAir applications)

Fault Description

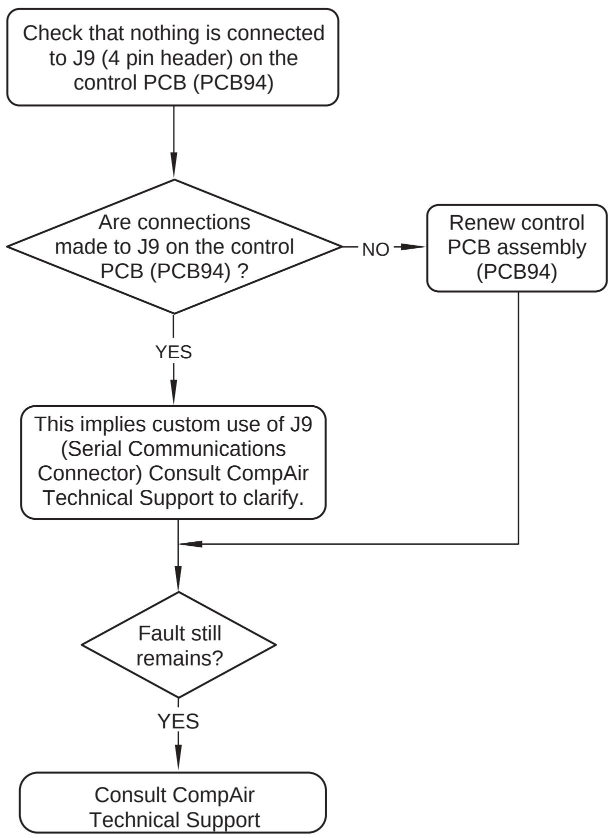
The control PCB (PCB41) is capable of implementing serial communications in several different formats, including RS232.
Fault 41 indicates that the RS232 port has a fault.

RS232 is not normally used or implemented in the Delcos 3100l/SR CompAir applications and this fault therefore should normally never be seen. The only exception to this might be where a compressor has some additional communications or data monitoring fitted to the drive - this would be done only in consultation with CompAir Technical Support and/or SR Drives Manufacturing Ltd.

Corrective Action

Not normally applicable to this application - RS232 functionality is not implemented in the current standard SR products.

In the highly unlikely event of Fault 41 arising in a CompAir application, follow steps below:



Fault 42: Rotor Sensor Power Supply Fault

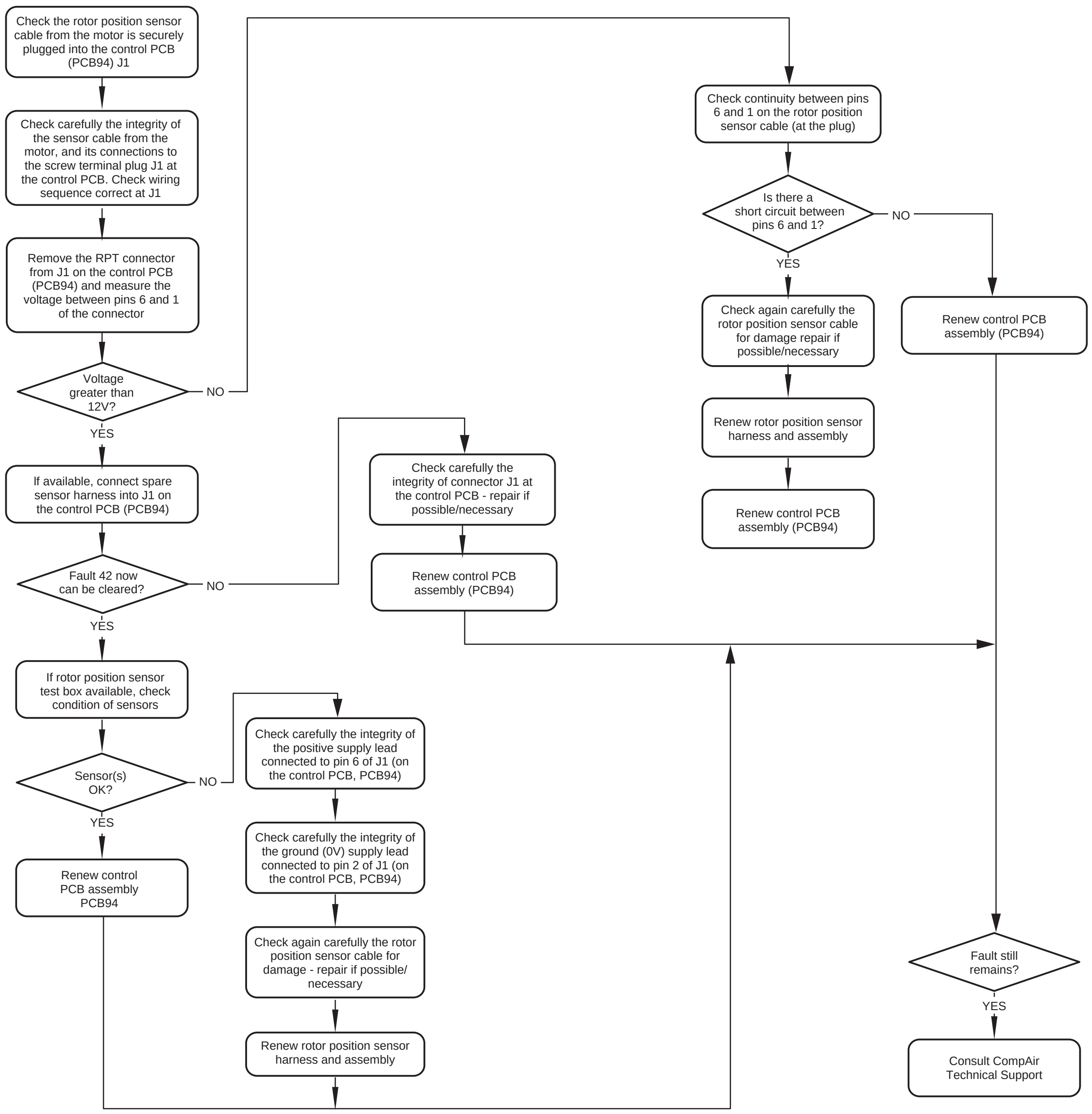
Fault Description

The motor incorporates a simple sensor (or set of sensors) so that the control PCB assembly can determine the rotor position and speed. These sensors, sometimes referred to as the "RPT", the rotor position transducer, require a power supply of nominally +15V DC, which is provided at connector J1 on the control PCB (PCB94).

To help detect damage to, incorrect connection or failure of, the rotor position sensor and its cable, the control PCB (PCB94) senses normal current flow in the power supply for the rotor position sensor. Fault 42 will be flagged up if the RPT power supply current falls to an abnormally low level.

This is particularly useful on two-phase motors which are equipped with a single sensor only, as- unlike a three-phase motor- it is not possible to detect, eg, a disconnected sensor from the status of the sensor input signal to the control board.

Corrective Action



Fault 43: Rotor Sensor Fault (3-Phase TEFV Motors Only)

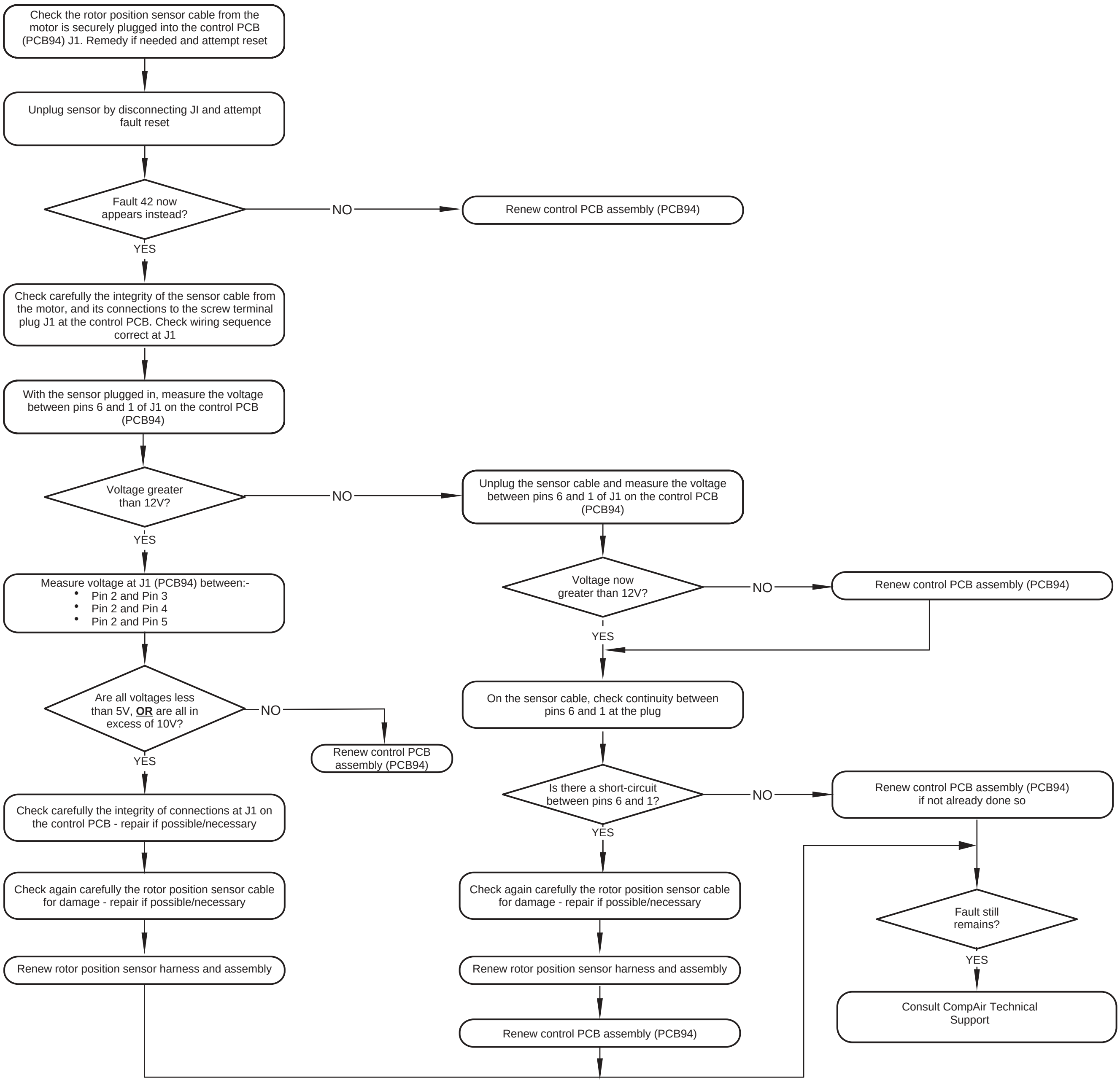
Fault Description

When operating with a three-phase SR motor, the control PCB receives three separate signals from the rotor position sensors, one for each phase of the motor. These change logical state from high (greater than 10V) to low (less than 5V) as the motor rotates, but at no time should all three sensors be either simultaneously "high" or simultaneously "low".

The control PCB (PCB94) detects these abnormal sensor states (ie "all high" or "all low") and flags Fault 43 in the event that either condition is seen.

These fault conditions can arise as a result of a power supply fault or power supply wiring error/defect to the sensors, but usually this will result in the higher priority Fault 42 being seen (unless there is an unusual combination of faults).

Corrective Action



Fault 44: Motor Over-Speed

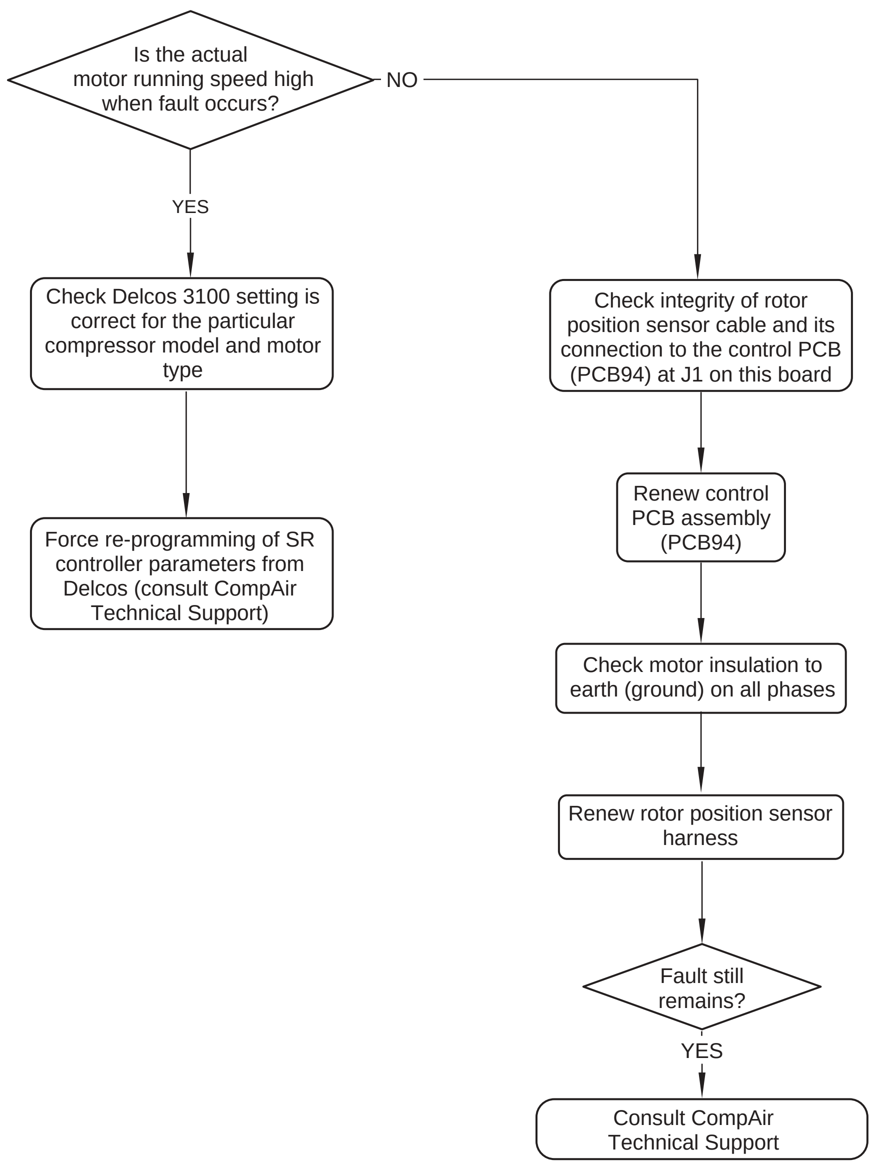
Fault Description

Over-speed indicates that the motor shaft speed, as measured from the electrical frequency of the rotor position sensor outputs, has exceeded the maximum permitted in the drive configuration parameters.

Fault 44 usually indicates that the actual rotor speed has genuinely exceeded the maximum, possibly due to incorrect configuration or controller error, but can occasionally indicate a problem with the rotor position sensor or its wiring. (Severe electrical noise in the rotor position sensor signals may be perceived as an abnormally high motor speed).

Speed control and all associated parameter settings are under the jurisdiction of the Delcos 3100 compressor controller, and therefore this fault is seldom seen in a correctly configured system.

Corrective Action



Fault 45: Heatsink Temperature Sensor Defect

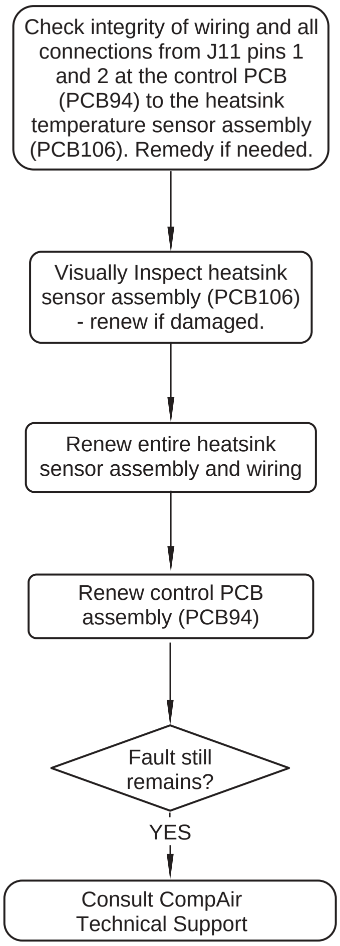
Fault Description

The control PCB (PCB94) monitors the temperature of the heat sink assembly via a small external PCB-mounted temperature sensor (PCB106).

In addition to detecting abnormally high heat sink temperatures (see Fault 47), the control PCB also detects temperature sensor outputs which are clearly outside the sensor's normal operating range.

Fault 45 is flagged when such a condition is detected, and is usually indicative of damage either to the temperature sensor PCB itself, or a defect in the associated wiring/connections which link the sensor (PCB106) to the control PCB (PCB94).

Corrective Action



Fault 46: Motor Temperature Sensor Defect

Fault Description

The control PCB (PCB94) is capable of monitoring the temperature of the SR motor via a standard PTC thermistor set. Such a thermistor can be connected between pins 7 and 8 on the rotor position sensor connector J1 (at the control PCB).

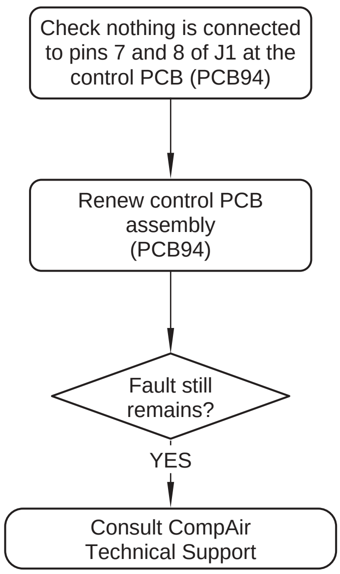
When used as such, in addition to detecting abnormally high motor temperatures (see Fault 48), the control PCB can also detect a motor temperature sensor resistance which is clearly outside the sensor's normal operating range; this might for instance be caused by an open-circuit or short-circuit in the connections to the motor temperature sensor.

HOWEVER in current CompAir SR compressors, the motor thermistor is separately monitored by the Delcos 3100 compressor controller, and the motor temperature sensor input at J1 is not used Nothing should be connected to pins 7 and 8 of this connector.

Fault 46 should not therefore normally be seen at all in current CompAir applications.

Corrective Action

This fault is therefore disabled in the current CompAir SR range and should not normally be seen. In the highly unlikely event it does appear, take steps as below:



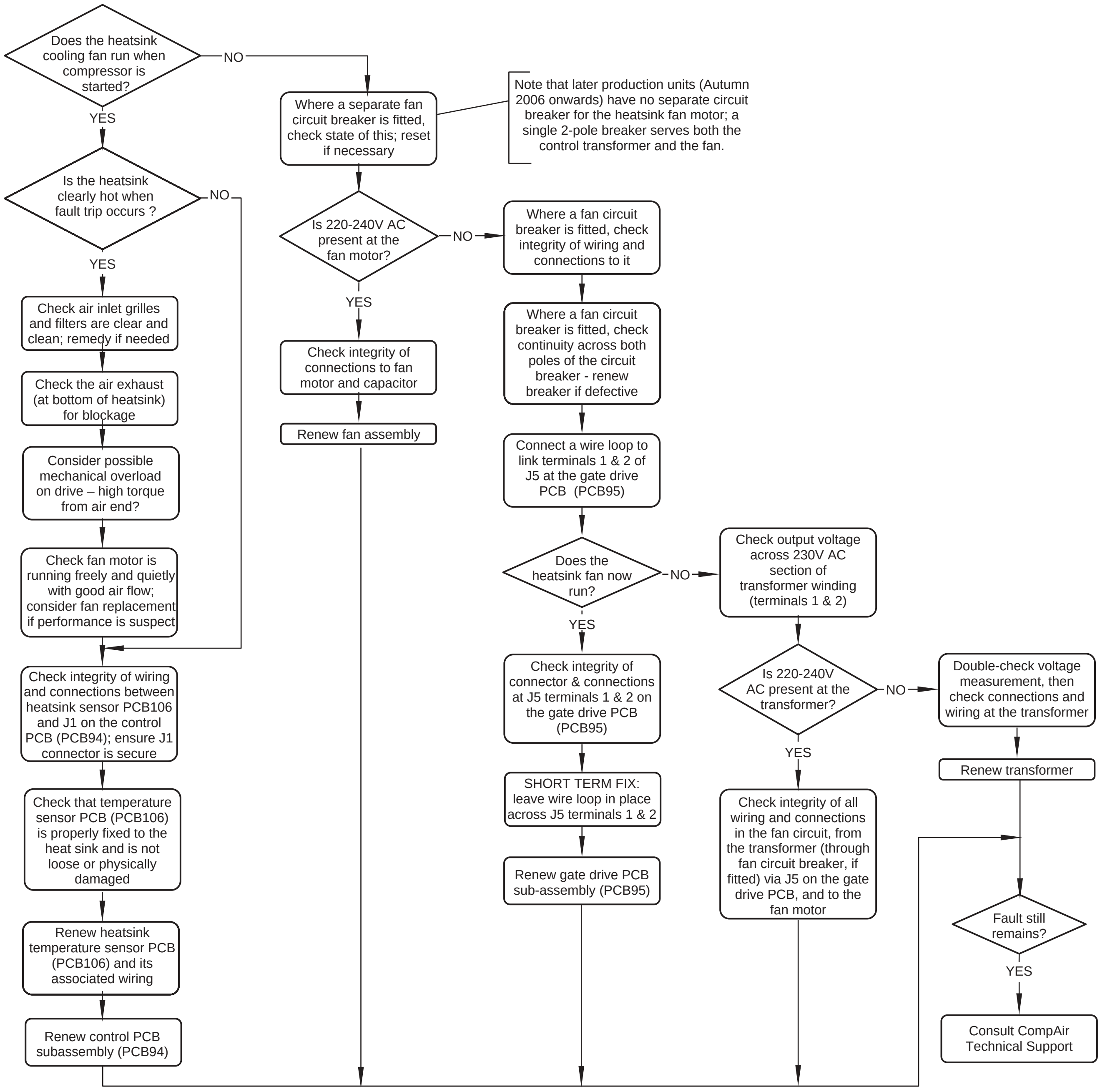
Fault 47: Heatsink Over-Temperature

Fault Description

The control PCB (PCB94) monitors the temperature of the heatsink assembly via a small external PCB-mounted temperature sensor (PCB106). Fault 47 normally indicates that the heatsink temperature has exceeded the programmed threshold of approx. 80°C, either due to prolonged drive system overload (especially at low supply voltage and/or high ambient temperature), or due to a ventilation system failure. The latter may be caused by blocked air inlet grilles or outlet port, or by failure of the internal motor controller cooling fan.

Alternatively, a fault with the temperature sensor or its wiring may cause this fault, but in most cases this will also cause the higher priority Fault 45, which will be preferentially displayed.

Corrective Action



Fault 48: Motor Over-Temperature

Fault Description

The control PCB (PCB94) is capable of monitoring the temperature of the SR motor via a standard PTC thermistor set. Such a thermistor can be connected between pins 7 and 8 on the rotor position sensor connector J1 (at the control PCB).

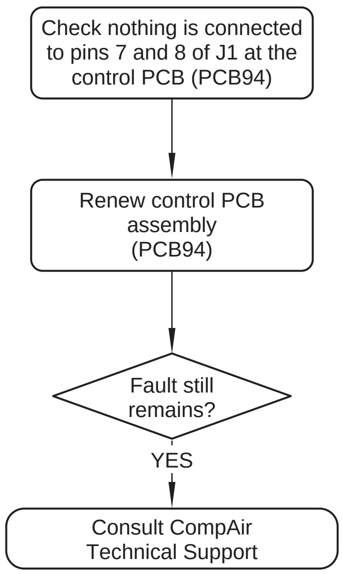
Where this functionality is used, Fault 48 will be flagged if the resistance of the motor temperature sensor increases sharply, indicating an abnormally high motor temperature. A sensor defect may also cause this fault to be seen, but this is likely to also result in Fault 46 being set; this will be preferentially displayed due to its higher priority in the fault list

HOWEVER in current CompAir SR compressors, the motor thermistor is separately monitored by the Delcos 3100 compressor controller, and the motor temperature sensor input at J1 is not used. Nothing should be connected to pins 7 and 8 of this connector.

Fault 48 should not therefore normally be seen at all in current CompAir applications.

Corrective Action

This fault is therefore disabled in the current CompAir SR range and should not normally be seen. In the highly unlikely event it does appear, take steps as below:



Fault 49: Current Sensor Fault (Phase A sensor, if multiple current sensors are fitted)

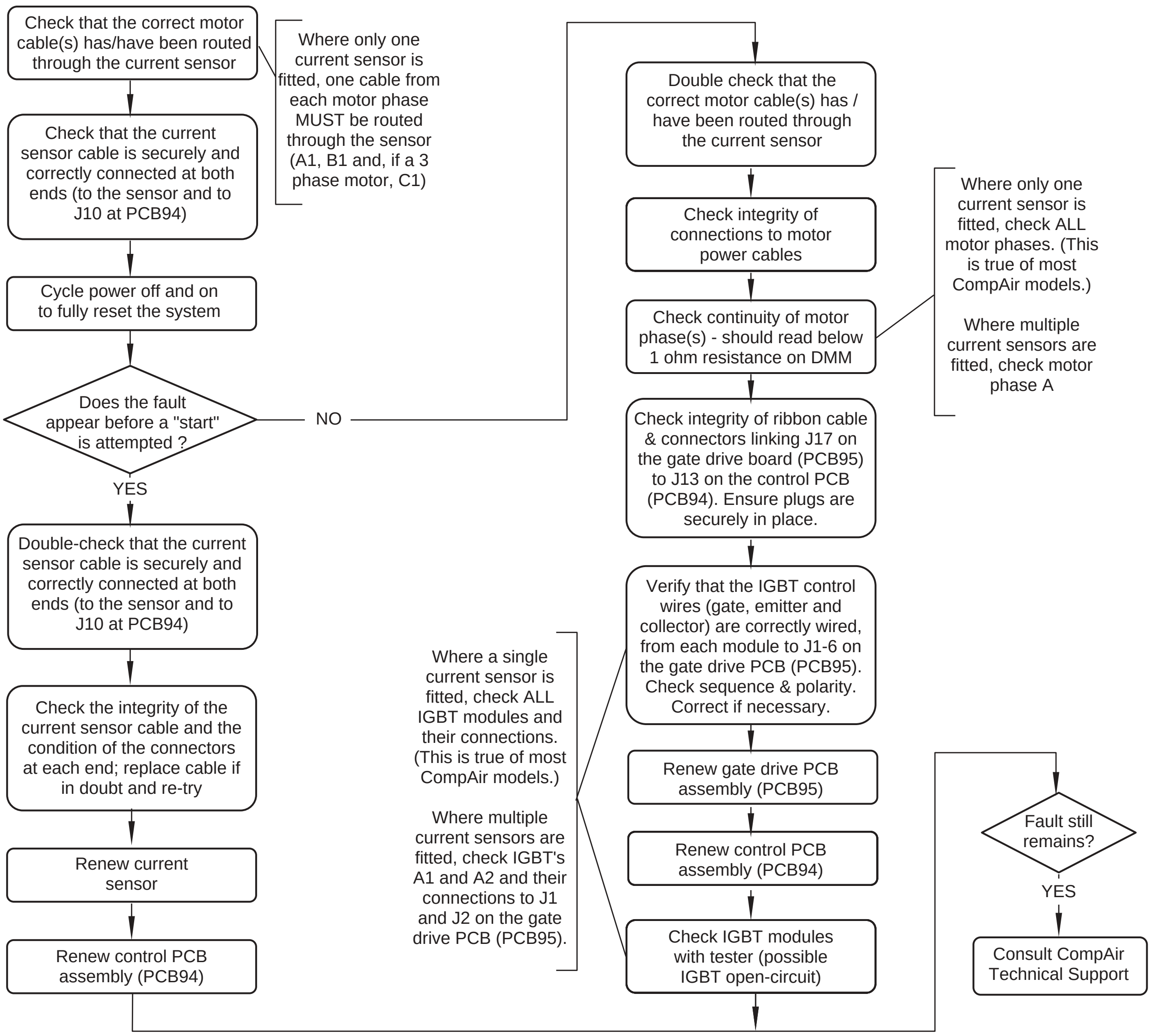
Fault Description

The drive relies on a secure measurement of current in the motor windings in order to both regulate torque at low speed, and to protect the power electronics against excessive current flow in the event of certain fault conditions. If the motor cables are not routed through the appropriate current sensor(s), or if a current sensor itself is disconnected or faulty, then there would be a risk of serious damage to the power electronics. To guard against this, the control PCB (PCB94) detects the disconnection of a current sensor, and flags a fault in the event of an open-circuit at the current sensor input J10. Later production units also check that the motor power cables are correctly routed through the sensor by applying a short pulse of current to each phase of the motor and verifying that a corresponding pulse of current is "seen" by the control PCB at the correct current sensor input. Loss of current in the motor windings for other reasons can cause this fault to be flagged, but the root cause will normally result in a higher priority fault being preferentially displayed.

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor. The correct two or three motor cables (for 2-phase and 3-phase motors respectively) must therefore be routed through the current sensor, as indicated inside the drive cabinet.

Where a single current sensor only is fitted, this must be connected to the current sensor channel "A" of the control PCB, and Fault 49 is the only current sensor fault that will normally be seen. Where multiple current sensors are fitted, separate faults will be flagged for defects associated with the other sensors (see Faults 50 and 51).

Corrective Action



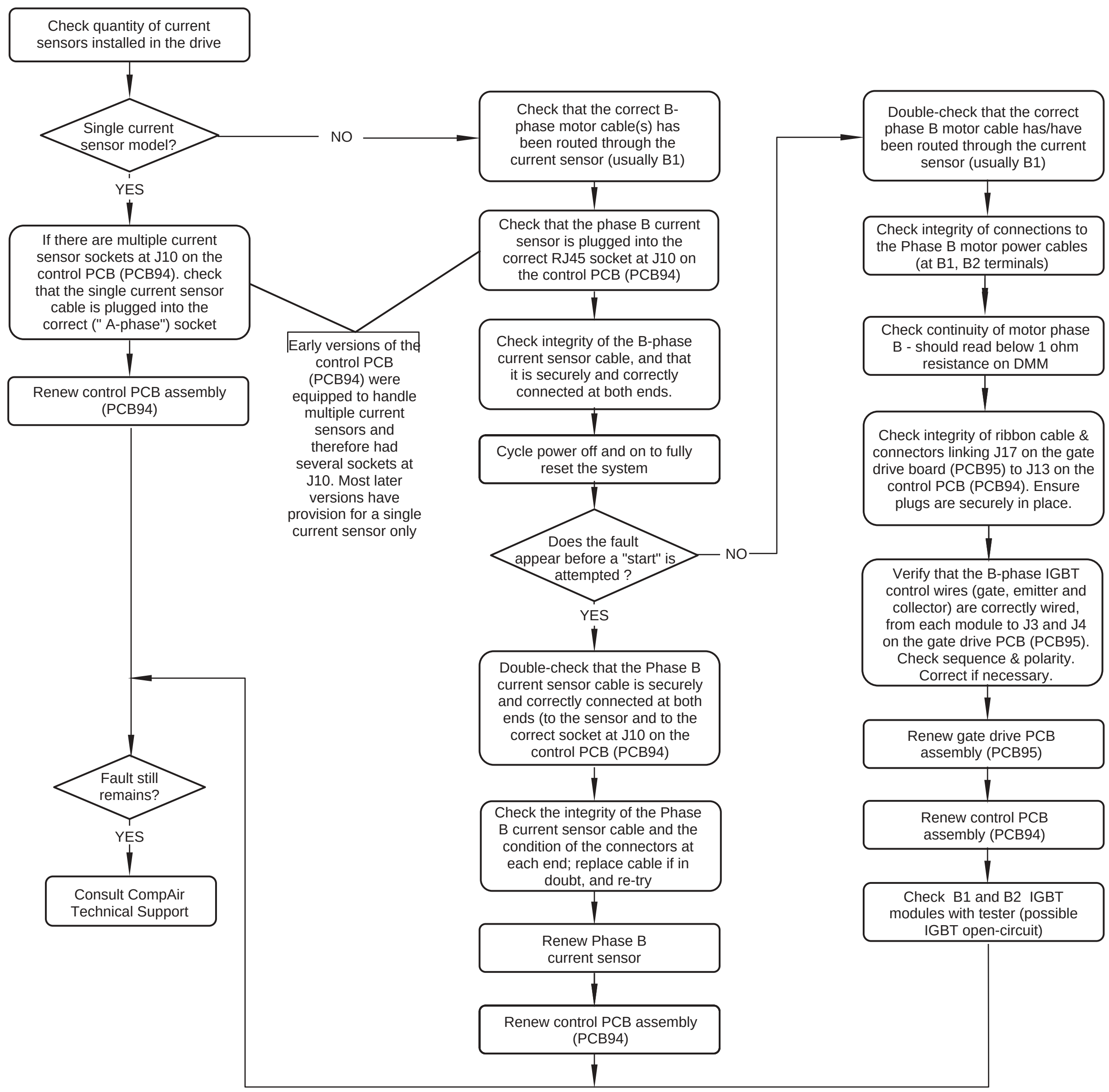
Fault 50: Current Sensor Fault - Phase B
(not applicable to single current sensor models)

Fault Description

The drive relies on a secure measurement of current in the motor windings in order to both regulate torque at low speed, and to protect the power electronics against excessive current flow in the event of certain fault conditions. If the motor cables are not routed through the appropriate current sensor(s), or if a current sensor itself is disconnected or faulty, then there would be a risk of serious damage to the power electronics. To guard against this, the control PCB (PCB94) detects the disconnection of a current sensor, and flags a fault in the event of an open-circuit at the current sensor input J10. Later production units also check that the motor power cables are correctly routed through the sensor by applying a short pulse of current to each phase of the motor and verifying that a corresponding pulse of current is "seen" by the control PCB at the correct current sensor input. Loss of current in the motor windings for other reasons can cause this fault to be flagged, but the root cause will normally result in a higher priority fault being preferentially displayed.

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor, and this is associated with Fault 49. <u>Fault 50 should not normally be seen at all unless multiple current sensors are fitted.</u>

Corrective Action



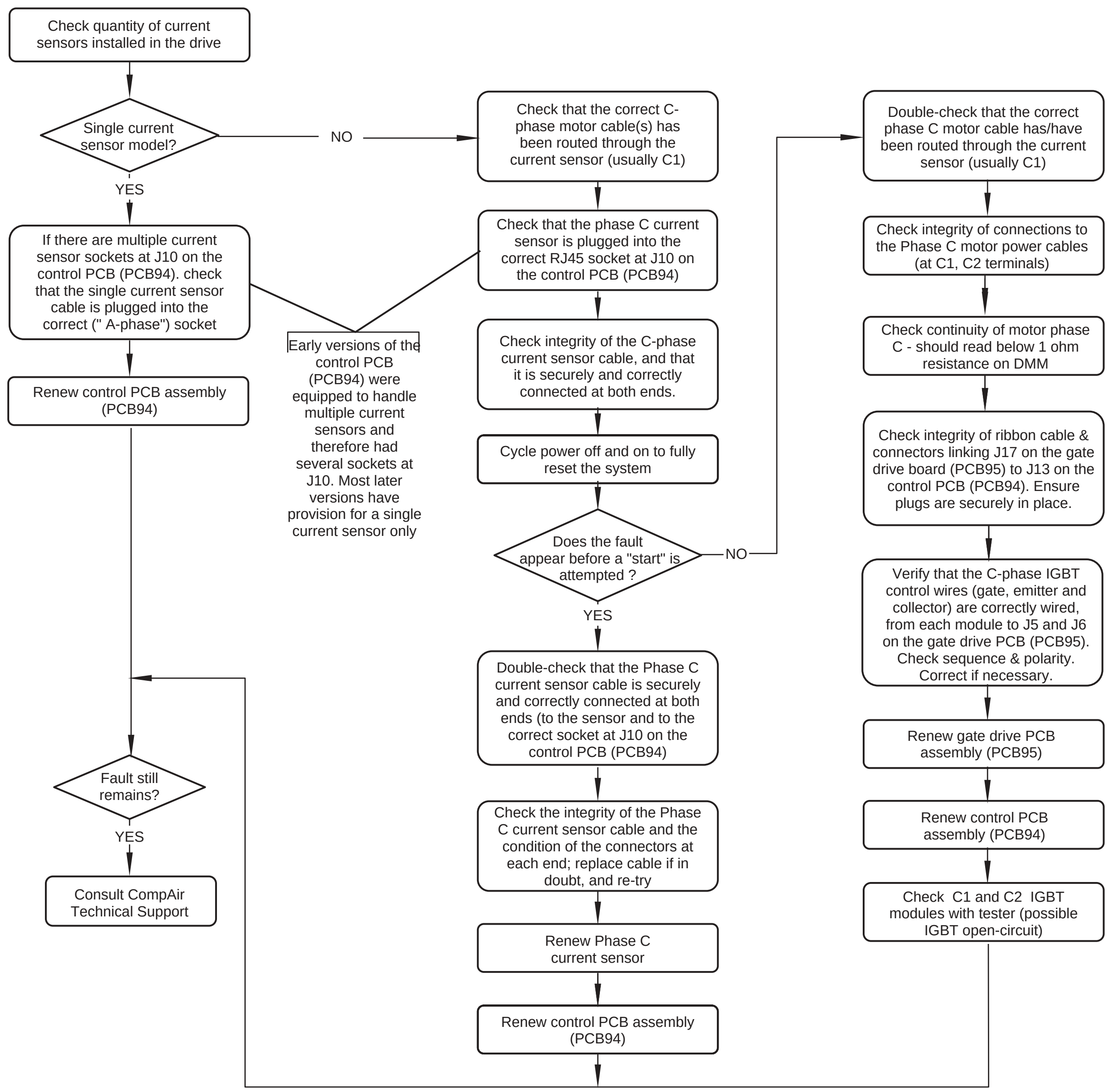
Fault 51: Current Sensor Fault - Phase C
(not applicable to single current sensor models)

Fault Description

The drive relies on a secure measurement of current in the motor windings in order to both regulate torque at low speed, and to protect the power electronics against excessive current flow in the event of certain fault conditions. If the motor cables are not routed through the appropriate current sensor(s), or if a current sensor itself is disconnected or faulty, then there would be a risk of serious damage to the power electronics. To guard against this, the control PCB (PCB94) detects the disconnection of a current sensor, and flags a fault in the event of an open-circuit at the current sensor input J10. Later production units also check that the motor power cables are correctly routed through the sensor by applying a short pulse of current to each phase of the motor and verifying that a corresponding pulse of current is "seen" by the control PCB at the correct current sensor input. Loss of current in the motor windings for other reasons can cause this fault to be flagged, but the root cause will normally result in a higher priority fault being preferentially displayed.

In most CompAir applications, only ONE current sensor is used to monitor all phases of the motor, and this is associated with Fault 49. Fault 51 should not normally be seen at all unless multiple current sensors are fitted.

Corrective Action



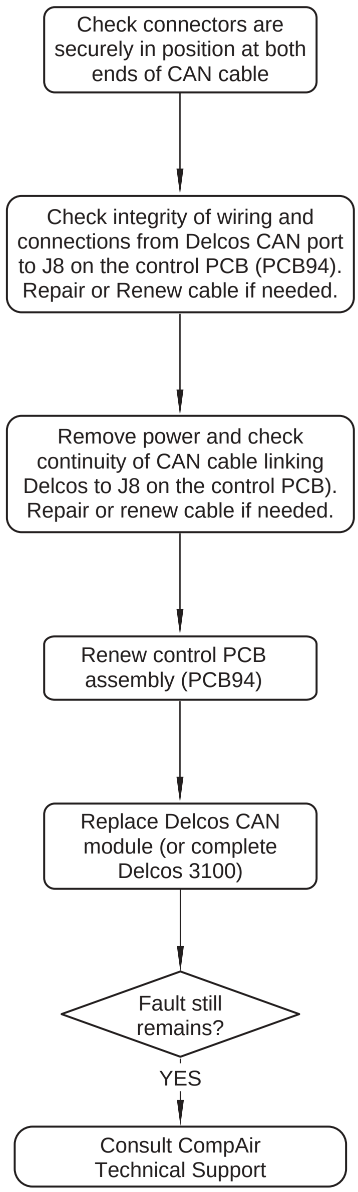
Fault 52: CAN Communications Failure

Fault Description

The communications between the Delcos 3100 compressor controller and the motor control system take place across a high-speed serial communications link. The serial bus employs the "CAN" protocol ("Controller Area Network"), which uses two-wire differential signalling with comprehensive error checking, and is as a consequence normally very robust.

Due to the obvious critical importance of the CAN communications link in the compressor application, the motor controller incorporates protection against loss of the CAN link. Fault 52 is flagged if the motor control PCB (PCB94) does not receive any correctly addressed CAN messages within an interval of 150 milliseconds (0.15 secs).

Corrective Action



Fault 53: “User Enable” Interlock Signal Missing

Fault Description

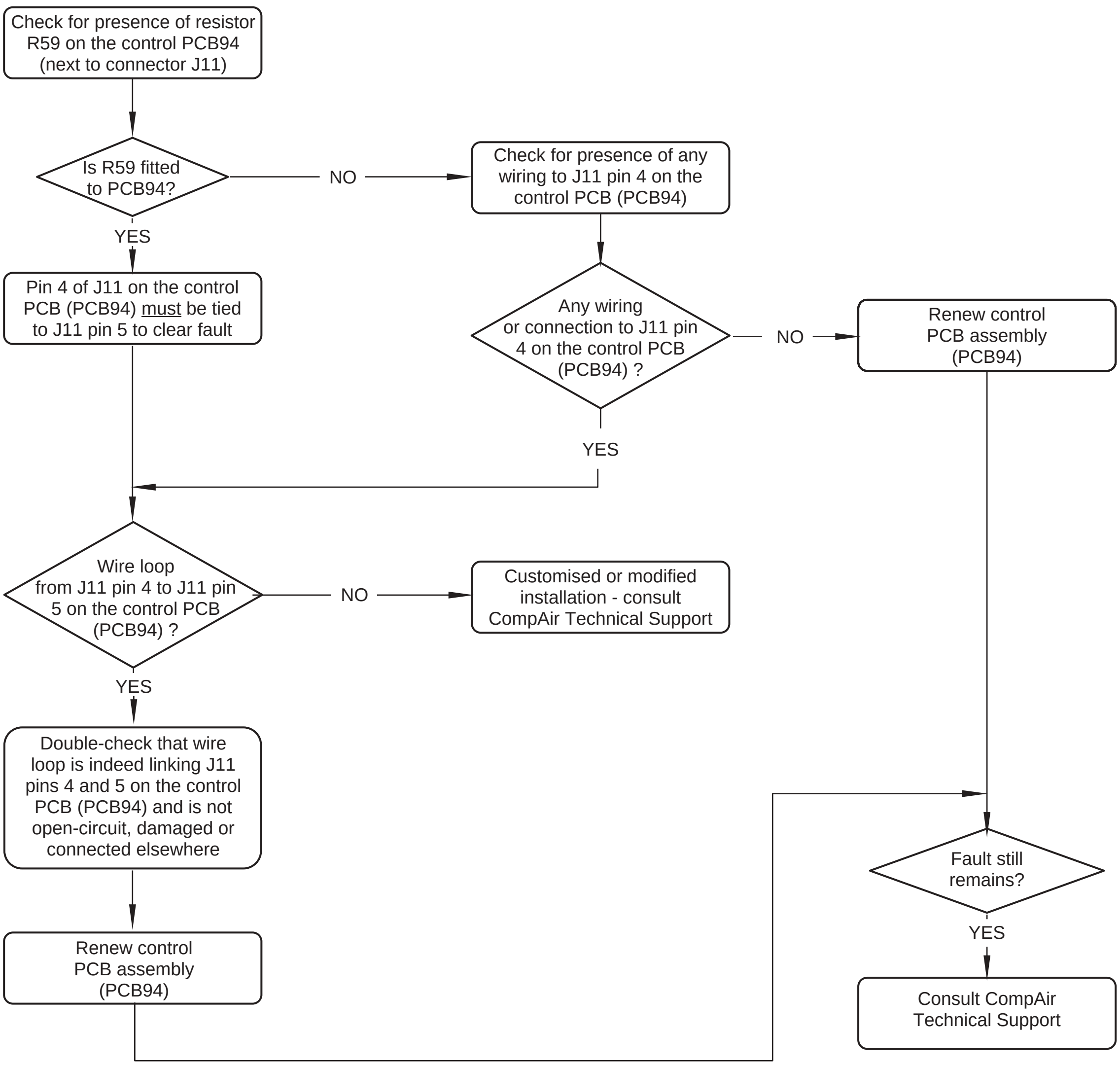
The control PCB incorporates as standard a number of "spare" digital inputs. These provide application flexibility and a degree of "future-proofing", but most are not used in current CompAir applications.

One digital input, connected via pin 4 of J11 on the control PCB (PCB94), is specifically provided for use as a (non-emergency) safety interlock. In order for the drive to operate, this input must be in the logical "low" state (typically less than 8 volts DC); otherwise Fault 53 will be flagged.

In most production control PCB's, resistor R59 is omitted when assembling the control PCB, and the "user enable" input then defaults to the logical "low" condition. However, it is conceivable that this input may in fact be activated (e.g. in special applications or customised units), and J11 pin 4 must then be pulled low in order to clear this fault (connect J11 pin 4 to control 0V at J11 pin 5, using e.g. a wire link between the pins).

If Fault 53 is seen, then any wiring to J11 pins 4 or 5 should be investigated, and the PCB population checked for the presence of R59.

Corrective Action



Fault 54: Motor Stall Fault

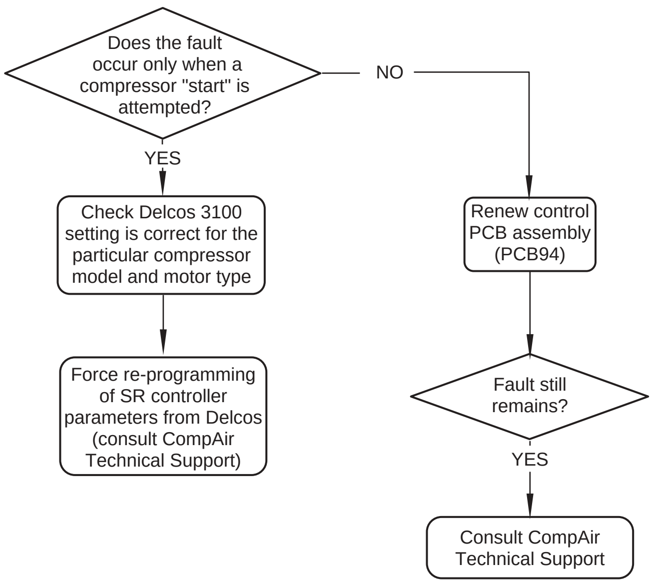
Fault Description

The motor control software detects stalling of the motor shaft (defined as zero actual speed whilst the motor controller is energised) via its speed measurement. A programmed parameter within the software dictates for how long the motor may remain stalled before Fault 54 is flagged and the motor controller disabled.

Normally, any stall condition will be detected by the Delcos 3100 compressor controller before it is "seen" by the SR control PCB software. The Delcos has its own algorithms for detecting stall, and these will normally take precedence. The stall settings within the SR control system (like other pre-programmed motor control parameters) are not normally accessible to field service personnel and - even if the requisite control/display keypad is available - should not be adjusted without specific instructions and authorisation from CompAir Technical Support.

Corrective Action

This fault will not normally be seen in CompAir applications. In the highly unlikely event that Fault 54 is displayed, follow steps as below:



Fault 55: Pre-Charge Fault
(Not applicable to current CompAir applications)

Description of Fault
The control PCB set (PCB94 and PCB95) provides – in principle – for the inclusion of a contactor to break the three-phase AC mains supply feed to the rectifier. This approach was used in the Mark 1 “Cyclon SR” compressors (with SureScan controller), but a contactor is NOT in practice employed in the Mark 2 SR compressors (with Delcos 3100 controller) This fault is relevant only to drive systems where, as in the old mark 1 SR “Cyclon” compressors, two contactors are used in conjunction with a set of power resistors in order to progressively charge the DC link capacitors after power-up. If the DC link voltage has not exceeded the under-voltage threshold after a given time period, this fault is flagged.
Corrective Action
Not applicable to this application. In the highly unlikely event this fault is seen, the control PCB (PCB94) should be renewed.

3.2 Lockout Flags

Overview

Lockout flags are an additional fault reporting mechanism – there are several fault events that should stop the drive from operating. It is not possible to reset these faults by remote or local commands. The drive power must be cycled off and on again in order to clear these faults.

Lockout 1 – Altera Configuration

Description of Fault The Altera FPGA on the control PCB (PCB94) had failed to configure during the motor control system boot-up sequence.
Corrective Action Cycle power and re-try. If the problem persists, then the control PCB (PCB94) should be renewed.

Lockout 2 – Keypad Lockout

Description of Fault Direct motor system control (independent of the Delcos) and parameter programming access to the motor control system is possible by connecting a proprietary keypad/display module to the control PCB (PCB94). “Lockout 2” occurs if, during power-up, this keypad has several keys pressed at once, or is damaged. The drive shuts down and locks itself to prevent incorrect, ambiguous and/or possibly hazardous keypad instructions.
Corrective Action If no keypad is connected, renew the control PCB (PCB94). If a keypad is connected, check its physical condition (renew if faulty or damaged). Check the connections to the keypad/display box. Try disconnecting the keypad entirely and cycling power; if the fault persists, renew the control PCB (PCB94).

Lockout 3 – Restoring Defaults Lockout

Description of Fault There has been a request for the default factory settings to be restored.
Corrective Action Wait for the settings to be programmed into the drive, then power cycle the drive.

Lockout 4 – Safety Interlock Lockout

Description of Fault The drive control board has a low safety interlock/emergency stop input (J3 pin 9) – see section 14.
Corrective Action Check that any circuit connected to this input has not been activated e.g. E-STOP button operated.

Lockout 5 – User Setting Lockout

Description of Fault The setting that controls the operating profile of the drive has not been set up or has been modified.
Corrective Action Power cycle the drive.

Lockout 6 – Internal Fault

Description of Fault A software fault was detected.
Corrective Action If power cycling the drive and restarting does not clear the problem, renew the control PCB assembly (PCB94).

Lockout 7 – Contactor Open Fault

Description of Fault The main contactor was detected as being open when it should be closed.
Corrective Action Not applicable to current CompAir applications – see also comments regarding Fault 25.

Lockout 8 – Contactor Closed Fault

Description of Fault The main contactor was detected as being closed when it should be open .
Corrective Action Not applicable to current CompAir applications – see also comments regarding Fault 25.