PRESSURIZATION CONTROL SYSTEM — SYSTEM DESCRIPTION

1. **Description**

   A. **General**

The pressurization control system operates on the outflow side of the airflow path to control the level of compartment pressurization. The Gulfstream IV pressurization system is classified as a variable isobaric, fixed differential, selective rate-of-change system.

The pressurization control devices, together with associated components, control compartment pressurization by allowing air to flow at a controlled rate from the occupied areas to atmosphere through the outflow valve.

Cabin altitude and ambient altitude are sensed and through automatic electronic devices, establish control over the outflow valve in accordance with predetermined programming by crew.

The pressurization control system functions in the following manner:

- Isobaric pressurized operation with cabin altitude as selected by crew and performed by system
- Maximum pressure differential operation, where system normal control devices limit maximum cabin to ambient differential to a fixed, predetermined amount. This function is not under control of crew
- Safety pressure relief operation, wherein system will prevent any further buildup of cabin to ambient differential beyond a fixed, predetermined amount, even if normal regulating (normal pressure differential) devices fail
- Selective rate-of-change operation, as determined by crew, within the fixed differential limits
- Vacuum (negative) pressure differential control which is a fixed value and is not under control of crew. This prevents buildup of a negative differential between cabin to ambient beyond a fixed value
- Barometric correction of programmed landing field elevation by manual means
- Landing field altitude preprogrammed by crew to establish descent pressurization profile
- Manual control over outflow valve by crew (if desired) with visual outflow valve position indication or in the event of a malfunction of the automatic, normal system
- Pressurization emergency limiting (automatic) which prevents cabin from pressurizing in excess of 3000 feet per minute
- Depressurization emergency limiting (automatic) which prevents cabin from depressurizing in excess of 3000 feet per minute in the event of a malfunction of normal control devices
- Ground differential control operation which suppresses pressure surges within occupied area during rapid airflow changes on ground, such as on takeoff, etc.
- Cabin pressurization warning by means of an aneroid pressure switch to alert crew when cabin altitude reaches a predetermined, fixed level
- Differential pressure, cabin altitude and cabin rate-of-climb indication (digital) to enable crew to monitor system operation
- Emergency ram air ventilation, as selected by crew, for smoke evacuation procedures
- Automatic depressurization of cabin under rate control during ground operation
- Self-test features are included in the electronic control system to enable maintenance personnel to ascertain that system is operating properly
- Dual selectable ambient pressure inputs from air data computers

Under normal operational conditions, crew programs system by controls in cockpit before takeoff and aside from manipulation of a single switch and possible landing field barometric correction, the system is virtually automatic. The pressurization programming may be changed at any time in flight if the situation warrants.

2. Major Component Locations

UNIT	NO. PER A/C	LOCATION
CABIN PRESSURE CONTROL Pnl	1	Cockpit Overhead Panel
Cabin Rate-of-Climb Ind (Digital)	1	Cockpit Overhead Panel (Part of CABIN PRESSURE CONTROL Pnl)
Differential Pressure Ind (Digital)	1	Cockpit Overhead Panel (Part of CABIN PRESSURE CONTROL Pnl)
Cabin Altimeter Ind (Digital)	1	Cockpit Overhead Panel (Part of CABIN PRESSURE CONTROL Pnl)
Circuit Breakers: • CABIN PRESS 28V • CABIN PRESS 115V	2	Pilot Overhead Circuit Breaker Pnl
Cabin Pressurization Selector	1	Copilot Instrument Panel
Warning Lights: • CABIN PRESS LOW	2	Locations: • Engine Instrument and Crew Advisory System (EICAS) • Standby Warning Lights Pnl
Nutcracker Relay #3	1	Copilot Junction Box
Pressurization Transducer	1	Right Hand (RH) Radio Rack
EMI Filter	1	RH Radio Rack
Cabin Pressure Ind Power Supply	1	RH Radio Rack (Bottom of Shelf #4)
Safety Valve	1	RH Radio Rack, Approximately FS 142 (Below Lower Shelf)
Outflow Valve	1	RH Radio Rack, Approximately FS 151 (Below Lower Shelf)
Pressure Relay Switch	1	RH Radio Rack, Forward Side of FS 157 Bulkhead
Cabin Pressure Warning (Aneroid) Switch	1	LH Radio Rack, Top Shelf
Air Data Computer	2	LH and RH Radio Racks
Cabin Pressure Control Relay	1	Main Relay and Junction Box, Radio Rack (Electronics Equipment Area) Entrance Compartment, Left Side
Cabin Pressure Transfer Relay	1	Main Relay and Junction Box (324A1) Pnl (325/326A1)
Cabin Differential Pressure Transducer	1	Main Relay and Junction Box (324A1) Pnl (325/326A1)

3. Major Component Details

A. Operational Data

The following is the pressurization control system operational data:

- Normal Maximum Pressure Differential: 9.55 ±0.10 psi
- Safety Pressure Relief: 9.70 +0.1 psi
- Maximum Vacuum Differential: 0.25 psi
- Pressurization Emergency Rate Limiting: 3000 fpm
- Depressurization Emergency Rate Limiting: 3000 fpm
- Ground Differential Reference Signal: 0.5 inches Hg
- Rate-of-Change Control: ±20% of selected value at all cabin altitudes
- Barometric Correction Range: 28.00 to 31.00 inches Hg
- Cabin Altitude-Isobaric Programming Range: –1000 to 15,000 feet
- Landing Altitude Selection Range: –1000 to 15,000 feet
- Rate-of-Change Selection Range:

  Minimum: UP 50ft/min. DOWN 30 ft/min.
  Maximum: UP 2000 ft/min. DOWN 2000 ft/min.

- Rate to Maximum Differential Control Transition: Not to exceed 50 feet with no overshoot beyond the final control value
- Final Absolute Control Pressure: Within 140 feet of selected value of all cabin inflow rates from outflow valve flow of 5 ppm to maximum flow

B. Function of Components

See Figure 1.

(1) Cabin Pressurization Selector

This unit is mounted in the copilot instrument panel and is the cockpit control device for system. It consists of various knobs and vertical readout dials for programming information into system.

(2) Cabin Pressure Control Panel

This unit is mounted in cockpit overhead panel. It consists of various switches, indicators and a selector knob. It is utilized by crew for either the automatic or manual modes of operation or flight programming mode.

(3) Pressurization Transducer

This is a "black box" device in the right hand radio rack area of entrance compartment. This unit is the "brain" of system. It receives all information and when in automatic operation produces an output signal for the ac driven motor of outflow valve to reflect programming of system. Digital Air Data Computers (DADC), which are devices used in many systems in this aircraft, take pitot and static information from pilot or copilot systems and converts it, with corrections, into static, airspeed and MACH electrical output signals to various components which require this information. One of the DADC outputs is a corrected static signal which is fed into the pressurization transducer for static reference. The transducer receives a signal from the nutcracker system for a ground reference signal.

The transducer also senses cabin pressure through a port in unit and converts this into an electric signal which will be used in controlling system.

The transducer incorporates the self-test feature for the system by means of a test selector knob and a light mounted on unit.

(4) Outflow Valve

This aircraft has a single outflow valve. It is electrically controlled and is a butterfly type valve. Position of the butterfly will predicate how much air will be exhausted overboard and will control pressurization of aircraft. The valve is controlled by one of two motors operating through a differential gear train:

- An ac motor which operates valve when in AUTOMATIC mode of operation
- A dc motor which will operate valve when in MANUAL mode

This is a very fast moving valve capable of going from open to close in 6 - 15 seconds, if required. Motors are not single speed. They are capable of operating extremely slow, fast or at any intermediate speed required by controlling devices.

Being an electrically driven device with a dual independent motor arrangement, only a complete and total loss of power from both dc and ac systems will render the system inoperative. The valve being motor driven would then remain in last position it attained when all power ceased. The valve itself is located just aft of Fuselage Station 151 bulkhead, right side.

(5) Safety Valve

This valve is self-contained requiring no electrical power for operation. This valve performs safety pressure relief, vacuum relief and a maximum pressurization rate limiting function which will be described later. It is essentially a pneumatic device using cabin air and ambient air to perform its function. There is one tubing connection to this valve which is attached to a static port located in the skin just above valve. Other than the above connection, unit can be considered self-contained. It requires no electrical or pneumatic power to operate.

(6) Pressure Relay Switch

This is a rate pressure switch which senses, by internal mechanisms, how fast the cabin altitude is increasing (losing pressure). This unit is strictly monitoring rate of depressurization and actually has no function in normal automatic operation. It is a safety device, which, if a system should fail in such a way that the cabin is rapidly depressurizing, it will cut out the automatic control system and take over control of outflow valve through the dc motor.

This pressure relay switch is set to take over control of outflow valve when cabin is depressurizing at approximately 3000 feet per minute. The unit senses cabin pressure through a port in side of device. It is located in the right hand radio rack area. Actual function will be discussed later.

(7) Cabin Pressure Warning (Aneroid) Switch

This unit is an aneroid pressure switch. It is set to close a circuit when a cabin altitude of 9250 ±750 feet is reached. The circuit illuminates CAB PRESS LOW warning to alert crew. It is located on top shelf of left hand radio rack.

(8) Cabin Altimeter Indicator (Digital)

This indicator is part of the CABIN PRESSURE CONTROL panel located in cockpit overhead panel. It indicates cabin altitude in thousands of feet. The indicator receives information from the cabin altimeter transducer which is an integral part of the indicator. Altitude information is directly related to field elevation at 29.92 and varies (±) depending on actual barometric pressure at the time.

(9) Differential Pressure Indicator (Digital)

This indicator is in cockpit overhead panel. It indicates psi in tenths of pressure differential. The indicator receives information from the cabin differential pressure transducer.

(10) Cabin Rate of Climb Indicator (Digital)

This indicator is located in cockpit overhead panel. It indicates rate of cabin pressure changes in thousands of feet per minute up or down. The indicator receives information from the cabin altimeter transducer.

4. Operation

A. Automatic Control of Pressurization

Operation of this system can best be understood by considering a typical flight commencing with a standard sea level field pressure altitude and proceeding to close the doors, start engines, taxi out, takeoff, climb out, cruise, descend, approach, land, shut down engines and open doors. See Figure 2.

Assuming the following conditions exist:

- Main door: Open
- Field barometric pressure: 29.92 Inches Hg.
- Air source: None
- Electrical power: Off
- Nutcrackers: Ground configuration
- Pressurization selector settings:

  FLIGHT/LANDING Switch – LANDING
  AUTO/MANUAL Switch – AUTO
  Barometric correction – Set to 29.92 Inches Hg.

Assuming that flight is to take place from this field with aircraft climbing out to 45,000 feet. Average rate of climb of aircraft will be about 2700 fpm. This would require 406 feet per minute cabin climb.

The crew, by programming this information into selector would do following:

- Selected aircraft FLIGHT altitude: Set to 45,000 feet on selector dial. Adjacent dial (CABIN) will then indicate 6550 feet which is 9.45 selected differential altitude for a 45,000 flight altitude.
- Cabin RATE of change: 500 FPM UP maximum limit. Rate dial will then also show 300 fpm down by a second arrow marked DOWN.

Once above information has been programmed by crew into selector, system will then react accordingly and automatically as soon as electrical power and a source of air is applied to aircraft.

Another feature of this system is the ability of programming in advance for eventual landing field conditions before takeoff. This, then would be done at this time by crew, taking an example of eventual landing field altitude of 4000 feet. Crew would feed this into the selector before takeoff by:

- Landing (LDG) field altitude: Set to 4000 FT.

Crew then places electrical power on (dc and ac). Outflow valve will immediately cycle to full open. This occurs because nutcrackers are feeding an on ground signal into the transducer and because there is no airflow. APU is then operated to supply air conditioning, engine starting pneumatic pressure and electrical power.

The crew then closes door. Considering leakage rates of aircraft are negligible with all aircraft openings closed (doors and windows), there will be a very slight pressure developed in aircraft estimated no more than about 1/20 psi which is merely the slight pressure drop across outflow valve. The safety valve, of course, is closed.

The crew then starts engines (air conditioning system being shut off for engine starting). Once engines are running, APU is shut down and engines take over supplying bleed air manifold air to system. Pressure in aircraft is still about 1/20 psi. This condition still occurs on taxi. Before aircraft is ready for takeoff, a crewman selects FLIGHT position of the FLIGHT/LANDING switch on CABIN PRESSURE CONTROL panel (cockpit overhead panel). At this time, outflow valve will close slightly to bring cabin pressure up (under rate control it may take as long as 110 seconds to stabilize cabin pressure) until there is about ¼ psi pressure (0.5 inch Hg.) in aircraft. This is done to decrease uncomfortable pressure variations during takeoff, commonly known as "pressure bumps". This is a function of the system known as ground differential pressure control.

As soon as aircraft becomes airborne, nutcrackers place system into a flight condition by removing ground signal from transducer. Aircraft then proceeds to pressurize at selected rate of 500 fpm 20% UP maximum until cabin reaches maximum normal differential of 9.55 ±0.10 psi which would be a 6550 foot cabin with an aircraft altitude of 45,000 feet.

As system is already at its final cabin altitude as selected by crew, as long as aircraft is not flown above 45,000 feet with these settings, cabin altitude will remain stable with ±140 feet of final cabin altitude. If crew continues to climb above 45,000 feet aircraft altitude without reprogramming system, cabin will change in proportion to aircraft rate of climb maintaining 9.60 ±0.05 psi differential which is the electronically controlled limit. If aircraft continues to climb, cabin pressure control system automatically increases cabin altitude to hold that limiting value of pressure differential.

When aircraft is ready to descend, FLIGHT/LANDING switch is placed to LANDING (crew having selected landing field altitude of 4000 feet before takeoff). The rate of cabin change in this case was programmed before takeoff to a cabin rate of 300 fpm DOWN. Crew needs only to make one more correction, if required, that is to correct the selector for landing field pressure by adjusting BARO CORR control on selector. This, then will complete descent programming. The cabin will then descend at a rate of 300 fpm automatically controlled by system bringing cabin altitude down in equal measurements with aircraft descent.

The system will control pressure in aircraft so that cabin will be approximately 400 to 500 feet below altitude of landing field (approximately ¼ psi). At touchdown, nutcrackers feed a ground configuration signal into transducer which shifts mode of operation over outflow valve moving it to a full open position at a cabin rate of 500 feet per minute. At this time, cabin pressure will be approximately 1/20 psi, this transition being made under the selected up rate of control. When air supply ceases, pressure in aircraft drops to zero.

B. Manual Control of Pressurization

To assume manual control over system, place AUTO/MANUAL switch in MANUAL, see Figure 1. This will cause MANUAL portion of that switch (an amber light located next to MAN HOLD knob) and CABIN PRESS MAN display to come on. The outflow valve may then be controlled by crew by means of a knob on control panel. This knob is spring-loaded in vertical position which is labeled MAN HOLD. Moving knob toward OPEN will move valve, through dc motor, toward OPEN. Moving knob toward CLOSE will move valve, through dc motor, toward CLOSE. The motor and manual control knob circuits are so arranged that the farther knob is moved away from HOLD toward OPEN or CLOSE, the faster valve moves in that direction, the valve motor being a variable speed motor. When desired valve position is attained, releasing knob will return it by spring-load to HOLD and valve will hold (stop) in that position. Valve position is shown by an indicator just to right of control valve light indicator on control panel. It will reflect position of valve at any time, whether in AUTO or MANUAL modes of operation. To return system to automatic mode, move AUTO/MANUAL switch back to AUTO position. Lights will go out and HOLD knob function will become inoperative.

NOTE: When manual knob is moved out of HOLD position in either direction, dc motor pulses outflow valve in selected direction. The manual indicating light on control panel will pulse at same rate, indicating valve movement. The farther knob is moved from HOLD toward OPEN or CLOSE, the faster the pulse rate and outflow valve movement.

On Aircraft having ASC 295 , cabin air pressure control is automatically reverted to manual operation in the event 115 Vac power to system is lost.

C. Safety Pressure Relief

If automatic or manual system should malfunction and not limit cabin pressure to 9.55 ±0.1 psi normal maximum, safety valve would take over and limit differential to safety pressure relief of 9.7 ±0.1 psi. This is a function which is independent of all other systems and will occur regardless of status of the rest of system. No electrical power or pneumatic pressure is required by the safety valve, see Figure 1.

D. Depressurization Rate Limiting Feature

In order to examine the function of depressurization rate limiting feature of system, we will assume that outflow valve has received a full open signal from some source due to malfunction when in AUTO operation. The result would be for cabin to depressurize very rapidly. The pressure relay switch will be activated automatically when cabin altitude increases at a rate of approximately 3175 ±375 feet-per-minute, see Figure 1. When this switch is activated, it automatically:

- Deactivates ac automatic control system (even though switch is still in AUTO)
- Alerts crew by turning on MANUAL light on CABIN PRESSURE CONTROL panel
- Places a full close signal to outflow valve causing dc motor to fully close outflow valve

What would happen after this would depend on what caused problem to occur. If there was still input air to system, pressure in compartment would build up rapidly as outflow valve cycled closed. If this occurred, pressurizing rate limiting function of safety valve would come into action.

E. Setting System to Automatic After a Depressurization Rate Limiting

Comply with following to reset system to automatic after a depressurization rate limiting occurs:

- Place pressurization AUTO/MANUAL switch to MANUAL
- Manually bring system back into control (rate should not exceed 500 ft/minute up or down)
- Place pressurization AUTO/MANUAL switch to AUTO
- If rate of change switch is reactivated, place pressurization AUTO/MANUAL switch to MANUAL and continue to fly in MANUAL. When flying in MANUAL mode, cabin rate of change should be monitored to maintain a maximum of 500 ft/min. up or down and care should be taken to land unpressurized with outflow valve in full open position

F. Pressurization System Manual Warning

The crew will be alerted by an amber manual light on CABIN PRESSURE CONTROL panel and a CABIN PRESS MAN display on EICAS any time pressurization system is not in automatic operation, see Figure 1 . Automatic operation will be terminated by selecting MANUAL with AUTO/ MANUAL switch on CABIN PRESSURE CONTROL panel or pressure relay switch sensing a depressurization rate of 3000 fpm or more (on Aircraft having ASC 295, cabin air pressure control is automatically reverted to manual operation in the event 115 Vac power to system is lost). When crew returns to automatic operation, light and display will go out.

If automatic system is not in operation, caused by pressure relay switch locking out automatic system or selecting MANUAL on control panel, the following functions will not be in operation:

- FLIGHT/LANDING switch operation
- Nutcracker operation of ground differential

- Automatic isobaric control.
- Maximum differential control of 9.55 ±0.1 psi.
- Selected rate of control
- Barometric correction control

The following functions are operative:

- 9.8 psi safety pressure relief
- 0.25 psi vacuum differential
- Manual control over outflow valve through MAN HOLD-OPEN/CLOSE knob on control panel if AUTO/MANUAL switch is in MANUAL
- 3000 fpm pressurization rate limiting (safety valve)

G. Pressurization Rate Limiting

This is a function of safety valve, see Figure 1. Continuing with a pressurization rate limiting situation as outflow valve was driven to full closed with airflow on, buildup of pressure would be rapid within compartments. When rate of pressure increase (cabin altitude decrease) reaches approximately 3000 feet per minute, a device (which is part of safety valve) comes into play to open safety valve to prevent excessively high pressurization rates. This device will modulate safety valve to limit cabin altitude to a 3000 feet per minute decrease (pressure rise).

Do not confuse depressurization rate limiting and pressurization rate limiting.

Depressurization rate limiting prevents excessive high rates of pressure losses, such as a condition if outflow valve should go to full open due to a malfunction in automatic system. This would activate cabin pressure rate switch which would fully close outflow valve, turn on manual light and deactivate automatic control system.

Pressurization rate limiting which is a function of safety valve, prevents excessively high pressure increases, such as a condition where outflow valve received a signal to go fully closed, that is 3000 fpm, but one is cabin climb (pressure loss), the other is cabin dive (pressure increase).

H. Detailed Electrical System Operation

This system utilizes both 28 Vdc from essential dc bus through CAB PRESS 28V circuit breaker and also 115V 400 CPS from essential ac bus through CAB PRESS 115V circuit breaker.

Basically, the dc is utilized for control circuitry in both AUTOMATIC and MANUAL modes and exclusively when in manual operation of system. The ac power is used exclusively in AUTOMATIC mode operation. See Figures 3, 4 and 5.

(1) AC Power Functions

AC power enters transducer, which is "brain" of system, from circuit breaker to Pin 31 of transducer. This feed is basic power for most of the internal devices within transducer. Internally, this 115V input is converted to various voltages required by system by an internal power supply. Among these are certain fixed reference voltages emitting from transducer Pins 3 and 15 for air data computer static pressure reference potentiometer and for landing altitude, barometric correction and flight isobaric potentiometers in pressurization selector. Another fixed reference voltage exits transducer at Pins 11 and 8 which is used by rate selector potentiometer in pressurization selector. All of these potentiometers, whether manually or mechanically operated, will supply signals to transducer which will be compared internally with other data and form an output signal to the ac motor of outflow valve. Internally, transducer incorporates a sensor which is vented into cabin through a port in transducer case. It is from this sensor that cabin pressure is sampled and creates another electronic signal which is also used in compiling of outflow valve ac motor signal.

Another circuit from the ac circuit breaker feeds Pin N of outflow valve. This input is for excitation of rate generator within outflow valve. As outflow valve ac motor moves butterfly, it also moves armature of rate generator and a feedback signal is induced into a coil which exits outflow valve plug through Pins H and G. It is this feedback signal which is sent to transducer and becomes part of the null circuit and a pulse network in transducer which in turn nulls out ac signal when valve is in proper position and also pulses valve to prevent valve overshoot when error signal is induced. The rate generator excitation coil is grounded through outflow valve Pin A along with the field of ac motor.

The ac motor signal comes out of transducer through Pins 39 and 40 and this signal is connected directly to Pins B and C of outflow valve. It then moves into an RFI filter and then to fields of the ac motor.

(2) DC Power Functions

The dc power inputs from CAB PRESS 28V circuit breaker are used in control circuitry involved with transducer, manual control, depressurization rate switch relay and eventually certain functions of outflow valve. Power is fed to cabin altitude warning aneroid switch from essential 28 Vdc bus via WARN LTS PWR #1 circuit breaker.

Tracing first the feed into manual control, 28 Vdc enters unit through Pin B. From that point it goes to center set of contacts of AUTO/MANUAL switch. It also goes through a dropping resistor where it is reduced to 10V and out Pin L to outflow valve Pin L. It then proceeds to one end of outflow valve position transmitter potentiometer. The other end of position transmitter is grounded through outflow valve Pin J to Pin G of manual control and internally tied to control ground Pin A.

The wiper of position transmitter potentiometer is mechanically linked to outflow valve butterfly and its position will vary in accordance with butterfly position. This produces a position signal from wiper through outflow valve Pin K to valve position indicator. The indicator ground is obtained from control common ground Pin A.

Continuing with feed to center set of contacts of AUTO/MANUAL switch with switch in AUTO, this feed goes out manual control Pin C arming the depressurization rate switch relay through Pin B. With AUTO/MANUAL switch in MANUAL, this feed is routed internally within control panel to power transistors, valve drive control circuit and light pulse circuit out control panel Pin M to CAB PRESS MAN light on Engine Instrument and Crew Advisory System (EICAS), out to outflow valve Pin M and transducer Pin 13. With switch in MANUAL, the open-hold-close control can be utilized to power valve drive control circuit which will provide a dc motor open signal through control panel Pin D or a dc motor close signal through control panel Pin E to outflow valve Pin E.

Therefore, the 28 Vdc feed powers both the position indicator as well as the dc motor of outflow valve. With an ac failure, dc components make it possible to control outflow valve by use of manual control. This position indicator will also be completely operative even with an ac failure.

(3) Automatic Operation

In AUTO operation, FLIGHT/LANDING switch in selector determines whether landing or flight profile information is fed into transducer.

With FLIGHT/LANDING switch in LANDING (as shown), the upper switch contact allows information which is manually programmed by crew from landing altitude and barometric correction potentiometers to be fed into transducer through Pin 4 of the control panel to Pin 2 of transducer. At same time, the lower contacts of FLIGHT/LANDING switch completes a circuit from selector Pin 5 to 7. This circuit goes to transducer Pin 33. The nutcracker relay contacts will place a 28 Vdc feed from circuit breaker on this circuit when on ground and also on transducer Pin 25. If FLIGHT/LANDING switch is in LANDING (as shown), this feed goes through switch, out control Pin V into transducer Pin 33 and within transducer causes outflow valve to cycle full open (under rate control) powered by ac motor. When FLIGHT/LANDING switch is in FLIGHT (as crew would select just before takeoff, this feed would be switched to Pin W of control panel and routed to Pin 32 of transducer. This would cause aircraft to pressurize to ground differential of 0.5 inches of Hg., to suppress surges in system during takeoff and also feed transducer the flight isobaric programming from selector. As soon as nutcracker system goes to flight configuration, this 28V feed is removed and system goes into a rate controlled, flight profile as programmed by crew by the flight control. Rate control is established by rate selector potentiometer in selector. The circuit is straight from transducer to selector Pins 8 to 8, 9 to 9 and 10 to 11 through a shielded, twisted cable as this is a sensitive circuit. Note that a good percentage of circuits are shielded, twisted cables as low level circuits would give erratic signals in presence of induced outside voltages which would result in erroneous system operation.

(4) Rate Depressurization Limiting (Automatic Lockout)

That portion of 28 Vdc input from control panel Pin B which arrived at AUTO/MANUAL switch (center) contact is used to provide power for manual operation with AUTO/MANUAL switch in MANUAL. With switch in AUTO, through Pin C, it arms depressurization switch relay Pin B. This is the unit which will cut out automatic system when cabin depressurizes at a rate greater than 3000 feet per minute, the rate diaphragm pulls its contacts closed and completes a circuit to one end of relay coil and also to a contact of the relay. The ground for relay coil is through Pin A. The relay will then close and hold through the now closed contact closest to coil as long as AUTO/MANUAL switch in control panel is in AUTO. This holding action through other set of relay contacts makes and holds power on Pin F of both pressure switch relay unit and control panel.

This 28V feed accomplishes the following simultaneously:

- Completes a feed to valve drive control unit and light pulse control unit (through Q1 and Q2 power transistors) placing a full close signal on outflow valve (out Pin E of control panel to Pin E of outflow valve actuator)
- Completes a feed to CABIN PRES MAN display on EICAS and cockpit overhead panel MANUAL CABIN PRESS advisory light
- Places a 28 Vdc feed on Pin 13 of transducer and Pin M of outflow valve. Pin 13 feed goes to a lockout circuit in transducer which completely terminates all automatic signals to ac motor. Pin M feed to outflow valve manual signal line clutches out ac motor and clutches in dc motor. The circuit is a continuation of feed through top contacts of AUTO/MANUAL switch, as it is parallels to EICAS system feed

As long as depressurization rate switch relay is held closed (power on Pin B), system will react as stated above. The only way that this relay can be relaxed is by interrupting power to Pin B. Since this power comes from AUTO/MANUAL switch of control panel, a reset of rate switch relay (relaxation) can only be accomplished by placing AUTO/MANUAL switch on control panel to MANUAL. This will terminate some of the above actions. If switch is left in MANUAL, ac (automatic operation) is still locked out through a circuit which starts at center set of contacts of switch and out Pin M to EICAS, cockpit overhead panel advisory lights system, valve drive control unit, light pulse unit and manual indicating light (flashing) in control panel.

(5) Manual Operation

When in MANUAL position of AUTO/MANUAL switch, movement of MAN HOLD–CLOSE/OPEN control on control panel will vary an input signal to manual control amplifier and motor drive amplifier. This will produce a proportional signal to dc motor of outflow valve in desired direction. Greater the deflection of control away from HOLD, greater the pulse signal and faster the dc motor will move butterfly valve. The manual indicating light on control panel will blink on and off at the same rate as pulse signal going to dc motor.

If crews elects to resume AUTO operation, they must return switch to AUTO and the circuits will be established in normal manner. Essentially this is done by removing lockout signals to transducer and outflow valve and turning off warning lights.

On Aircraft not having ASC 295 , crew must move AUTO/MANUAL switch to MANUAL in order to attain manual control through MAN HOLD-CLOSE/OPEN manual control of the control panel. On Aircraft having ASC 295 , cabin air pressure control is automatically reverted to manual operation in the event 115 Vac power to system is lost. The crew has the option at any time to control system manually by placing MANUAL/AUTO switch on the control panel to MANUAL. The amber light on control panel, MANUAL CABIN PRESS advisory light in cockpit overhead panel and CABIN PRESS MAN display on EICAS will come on alerting crew that they do not have automatic operation.

(6) Control Panel Lighting Circuit

The control internal lighting is accomplished by a feed from 5 Vac lighting bus through Pin H and a ground through Pin J of control panel.

(7) Selector Lighting Circuit

The selector internal lighting is accomplished by a feed from 5 Vac lighting bus though Pin 12 and a ground through Pin 11 of selector.

(8) Cabin Pressure Warning Circuit

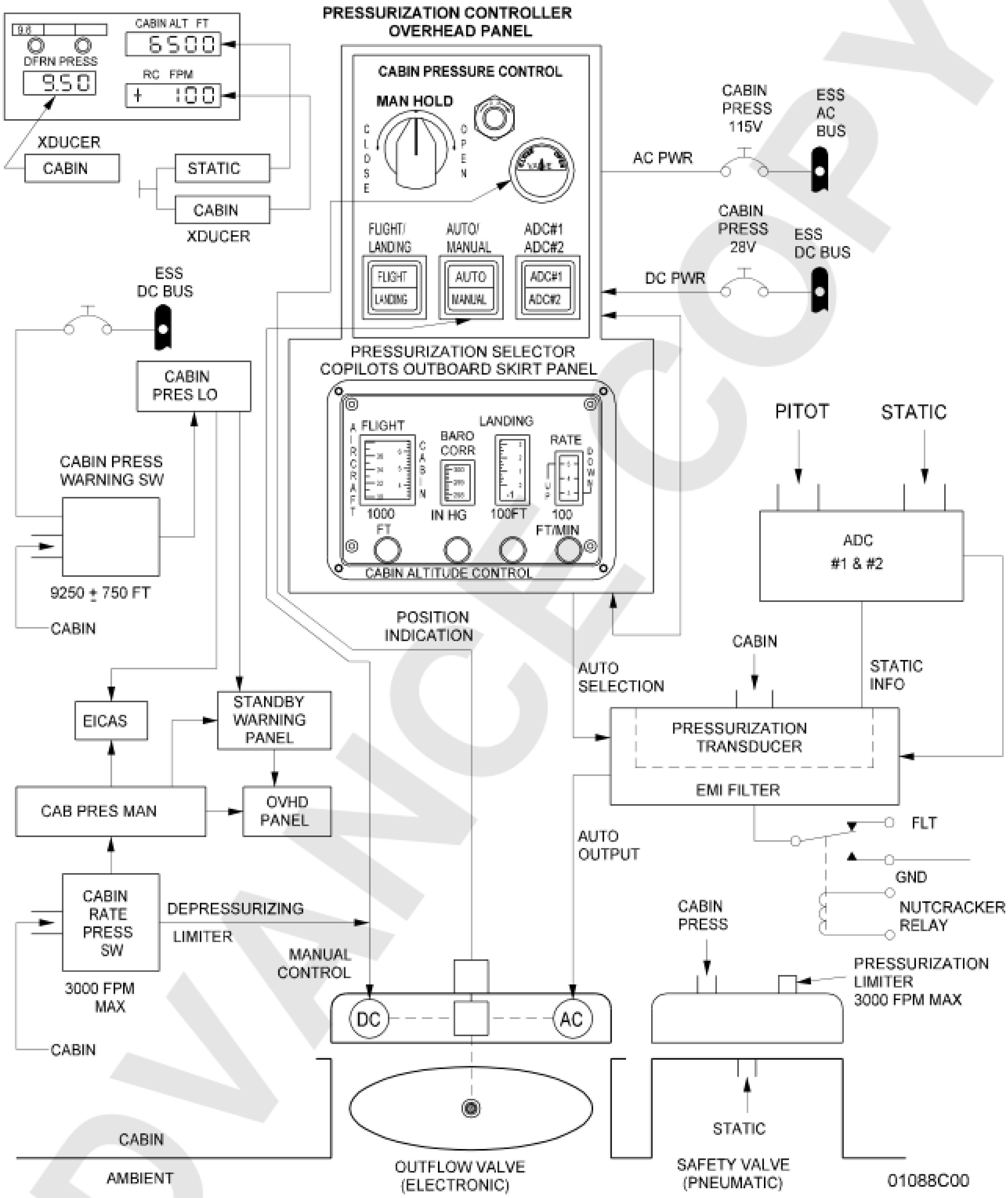
The cabin pressure warning aneroid switch utilizes power from 28 volt essential dc bus via WARN LTS PWR #1 circuit breaker. Power enters Pin B of unit and if aneroid sense 9250 ±750 feet of cabin altitude, it completes a feed to CABIN PRESS LO light on EICAS and CABIN PRESS LOW light in standby warning lights panel (Aircraft 1000 - 1252 not having ASC SPZ-8400) .

(9) Discriminator Circuit

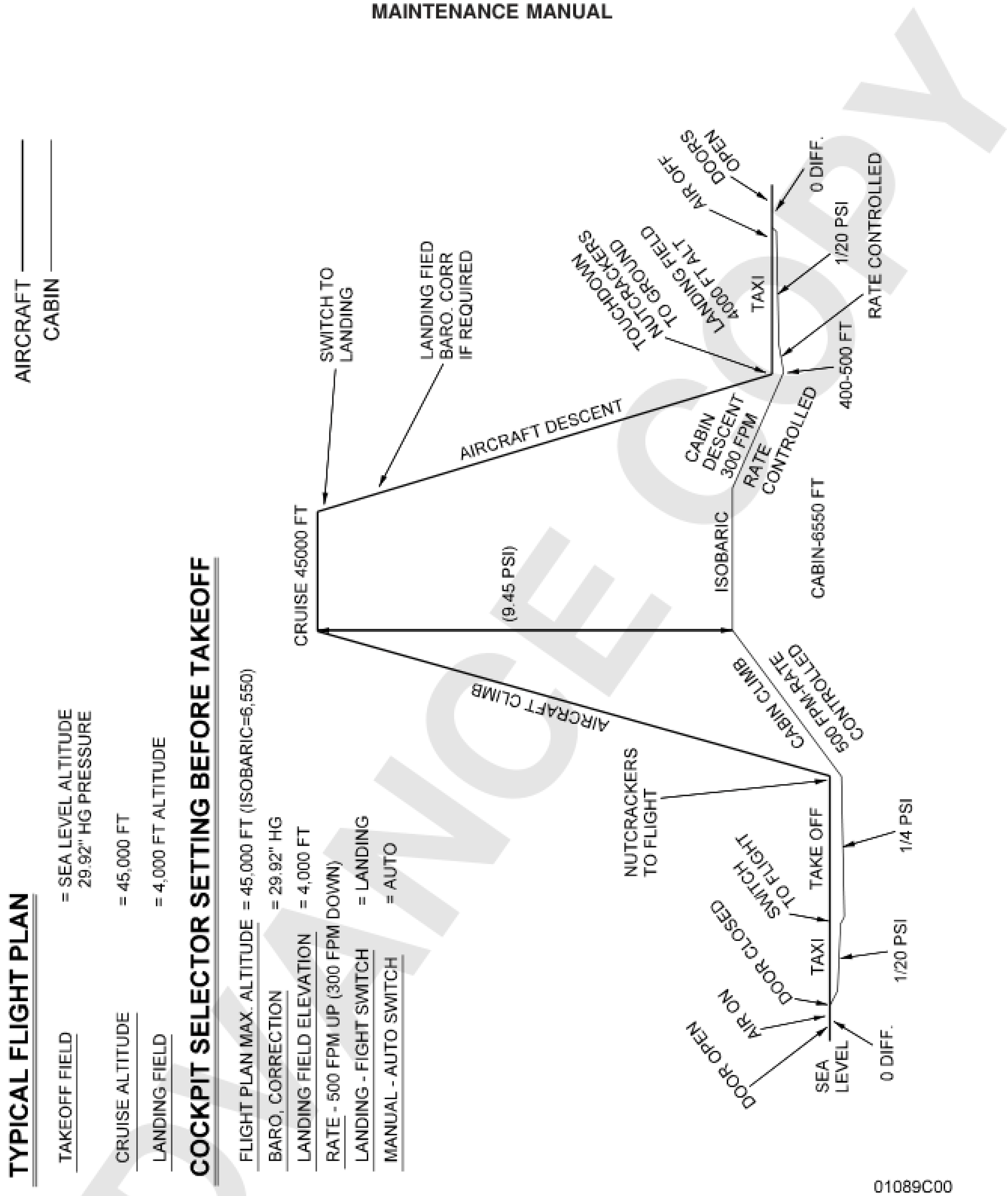
The discriminator circuit is built into the pressurization transducer. Its purpose is to prevent a situation where crew programs for a lower isobaric cabin altitude than landing field altitude when in AUTO mode. If flight plan was such that this programming were allowed to exist, it would be possible to have a large differential on touchdown. This is not advisable and also violates placarded restriction. of CAUTION: PRESSURE DIFFERENTIAL SHOULD NOT EXCEED 0.3 PSI DURING TAXIING, TAKEOFF OR LANDING.

If, on programming, aircraft / cabin dial on pressurization selector is set to a lower cabin altitude than is set into landing altitude dial, an enroute cabin isobaric that was dialed in will not be obtained. An enroute cabin altitude equal to landing field altitude which was set into system will be obtained. This will be evidenced by a lower differential and a higher cabin altitude for that particular flight. On takeoff, system will up-program under rate control; however, it will go to landing field altitude in this situation.

This feature of system is purely electronic within transducer. It compares the two settings made by crew and if landing setting is higher than isobaric cabin altitude setting, landing setting is allowed to override cabin altitude setting to control outflow valve. This is the only time that landing field altitude selection can override isobaric selection with FLIGHT/LANDING switch in FLIGHT. It is only in effect in automatic mode of system operation.



Pressurization System – Block Diagram
Figure 1



Pressurization System – Typical Flight Profile
Figure 2

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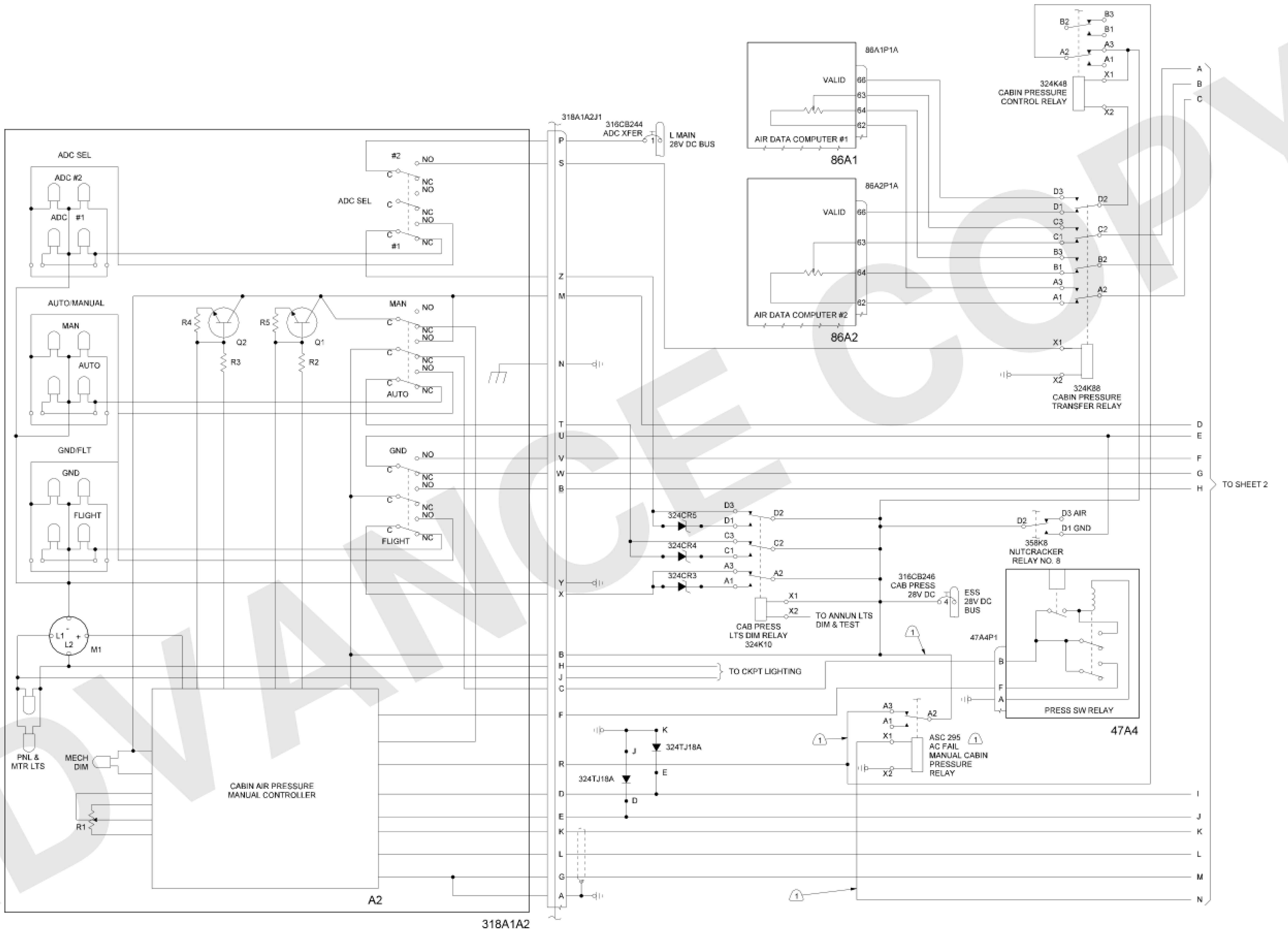
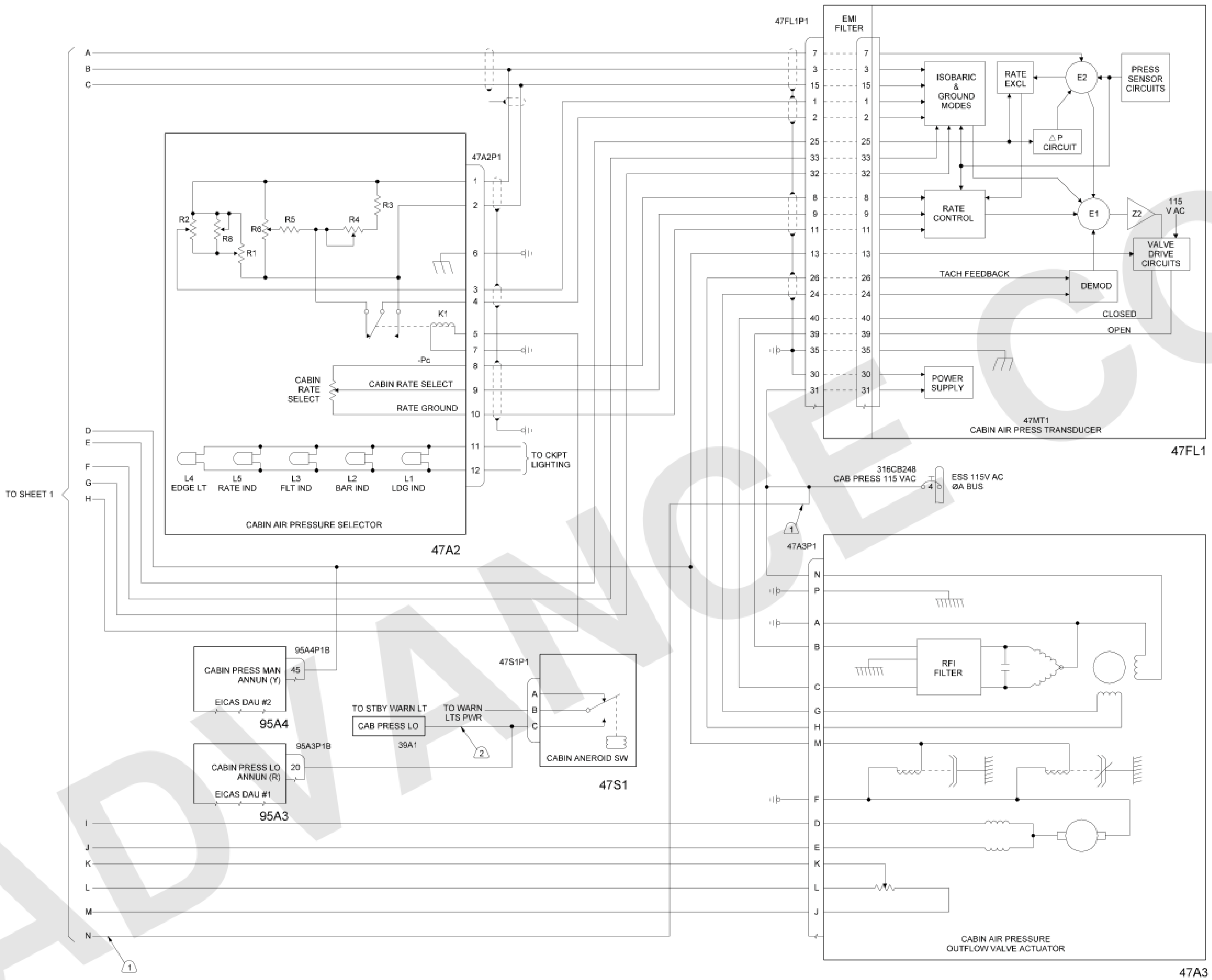


Cabin Pressure Control – Electrical Schematic (Aircraft 1000, 1002 - 1005)
Figure 3 (Sheet 1 of 2)

CALLOUT(S):
1 AIRCRAFT HAVING ASC 295
2 AIRCRAFT NOT HAVING SPZ-8400



Cabin Pressure Control – Electrical Schematic (Aircraft 1000, 1002 - 1005)
Figure 3 (Sheet 2 of 2)

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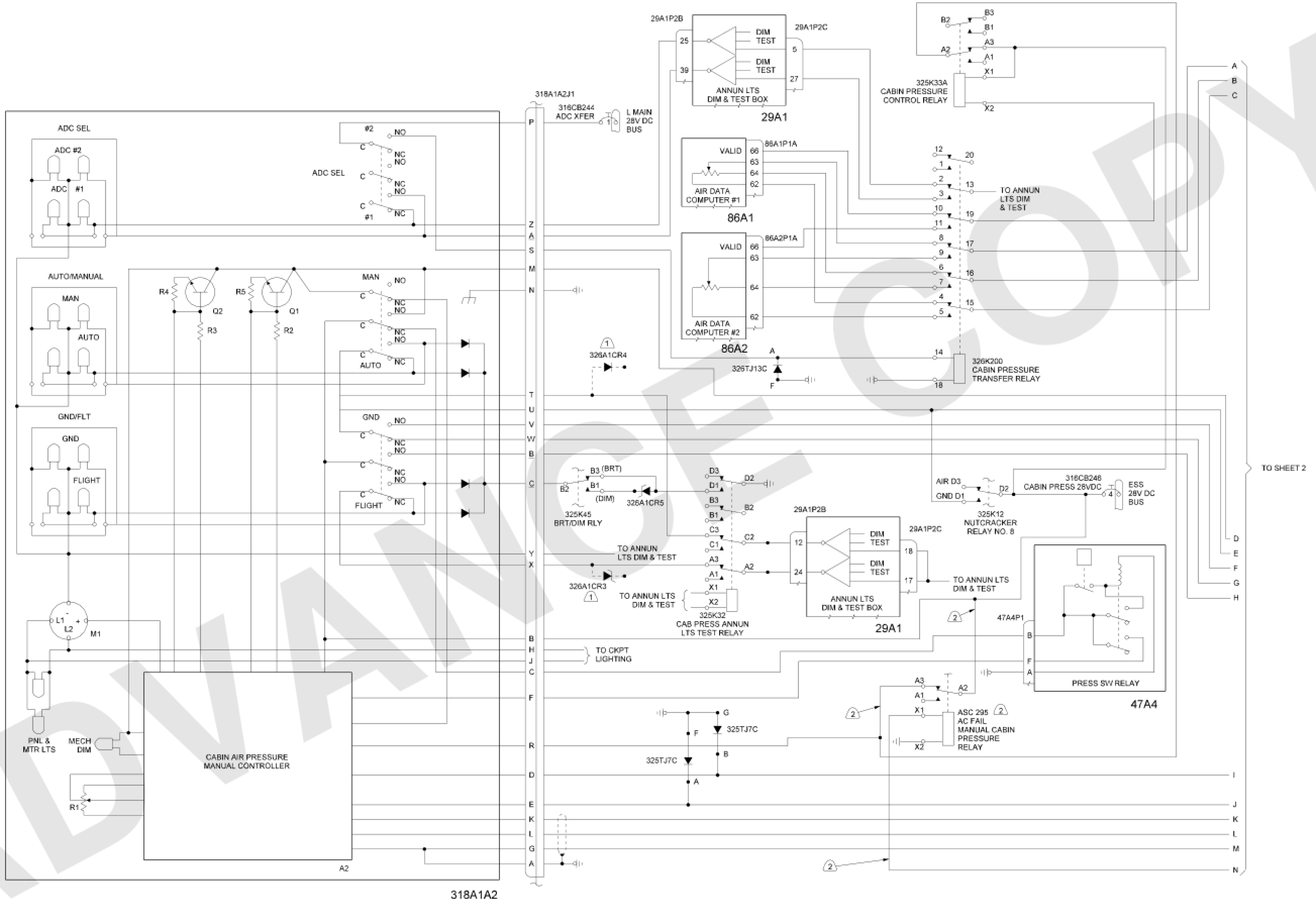
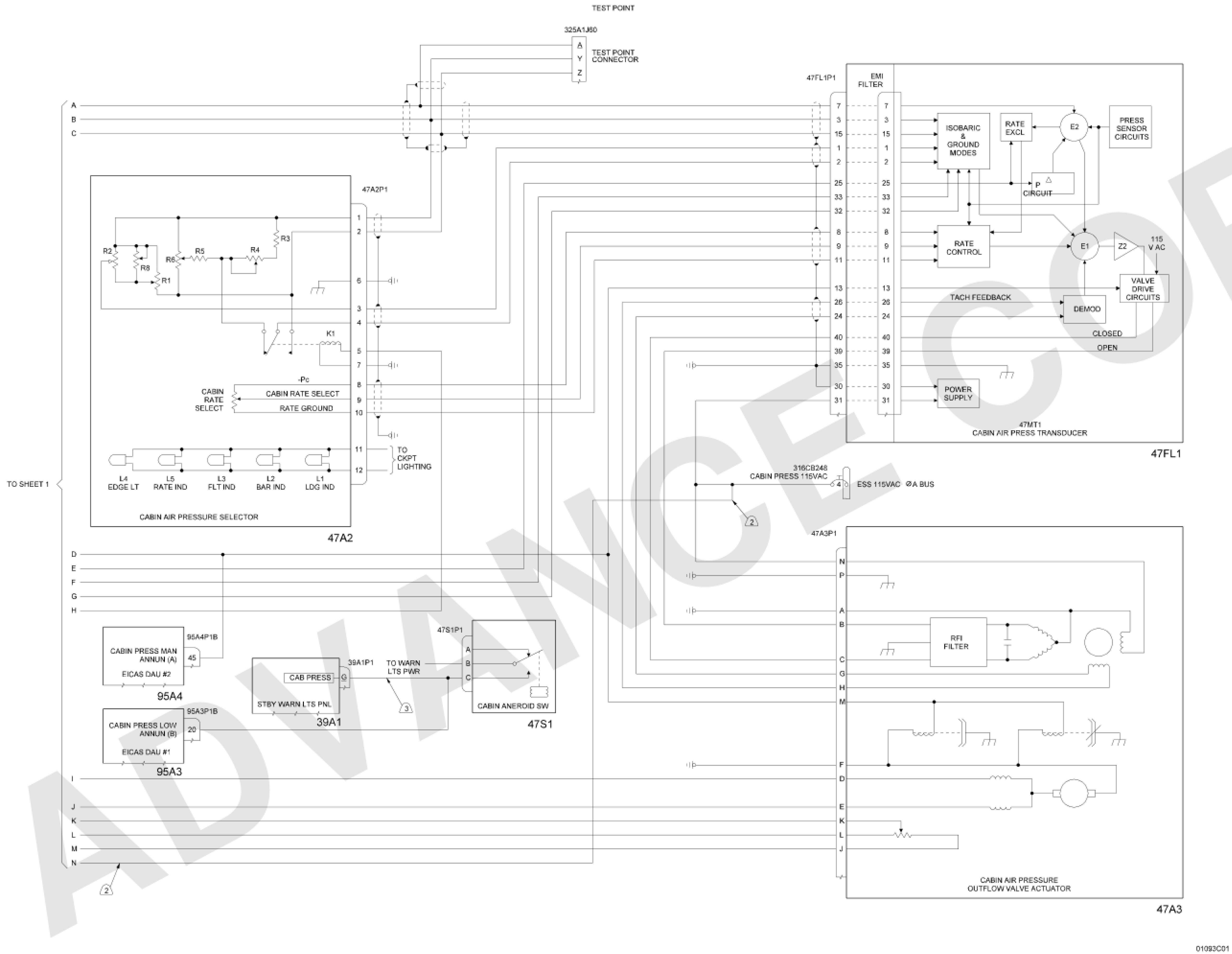


Cabin Pressure Control –
Electrical Schematic (Aircraft
1001, 1006 and Subsequent)
Figure 4 (Sheet 1 of 2)

01092C01

CALLOUT(S):

1. AIRCRAFT 1006 - 1013
2. AIRCRAFT HAVING ASC 295
3. AIRCRAFT 1001, 1006 - 1252 NOT HAVING SPZ-8400



Cabin Pressure Control – Electrical Schematic (Aircraft 1001, 1006 and Subsequent)
Figure 4 (Sheet 2 of 2)

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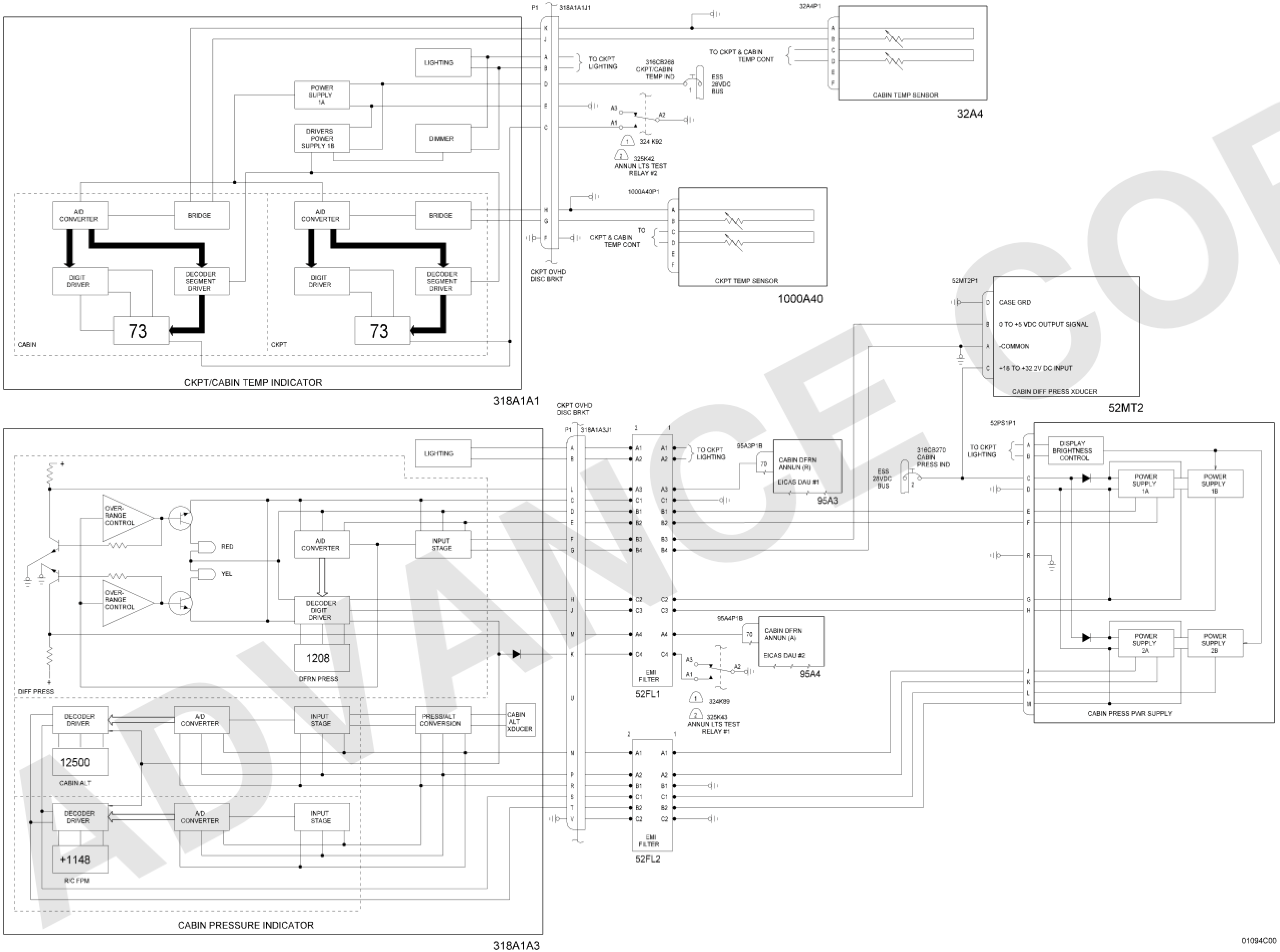
CALLOUT(S):

1. AIRCRAFT 1000, 1002 - 1005
2. AIRCRAFT 1001, 1006 AND SUBSEQUENT



Cockpit and Cabin Temp / Press Indicator – Electrical Schematic
Figure 5

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