SULLAIR

SULLAIR
HEAT RECOVERY SYSTEM
EES
Series LS25S, LS32 & TS32
200-450HP/ 149-336KW

OPERATOR'S MANUAL AND PARTS LIST

KEEP FOR FUTURE REFERENCE

Part Number 02250135-752

AIR CARE
SEMINAR TRAINING

Sullair Air Care Seminars are 3-day courses that provide hands-on instruction in the proper operation, maintenance and service of Sullair equipment. Individual seminars on Industrial compressors and compressor electrical systems are presented at regular intervals throughout the year at a dedicated training facility at Sullair's corporate headquarters in Michigan City, Indiana.

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Michigan City, IN 46360
Attn: Service Training Department

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OPERATOR IS REQUIRED TO READ ENTIRE INSTRUCTION MANUAL

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Section 6 ILLUSTRATIONS AND PARTS LIST

Section 1
SAFETY

1.1 GENERAL

Sullair Corporation and its subsidiaries design and manufacture all of their products so they can be operated safely. However, the responsibility for safeoperation rests with those who use and maintain these products. The following safety precautions are offered as a guide which, if conscientiously followed, will minimize the possibility of accidents throughout the useful life of this equipment.

The compressor should be operated only by those who have been trained and delegated to do so, and who have read and understood this Operator's Manual. Failure to follow the instructions, procedures and safety precautions in this manual may result in accidents and injuries.

NEVER start the compressor unless it is safe to do so. **DO NOT** attempt to operate the compressor with a known unsafe condition. Tag the compressor and render it inoperative by disconnecting and locking out all power at source or otherwise disabling its prime mover so others who may not know of the unsafe condition cannot attempt to operate it until the condition is corrected.

Install, use and operate the compressor only in full compliance with all pertinent OSHA regulations and/or any applicable Federal, State, and Local codes, standards and regulations.

DO NOT modify the compressor and/or controls in any way except with written factory approval.

While not specifically applicable to all types of compressors with all types of prime movers, most of the precautionary statements contained herein are applicable to most compressors and the concepts behind these statements are generally applicable to all compressors.

1.2 PERSONAL PROTECTIVE EQUIPMENT

Prior to installing or operating the compressor, owners, employers and users should become familiar with, and comply with, all applicable OSHA regulations and/or any applicable Federal, State and Local codes, standards, and regulations relative to personal protective equipment, such as eye and face protective equipment, respiratory protective equipment, equipment intended to protect the extremities, protective clothing, protective shields and barriers and electrical protective equipment, as well as noise exposure administrative and/or engineering controls and/or personal hearing protective equipment.

1.3 PRESSURE RELEASE

A. Install an appropriate flow-limiting valve between the service air outlet and the shut-off (throttle) valve, either at the compressor or at any other point along the air line, when an air hose exceeding 13mm inside diameter is to be connected to the shut-off (throttle) valve, to reduce pressure in case of hose failure, per OSHA Standard 29 CFR 1926.302(b)(7) and/or any applicable Federal, State and Local codes, standards and regulations.

B. When the hose is to be used to supply a manifold, install an additional appropriate flow-limiting valve between the manifold and each air hose exceeding13mm inside diameter that is to be connected to the manifold to reduce pressure in case of hose failure.

C. Provide an appropriate flow-limiting valve at the beginning of each additional 23m of hose in runs of air hose exceeding13mm inside diameter to reduce pressure in case of hose failure.

D. Flow-limiting valves are listed by pipe size and flow-rated. Select appropriate valves accordingly, in accordance with their manufacturer's recommendations.

E. DO NOT use air tools that are rated below the maximum rating of the compressor. Select air tools, air hoses, pipes, valves, filters and other fittings accordingly. **DO NOT** exceed manufacturer's rated safe operating pressures for these items.

F. Secure all hose connections by wire, chain or other suitable retaining device to prevent tools or hose ends from being accidentally disconnected and expelled.

G. Open fluid filler cap only when compressor is not running and is not pressurized. Shut down the compressor and bleed the sump (receiver) to zero internal pressure before removing the cap.

H. Vent all internal pressure prior to opening any line, fitting, hose, valve, drain plug, connection or other component, such as filters and line oilers, and before attempting to refill optional air line anti-icer systems with antifreeze compound.

I. Keep personnel out of line with and away from the discharge opening of hoses or tools or other points of compressed air discharge.

J. Use air at pressures less than 2.1 bar for cleaning purposes, and then only with effective chip guarding and personal protective equipment per OSHA Standard 29 CFR 1910.242 (b) and/or any applicable Federal, State, and Local codes, standards and regulations.

K. DO NOT engage in horseplay with air hoses as

death or serious injury may result.

1.4 FIRE AND EXPLOSION

A. Clean up spills of lubricant or other combustible substances immediately, if such spills occur.

B. Shut off the compressor and allow it to cool. Then keep sparks, flames and other sources of ignition away and **DO NOT** permit smoking in the vicinity when checking or adding lubricant or when refilling air line anti-icer systems with antifreeze compound.

C. DO NOT permit fluids, including air line anti-icer system antifreeze compound or fluid film, to accumulate on, under or around acoustical material, or on any external surfaces of the air compressor. Wipe down using an aqueous industrial cleaner or steam clean as required. If necessary, remove acoustical material, clean all surfaces and then replace acoustical material. Any acoustical material with a protective covering that has been torn or punctured should be replaced immediately to prevent accumulation of liquids or fluid film within the material. **DO NOT** use flammable solvents for cleaning purposes.

D. Disconnect and lock out all power at source prior to attempting any repairs or cleaning of the compressor or of the inside of the enclosure, if any.

E. Keep electrical wiring, including all terminals and pressure connectors in good condition. Replace any wiring that has cracked, cut, abraded or otherwise degraded insulation, or terminals that are worn, discolored or corroded. Keep all terminals and pressure connectors clean and tight.

F. Keep grounded and/or conductive objects such as tools away from exposed live electrical parts such as terminals to avoid arcing which might serve as a source of ignition.

G. Remove any acoustical material or other material that may be damaged by heat or that may support combustion and is in close proximity, prior to attempting weld repairs.

H. Keep suitable fully charged Class BC or ABC fire extinguisher or extinguishers nearby when servicing and operating the compressor.

I. Keep oily rags, trash, leaves, litter or other combustibles out of and away from the compressor.

J. DO NOT operate the compressor without proper flow of cooling air or water or with inadequate flow of lubricant or with degraded lubricant.

K. DO NOT attempt to operate the compressor in any classification of hazardous environment unless the compressor has been specially designed and manufactured for that duty.

1.5 MOVING PARTS

A. Keep hands, arms and other parts of the body and also clothing away from couplings, fans and other moving parts.

B. DO NOT attempt to operate the compressor with the fan, coupling or other guards removed.

C. Wear snug-fitting clothing and confine long hair when working around this compressor, especially when exposed to hot or moving parts.

D. Keep access doors, if any, closed except when making repairs or adjustments.

E. Make sure all personnel are out of and/or clear of the compressor prior to attempting to start or operate it.

F. Disconnect and lock out all power at source and verify at the compressor that all circuits are de-energized to minimize the possibility of accidental start-up, or operation, prior to attempting repairs or adjustments. This is especially important when compressors are remotely controlled.

G. Keep hands, feet, floors, controls and walking surfaces clean and free of fluid, water or other liquids to minimize the possibility of slips and falls.

1.6 HOT SURFACES, SHARP EDGES AND SHARP CORNERS

A. Avoid bodily contact with hot fluid, hot coolant, hot surfaces and sharp edges and corners.

B. Keep all parts of the body away from all points of air discharge.

C. Wear personal protective equipment including gloves and head covering when working in, on or around the compressor.

D. Keep a first aid kit handy. Seek medical assistance promptly in case of injury. **DO NOT** ignore small cuts and burns as they may lead to infection.

1.7 TOXIC AND IRRITATING SUBSTANCES

A. DO NOT use air from this compressor for respiration (breathing) except in full compliance with OSHA Standards 29 CFR 1910 and/or any applicable Federal, State or Local codes or regulations.

⚠ DANGER

Death or serious injury can result from inhaling compressed air without using proper safety equipment. See OSHA standards and/or any applicable Federal, State, and Local codes, standards and regulations on safety equipment.

B. DO NOT use air line anti-icer systems in air lines supplying respirators or other breathing air utilization equipment and **DO NOT** discharge air from these systems into unventilated or other confined areas.

C. Operate the compressor only in open or adequately ventilated areas.

D. Locate the compressor or provide a remote inlet so that it is not likely to ingest exhaust fumes or other toxic, noxious or corrosive fumes or substances.

E. Coolants and lubricants used in this compressor are typical of the industry. Care should be taken to avoid accidental ingestion and/or skin contact. In the event of ingestion, seek medical treatment promptly. Wash with soap and water in the event of skin contact. Consult Material Safety Data Sheet for information pertaining to fluid of fill.

F. Wear goggles or a full face shield when adding antifreeze compound to air line anti-icer systems.

G. If air line anti-icer system antifreeze compound enters the eyes or if fumes irritate the eyes, they should be washed with large quantities of clean water for fifteen minutes. A physician, preferably an eye specialist, should be contacted immediately.

H. DO NOT store air line anti-icer system antifreeze compound in confined areas.

I. The antifreeze compound used in air line antifreeze systems contains methanol and is toxic, harmful or fatal if swallowed. Avoid contact with the skin or eyes and avoid breathing the fumes. If swallowed, induce vomiting by administering a tablespoon of salt, in each glass of clean, warm water until vomit is clear, then administer two teaspoons of baking soda in a glass of clean water. Have patient lay down and cover eyes to exclude light. Call a physician immediately.

1.8 ELECTRICAL SHOCK

A. This compressor should be installed and maintained in full compliance with all applicable Federal, State and Local codes, standards and regulations, including those of the National Electrical Code, and also including those relative to equipment grounding conductors, and only by personnel that are trained, qualified and delegated to do so.

B. Keep all parts of the body and any hand-held tools or other conductive objects away from exposed live parts of electrical system. Maintain dry footing, stand on insulating surfaces and **DO NOT** contact any other portion of the compressor when making adjustments or repairs to exposed live parts of the electrical system. Make all such adjustments or repairs with one hand only, so as to minimize the possibility of creating a current path through the heart.

C. Attempt repairs in clean, dry and well lighted and ventilated areas only.

D. DO NOT leave the compressor unattended with open electrical enclosures. If necessary to do so, then disconnect, lock out and tag all power at source so others will not inadvertently restore power.

E. Disconnect, lock out, and tag all power at source prior to attempting repairs or adjustments to rotating machinery and prior to handling any ungrounded conductors.

1.9 LIFTING

A. If the compressor is provided with a lifting bail, then lift by the bail provided. If no bail is provided, then lift by sling. Compressors to be air-lifted by helicopter must not be supported by the lifting bail but by slings instead. In any event, lift and/or handle only in full compliance with OSHA standards 29 CFR 1910 subpart N and/or any applicable Federal, State, and Local codes, standards and regulations.

B. Inspect points of attachment for cracked welds and for cracked, bent, corroded or otherwise degraded members and for loose bolts or nuts prior to
lifting.

C. Make sure entire lifting, rigging and supporting structure has been inspected, is in good condition and has a rated capacity of at least the weight of the compressor. If you are unsure of the weight, then weigh compressor before lifting.

D. Make sure lifting hook has a functional safety latch or equivalent, and is fully engaged and latched on the bail or slings.

E. Use guide ropes or equivalent to prevent twisting or swinging of the compressor once it has been lifted clear of the ground.

F. DO NOT attempt to lift in high winds.

G. Keep all personnel out from under and away from the compressor whenever it is suspended.

H. Lift compressor no higher than necessary.

I. Keep lift operator in constant attendance whenever compressor is suspended.

J. Set compressor down only on a level surface capable of safely supporting at least its weight and

its loading unit.

K. When moving the compressor by forklift truck, utilize fork pockets if provided. Otherwise, utilize pallet if provided. If neither fork pockets or pallet are provided, then make sure compressor is secure and well balanced on forks before attempting to raise or transport it any significant distance.

L. Make sure forklift truck forks are fully engaged and tipped back prior to lifting or transporting the compressor.

M. Forklift no higher than necessary to clear obstacles at floor level and transport and corner at minimum practical speeds.

N. Make sure pallet-mounted compressors are firmly bolted or otherwise secured to the pallet prior to attempting to forklift or transport them. **NEVER** attempt to forklift a compressor that is not secured to its pallet, as uneven floors or sudden stops may cause the compressor to tumble off, possibly causing serious injury or property damage in the process.

1.10 ENTRAPMENT

A. If the compressor enclosure, if any, is large enough to hold a man and if it is necessary to enter it to perform service adjustments, inform other personnel before doing so, or else secure and tag the access door in the open position to avoid the possibility of others closing and possibly latching the door with personnel inside.

B. Make sure all personnel are out of compressor before closing and latching enclosure doors.

Section 2
DESCRIPTION

2.1 INTRODUCTION

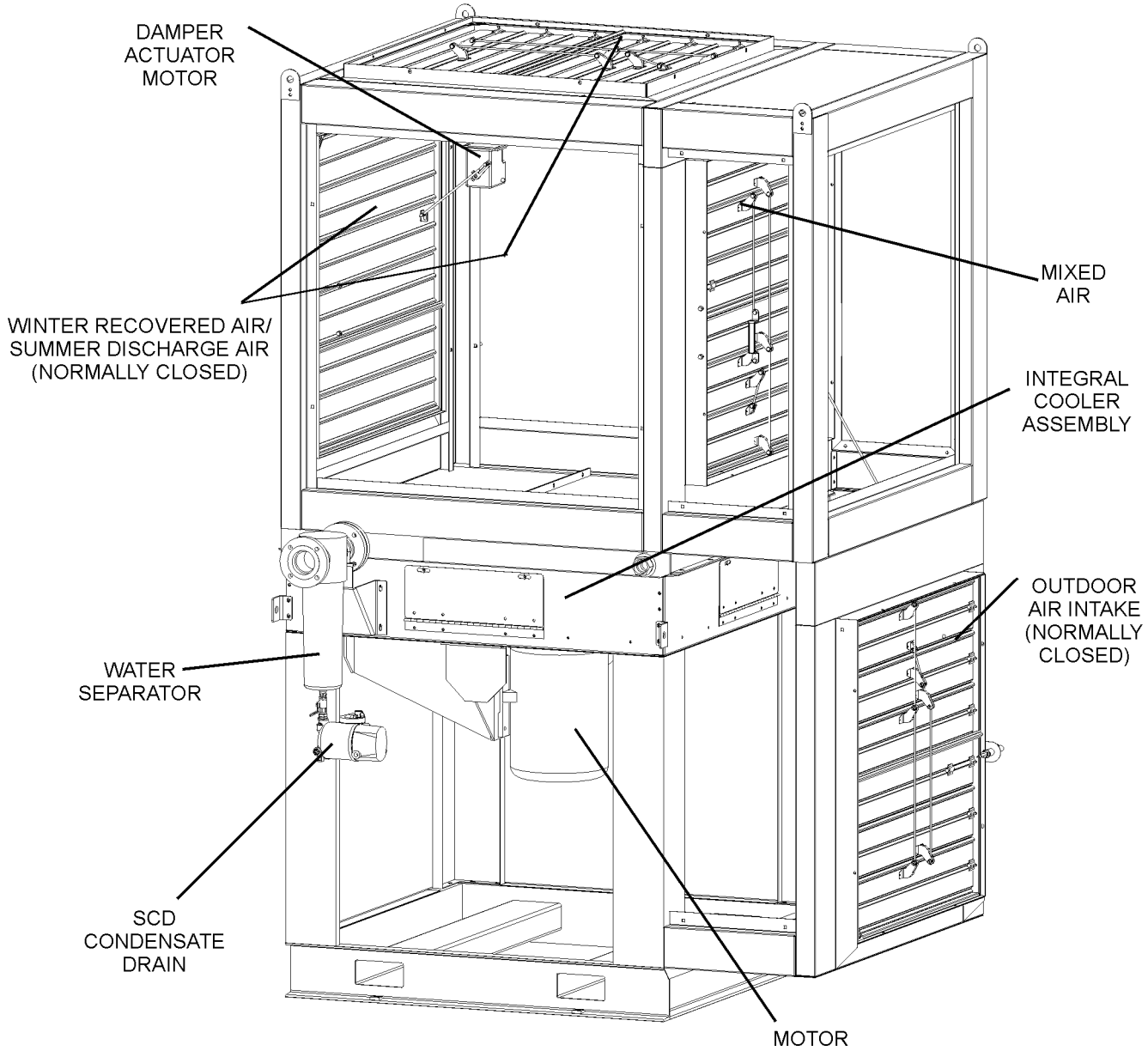
The Sullair Integral Heat Recovery System is a means of recovering energy which is expended while producing compressed air. This energy can be converted into a usable source of heat. The heat is stored in the compressor cooling air as it passes over the compressor motor, fluid cooler and after-cooler. The compressor cooling air can then be used as preheated make-up air or heating air for plants, warehouses, etc. Heat may also be rejected from the system when it is not required.

⚠ WARNING

Any make-up air introduced into a heating or ventilation system by this system must be of breathing air quality as defined by applicable codes, laws or regulations.

Because the heat recovery system is built into the compressor package it requires a minimal amount of installation labor. The system has been designed so that use of auxiliary blowers is not needed as long as good duct design is practiced (See Section 4.4).

Figure 2-1 Sullair Heat Recovery System- Typical Overview



Section 2
DESCRIPTION

Should any questions arise which cannot be answered in the following text, call your nearest Sullair office or the Sullair Corporation Service Department.

2.2 APPLICATION CONSIDERATIONS

A. GENERAL

The Sullair EES is designed primarily to recover the heat of compression in the form of heated make-up air. Maximum energy utilization, minimum cost of installation, and therefore maximum return on investment will be realized by using the EES in this fashion. For every cubic foot of outside air brought into a building by this EES, another cubic foot of air that would have infiltrated into the building at outside temperature will be eliminated. The fuel savings result from the plant's primary heating system not having to heat that cubic foot of air at outside temperature up to the temperature of the heated space.

It is possible for the EES system to operate efficiently as a heating system; that is, where air is drawn and heated to some higher temperature (say 90ºF [32ºC]), then the hot air distributed through-out the heated space. However, this usually requires greater capital investment in the form of a larger ductwork system to distribute the heated air.

As a preheated make-up air system, air is brought in from the outside at some low temperature (say 40ºF [14ºC]), heated approximately to the heated space temperature (say 65ºF [18ºC]), and then released to the heated space at one point. Since the air is close to heated space temperature, there is little advantage in distributing this air throughout the plant.

In either case, the same amount of heat is recovered, but in the make-up air system, significant reductions in the installed cost are possible. This is the key to the popularity of the Sullair EES Integral Heat Recovery System.

B. PROCESS HEATING

It is also possible to utilize the waste-heat of compression for some process heating applications, such as drying parts, etc. This type of application will usually net a greater return on investment because the heat can be used year round. If this is the case, you may want to contact your local Sullair distributor for application assistance.

C. MULTIPLE COMPRESSOR INSTALLATIONS

For multiple machine installations, it is usually less expensive to manifold all or most of the ductwork, rather than run separate ducts for each machine. Care should be taken in the design of such a system, because unlike duct elbows and straight duct, divided flow duct fittings (tees, crosses, laterals, and wyes) have different performance characteristics depending on whether they are diverging flow or converging flow. Generally speaking, ductwork on the inlet side of the compressor may be treated as a supply system, and ductwork on the discharge side of the compressor may be considered as an exhaust system. (Refer to Section 4.4 for more information). It is good design practice to size all ducts such that when all compressors are running there will be constant velocity in all ducts.

D. COMPRESSORS IN UNHEATED SPACES

It is quite feasible to locate the Sullair compressor with Integral EES in unheated spaces with minimum modifications, because heated air is automatically bypassed to maintain a thermostatically controlled temperature in the compressor enclosure, thereby allowing aftercooled compressors to run reliably in even sub-zero temperatures. However, provisions must be made to prevent freezing when the compressor is not running. A heated trap should be used, and the condensate drain should be heat traced and insulated. The section of pipe conveying compressed air from the compressor to the heated space should be insulated. Some compressor fluids may not be suitable because of excessively high viscosity on a completely cold start-up. More information on compressor lubricants can be found in the Compressor Manual, or by contacting your local Sullair Distributor.

E. COMPRESSORS IN ENCLOSED SPACES

When one or more compressors are located in an enclosed space, no special room ventilation is required, other than the usual ductwork. However, if other heat-affected equipment is also located in the enclosed space (transformers, instrumentation, etc.), it may be necessary to provide auxiliary ventilation to prevent excessive heat buildup.

F. BOOSTER FANS

The internal circulating fan on the EES has additional static capability to allow for a generous amount of external ductwork, and it is almost always possible to design the system ductwork in such a way that a booster fan will not be required. However, a booster fan will be the only practical solution in some applications. If this is the case, the following guidelines should be observed:

- If ductwork static is greater than 0.5 in. W.G. (see Section 3).
- Manufacturer's fan ratings are based on an idealized test procedure, and some de-rat-

ing might be required depending on how the fan is applied.

- Tube-axial type fans are the most commonly used type of booster fans.
- The selected fan should be non-overloading; i.e. if the fan discharge or inlet is shut off, the fan drive motor should not overload.

2.3 DESCRIPTION OF COMPONENTS

Refer to Figure 2-1. The basic components of the Sullair Integral Heat Recovery System are shown. The complete package of a structural steel base frame, inlet and discharge plenums, oil cooler (aftercooler optional), motor and cooling fan, moisture separator and heated trap, damper panels for outdoor air, recovered heated air, bypass air, and rejected heated air; two temperature probes; two pneumatic cylinders; room thermostat; damper actuator motor; solenoid valve; and a temperature controller.

The following text explains the functional description of these components.

TEMPERATURE PROBE “A”- MIXED AIR

Probe A is mounted in the compressor enclosure, where it monitors the temperature of the mixture of bypass and outdoor air. Refer to Figures 2-2, 2-3 and 2-4.

The damper motor actuator will modulate so that the set mixed air temperature will be maintained. Since the mixed air temperature remains constant, the heated exhaust air temperature will vary depending on the demand for compressor loading. The air temperature rise across the coolers can be as little as 5ºF (3ºC) for a completely unloaded compressor. This is a thermistor type of temperature probe.

TEMPERATURE PROBE “B”- OUTSIDE AIR

This probe monitors the outdoor air temperature. When the outdoor temperature exceeds the set value on the temperature controller, an electrical signal is sent to the exhaust plenum damper motor actuators, and the heated cooling air will be rejected outdoors.

At the same time, the temperature controller sends an electrical signal to the mixed air damper motor actuator, which positions the dampers so that all cooling air will enter the compressor cabinet from outdoors.

ROOM THERMOSTAT

This thermostat monitors the temperature of the heated space. If the set value on this thermostat is exceeded, an electrical signal is sent to the exhaust plenum damper motor actuators, and the heated cooling air will be rejected outdoors.

DAMPER MOTOR ACTUATORS- RECOVERED AND REJECTED AIR

The motor actuators control the movements of the rejected and recovered air dampers. When the compressor is not running, the motor actuators maintain the recovered and rejected dampers in a closed position.

When the compressor is running and the room thermostat and the outside air temperature probe indicate temperatures below their setpoints, the motor actuator will fully open the recovered air damper directing all heated cooling air to the heated space.

When the recovered air damper motor actuator receives an electrical signal due to a rise in room temperature, it will close the recovered air damper. The rejected air damper actuator will simultaneously open the rejected air damper, directing all heated cooling air outdoors.

MOTOR ACTUATOR- MIXED AIR

The motor actuator positions the outdoor and bypass air dampers. It utilizes an electrical signal, which is a function of the temperature sensed by Probe “A”. The actuator maintains the outdoor air damper in a closed position when the compressor is not running.

Figure 2-2 High Room Temperature

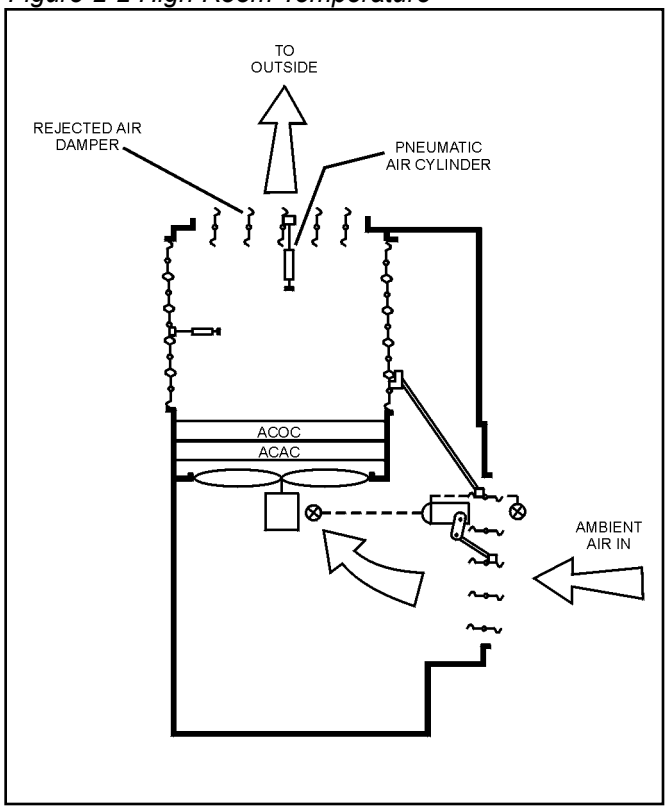


Figure 2-3 Low Room Temperature

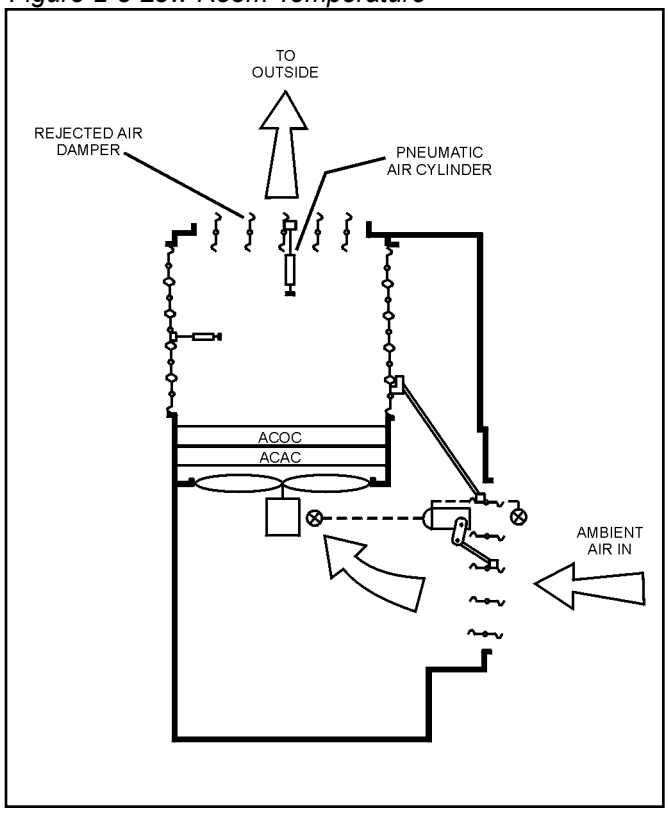
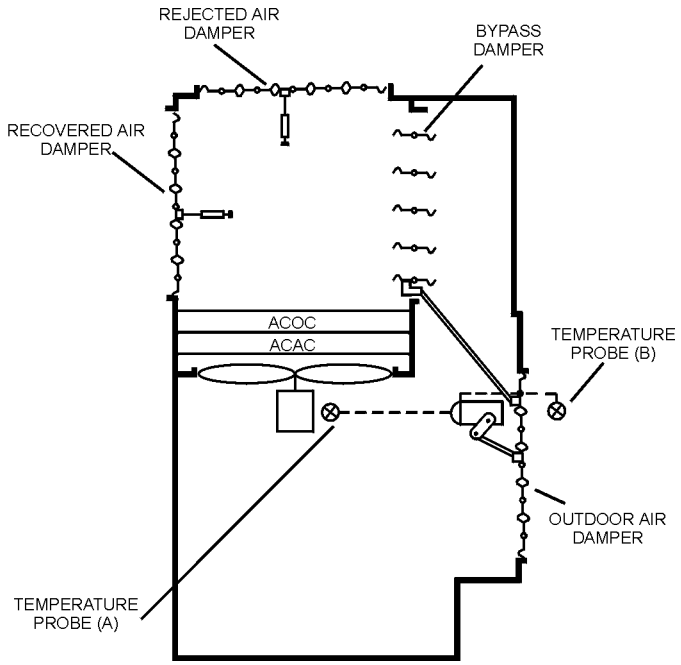


Figure 2-4 No Power



Section 3
SPECIFICATIONS

3.1 SPECIFICATIONS

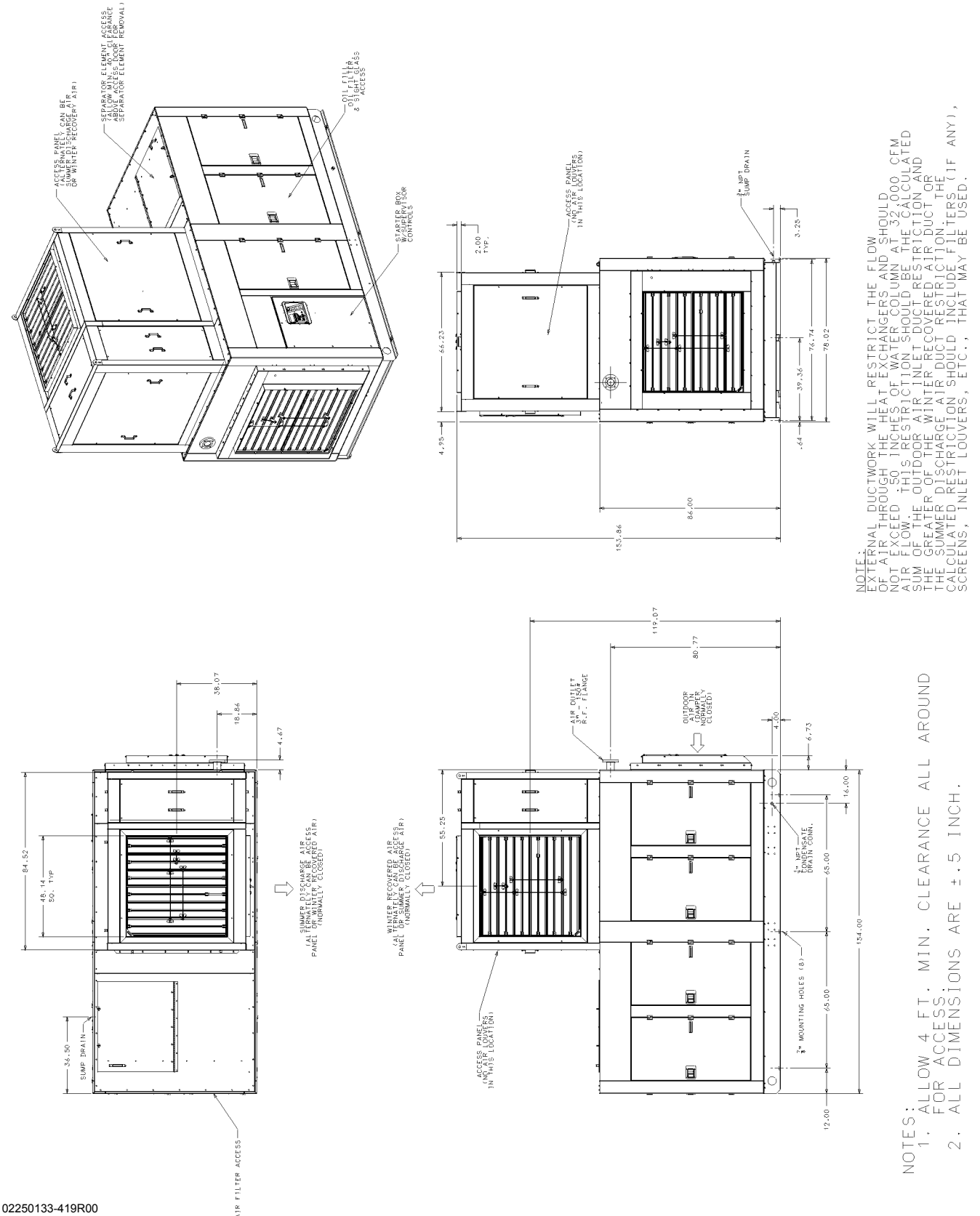
COMPRESSOR POWER RANGE:	200-450HP/ 149-335KW
FAN DIAMETER:	42” (200-250HP/ 149-186KW) 48” (300-450HP/ 224-336KW)
FAN POWER:	71/2HP (REMOTE) (200HP)/900RPM/AOPE 10HP (INTEGRAL) (250HP)/1200RPM/AOPE 15HP (300-350HP)/900RPM/AOPE 20HP (400-450HP)/1200RPM/AOPE
TEMPERATURE CONTROLLERS:	
Electrical:	120VAC Input/24VAC Output 50/60HZ
Enclosure:	Nema 1
Mixed Air Range:	10º to 90ºF (-12º to 32ºC)
Outdoor Air Changeover Range:	20º to 90ºF (-6º to 32ºC)
ROOM THERMOSTAT:	
Electrical:	120VAC
Range:	40º to 90ºF (4º to 32ºC)
Solenoid Valve:	
Electrical:	120VAC/60HZ
Enclosure:	Nema 1
AIR VOLUME (at listed Water Gauge Duct Restriction):	18,000 CFM- 200HP/149KW 30,000 CFM- 250-350HP/186-261KW 35,000 CFM- 400-450HP/298-336KW

NOTE

Allowable ductwork pressure drop is 0.5 w.g. static maximum for all horsepowers listed. A booster fan is required if pressure drop exceeds 0.5 w.g.

Section 3
SPECIFICATIONS

Figure 3-1 Identification- TS32A-300/350 EES (Typical)



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4.1 LOCATION AND ASSEMBLY OF COMPRESSOR

Upon delivery, check your compressor and integral heat recovery system for any damage which may have occurred during shipment. Any damage should be noted on the delivery receipt and a damage claim filed with the shipper.

After the EES is in place, seal all unused holes in the cabinet and base frame. This is to insure that cooling air can only enter the compressor cabinet through the outside air damper.

4.2 THERMOSTAT PLACEMENT

Install the room thermostat (Refer to room thermostat description in Section 2.3) in the space to be heated in a location where it will sense a representative temperature and be safe from physical damage or tampering.

4.3 ELECTRICAL PREPARATION

Interior electrical wiring is performed at the factory. Required customer wiring is minimal, but should be done by a qualified electrician in compliance with OSHA, National Electric Code, and/or any other applicable local electrical codes concerning isolation switches, fused disconnects, etc. Refer to Sections 6.16, 6.17 or 6.18 for the internal heat recovery system wiring diagram proportionate to your EES package.

4.4 DUCTWORK

A. TYPE OF DUCT

Traditionally, duct systems are rectangular and constructed of light gauge, galvanized steel. However, in recent years, round section galvanized steel and round or rectangular section fiberglass products have found increased use because of generally lower installed costs. Galvanized steel, flat, oval and cross section duct are also available.

The best type of duct system to use should be evaluated on an individual basis because each installation has its own unique requirements and problems. Because of the large air volumes, low velocities and low pressures normally encountered, generally, round section sheet metal duct will produce the lowest installed cost.

For EES units located in a heated space, it is recommended that the duct carrying cold, outdoor air be insulated to prevent wintertime, (exterior of the duct) water condensation (sweating). If the exterior of the duct is insulated, a vapor barrier should be used. If the interior of the duct is insulated, this will affect the air handling performance of the duct and should be accounted for in the ductwork static pressure calculations. For EES units located in an unheated space where the recovered air is ducted to a heated space, that portion of the duct exposed to low ambient temperatures should be insulated to prevent excessive heat loss. For EES units mounted in a space that is also air-conditioned in summer, the summer rejected air duct should be insulated to reduce the air conditioning load.

B. DUCTWORK STATIC PRESSURE CALCULATION

The static pressure loss imposed by the ductwork must be calculated. The static pressure loss must not exceed .50 inches of water column at the rated CFM. Static pressure loss is calculated using the total of the inlet duct loss and discharge duct loss.

The following text, tables and formulas will show how to calculate the ductwork static pressure loss for your machine. A worksheet has been included to help in the calculation.

The following three steps must be taken to ensure the adequacy of an installation's ductwork design.

1. A total static pressure loss must be calculated for each branch by summing the static pressure losses for every component of that branch
2. A total system static pressure loss is calculated by adding the greater of the two discharge duct static pressure losses to the inlet duct static pressure loss.
3. If total system pressure loss exceeds .50 inches of water, the ductwork must be redesigned or booster fans added. To reduce the amount of system static pressure loss, the following changes will have the greatest effect:

a) Increase in duct size.

b) Increase in the radius of elbows and tees.

c) Addition of turning vanes to tees and elbows.

d) Avoid the use of abrupt duct size changes.

e) Redesign the entrances and exits for the system.

f) Add booster fans if necessary (see Section 3).

C. COMPONENT STATIC PRESSURE LOSS CALCULATION

STRAIGHT DUCT STATIC PRESSURE LOSS

1. Determine the volume of air to be handled by the ductwork (consult Section 3).
2. If your ductwork is square or rectangular, find the equivalent round duct diameter from Table 1.
3. Using Figure 4-1, find the static pressure loss for 100 feet of straight duct.
4. Find the actual static pressure loss in the straight

duct using the following equation:

Ft. of Straight Duct **(I)** / 100 X *Static Press.* = *Actual Static Pressure Loss*

DUCT FITTING STATIC PRESSURE LOSS

1. The volume of air to be delivered through the fitting is 30,000 CFM (250HP), and 35,000 CFM (450HP).
2. Calculate the fitting area through which the air is flowing. Be sure this area corresponds to the area used in Table 3 for calculating the loss coefficient.

For Rectangular Duct:

$$Area = \frac{Width\ \textbf{(II)} \times Height\ \textbf{(II)}}{144}$$

For Round Duct:

$$Area = .00545 \times Diameter^2\ \textbf{(II)}$$

3. Calculate the air velocity through the fitting.

$$Velocity\ \textbf{(III)} = \frac{CFM\text{ - From Step 1}}{Area\text{ - From Step 2}}$$

4. Select the proper loss coefficient from Table 3. Be sure that the loss coefficient corresponds to the area calculated in Step #2.
5. Calculate the static pressure loss for the fitting using the following equation:

$$C\textbf{(III)} \times \frac{(Velocity\ [ft./min.])^2}{4005} = Static\ Pressure\ Loss\ (inches\ of\ water)$$

6. Repeat Steps 2 through 5 for each fitting. The calculations for each fitting and section of straight duct should be tabulated on the worksheet provided (Table 2).
7. Total the static pressure loss for each duct branch.

(I) *Because fitting static pressure losses are "zero length" losses, calculation of amount of straight duct should be from the intersections of the centerlines of the straight duct sections.*

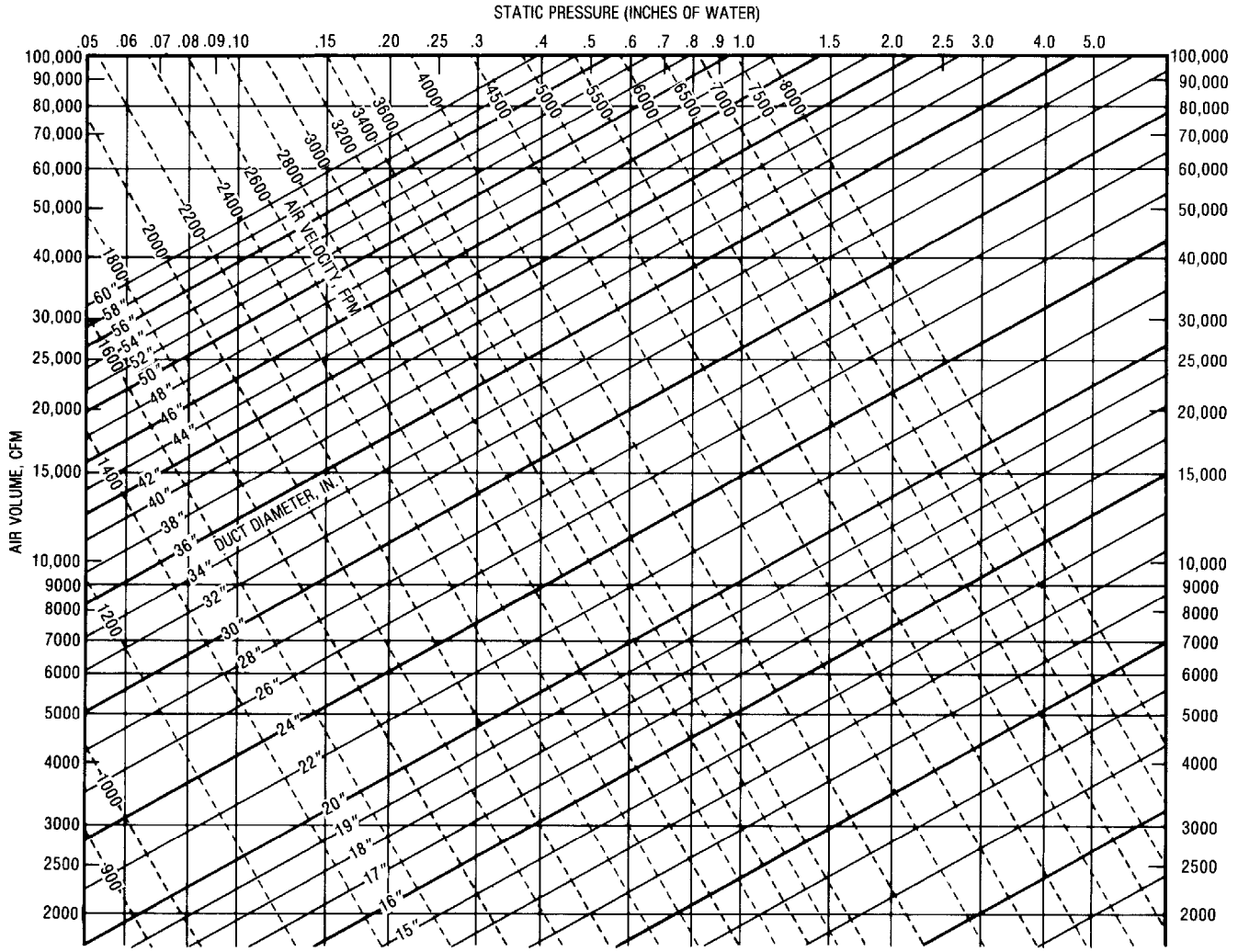
(II) *In feet per minute.*

(III) *Use C, C1, C2, or C0 as indicated in Table 3.*

Table 1- Duct Size Conversion

DUCT SIZE (INCHES)	EQUIVALENT ROUND DUCT DIAMETER (INCHES)
18 X 36	27
18 X 42	29
18 X 48	31
18 X 54	33
18 X 60	34
18 X 66	36
18 X 72	37
24 X 24	26
24 X 30	29
24 X 36	32
24 X 42	34
24 X 48	37
24 X 54	39
24 X 60	40
30 X 30	33
30 X 36	36
30 X 42	39
30 X 48	41
30 X 54	44
30 X 60	46
36 X 36	39
36 X 42	42
36 X 48	45
36 X 54	49
36 X 60	50
42 X 42	46
42 X 48	49
42 X 54	52
48 X 48	52
48 X 54	56
54 X 54	59
54 X 60	62
60 X 60	66
60 X 72	73
72 X 72	79

Figure 4-1 Static Pressure Loss



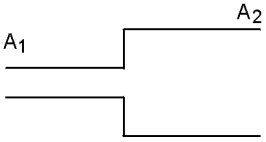
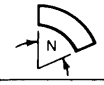
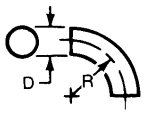
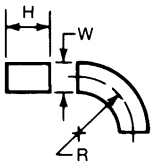
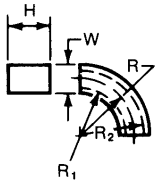
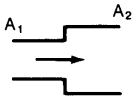
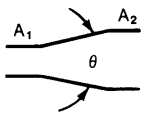
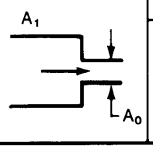
TYPE	ILLUSTRATION CONDITIONS	LOSS COEFFICIENT		
		A_1/A_2	C_1	C_2
Abrupt Expansion		0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	0.81 0.64 0.49 0.36 0.25 0.16 0.08 0.04 0.01	81 16 5 2.25 1.00 0.45 0.18 0.06 0.01

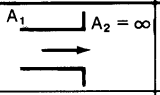
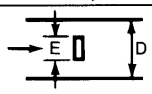
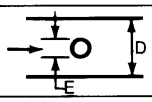
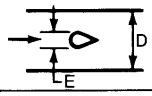
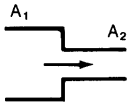
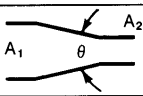
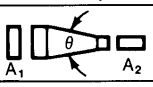
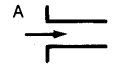
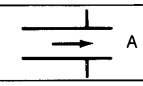
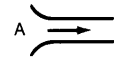
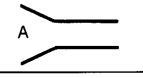
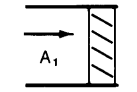
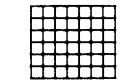
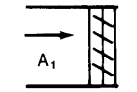
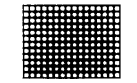
Table 2- Ductwork Static Pressure Loss Worksheet

DUCT BRANCH _____

COMPONENT	AIR FLOW (CFM)	DUCT AREA (SQ. FT.)	AIR VELOCITY (FPM)	C, C_1, C_2 OR C_n	$\frac{V^2}{4005}$	EQUIVALENT RD. DUCT DIAMETER	DUCT LENGTH (FT.)	STATIC PRESSURE LOSS

Table 3- Loss Coefficient Calculations

TYPE	ILLUSTRATION	CONDITIONS	LOSS COEFFICIENT
N, degree		Rectangular or round; with or without vanes	C $\frac{N}{90}$
90-degree round section		R/D Miter 0.5 0.75 1.0 1.5 2.0	C 1.30 0.90 0.45 0.33 0.24 0.19
90-degree rectangular section		H/W R/W 0.25 Miter 0.25 0.75 1.0 1.5 0.5 Miter 0.5 0.75 1.0 1.5 1.0 Miter 0.5 0.75 1.0 1.5 4.0 Miter 0.5 0.75 1.0 1.5	C 1.25 1.25 0.60 0.37 0.19 1.47 1.10 0.50 0.28 0.13 1.50 1.00 0.41 0.22 0.09 1.38 0.96 0.37 0.19 0.07
90-degree square section with splitter vanes		R/W R1/W R2/W Miter 0.5 0.5 0.4 0.7 0.6 1.0 1.0 1.5 Miter 0.3 0.5 0.5 0.2 0.4 0.75 0.4 0.7 1.0 0.7 1.0 1.5 1.3 1.6	C 0.70 0.13 0.12 0.45 0.12 0.10 0.15
Miter with turning vanes		Plate vanes Formed vanes	0.35 0.10
Miter tee with vanes		Consider equal to a similar elbow. Base loss on entering velocity.	
Radius tee			
Abrupt expansion		A_1/A_2 / C_1 / C_2 0.1 / 0.81 / 81 0.2 / 0.64 / 16 0.3 / 0.49 / 5 0.4 / 0.36 / 2.25 0.5 / 0.25 / 1.00 0.6 / 0.16 / 0.45 0.7 / 0.08 / 0.18 0.8 / 0.04 / 0.06 0.9 / 0.01 / 0.01	
Gradual expansion		θ / C_r 5° / 0.17 7° / 0.22 10° / 0.28 20° / 0.45 30° / 0.59 40° / 0.73	
Square edge orifice exit		A_0/A_1 / C_0 0.0 / 2.50 0.2 / 2.44 0.4 / 2.26 0.6 / 1.96 0.8 / 1.54 1.0 / 1.00	

TYPE	ILLUSTRATION	CONDITIONS	LOSS COEFFICIENT
Abrupt exit		$\frac{A_1}{A_2}=0$	C_1 1.00
Bar across duct		E/D 0.10 0.25 0.50	C 0.7 1.4 4.0
Pipe across duct		E/D 0.10 0.25 0.50	C 0.20 0.55 2.00
Streamlined strut across duct		E/D 0.10 0.25 0.50	C 0.07 0.23 0.90
Abrupt contraction, square edge		A_2/A_1 0.0 0.2 0.4 0.6 0.8	C_2 0.34 0.32 0.25 0.16 0.06
Gradual contraction		θ 30° 45° 60°	C 0.02 0.04 0.07
Equal area transformation		$A_1 = A_2$ θ ≤14°	C 0.15
Flanged entrance		A = ∞	C 0.34
		A = ∞	C 0.85
Formed entrance		A = ∞	C 0.03
Cone entrance		A = ∞	C 0.22
Louver		A = ∞	C_1 1.6
Grill		A = ∞	C_1 1.6
Louver and screen		A = ∞	C_1 2.0
Register		A = ∞	C_1 4.0
Intake		A = ∞	C_1 1.0

NOTES

5.1 INLET DAMPER LINKAGE ADJUSTMENT

The inlet dampers (outside air inlet and bypass dampers) are positioned by the motor actuator to maintain a constant mixed air temperature. The operation of these two dampers is opposed; i.e. when one is open, the other is closed. The motor actuator is a spring return type, and will return the outside air inlet damper to a fully closed position when the compressor is not running. To adjust the inlet damper linkage, perform the following steps in sequence:

NOTE

Too many starts may result in motor damage. If there are questions, contact the motor manufacturer.

1. When looking at the mixed air motor actuator from the end which is driving the damper, the crank arm should be in the 2:00 position.

NOTE

The compressor should be OFF for this check.

2. With the compressor not running, adjust the active length of the short link rod by loosening the lock bolt of the swivel mounted on the crank arm, until the outside air damper is closed. The crank arm swivel should be attached to the crank arm at the largest radius that the crank arm adjusting slot will allow.
3. When looking at the motor actuator from the control side (bypass air damper) the crank should be in the 2:00 position (See Figure 5-1).

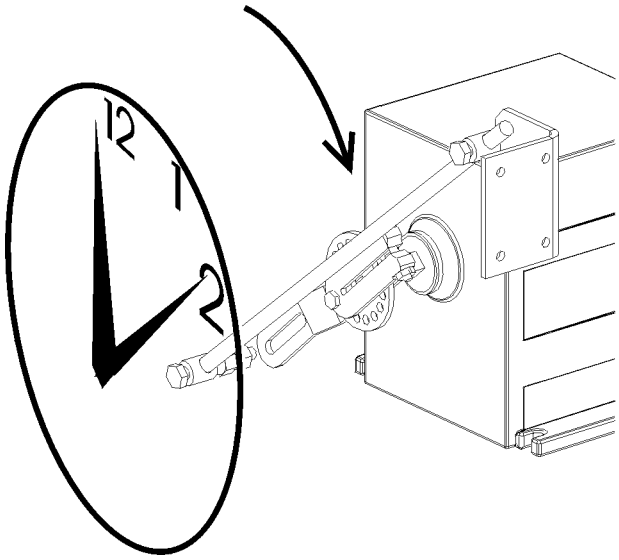
NOTE

The compressor should be OFF for this check.

The crank arm located on the bypass damper should be in the 2:00 position with the bypass damper fully opened.

4. Refer to Figure 5-2. Place the outdoor air temperature changeover control at its minimum position. Set the room thermostat at its minimum temperature setting and start compressor, observing the movement of the outdoor air damper and the bypass damper. Within 60 seconds of start up, the outdoor air damper should be opened fully and the bypass damper should close fully. Rotation of either damper should not exceed 90º, and the damper actuator motor should not be stalled by the linkage. If the bypass damper does not fully open, or the damper actuator motor stalls, proceed to the next step. Otherwise, the inlet damper linkage is now correctly adjusted.

Figure 5-1 Typical Damper Actuator Motor



5. Refer to Figure 5-3. With the compressor not running remove the motor actuator cover. This will expose the travel adjustment screw on the motor actuator.

   Start the compressor, again observing the movement of the outside air damper and bypass damper. The travel adjustment screw on the motor actuator should be adjusted so that the outdoor air damper opens fully (horizontal), counterclockwise to reduce travel, or clockwise to increase travel, as required.

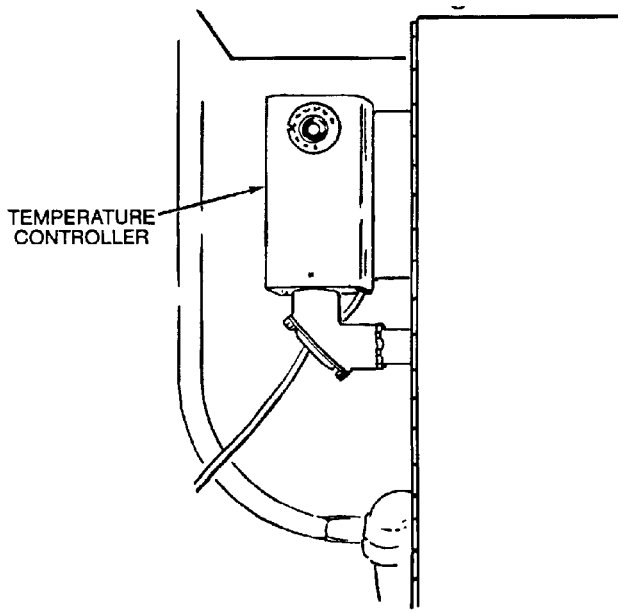
   If the motor actuator becomes stalled before the outdoor air damper fully opens as a result of the bypass damper closing too soon, loosen the stud locknuts at the cable ends. When the outdoor air damper is fully open, close the bypass damper manually and retighten the locknuts. Shut off the compressor. The spring return in the motor actuator should pull the outdoor air damper fully closed, and the bypass damper fully open. At this point the inlet dampers should be properly adjusted. Replace the temperature controller cover and motor actuator cover.

5.2 DISCHARGE DAMPER LINKAGE ADJUSTMENT

The discharge dampers (rejected air damper and recovered air damper) are factory adjusted and should not require periodic re-adjustment. However, if components are replaced or adjustment is other-

Section 5
OPERATION

Figure 5-2 Outdoor air Changeover Adjustment



wise required, perform the following adjustment:

1. With the compressor off, the rejected air damper and recovered air damper should both be in the “closed” position. When looking at the damper positioners from the drive sides, the crank arm should be in the 8:00 position. Adjust the active length of the link rod by loosening the lock bolt of the swivel mounted on the crank arm until the damper is closed (Refer to Figure 5-4). The crank arm swivel should be attached to the crank arm at the largest radius that the crank arm adjusting slot will allow.

5.3 SETTING OF CONTROLS

A. MINIMUM OUTDOOR AIR DAMPER MINIMUM POSITION ADJUSTMENT

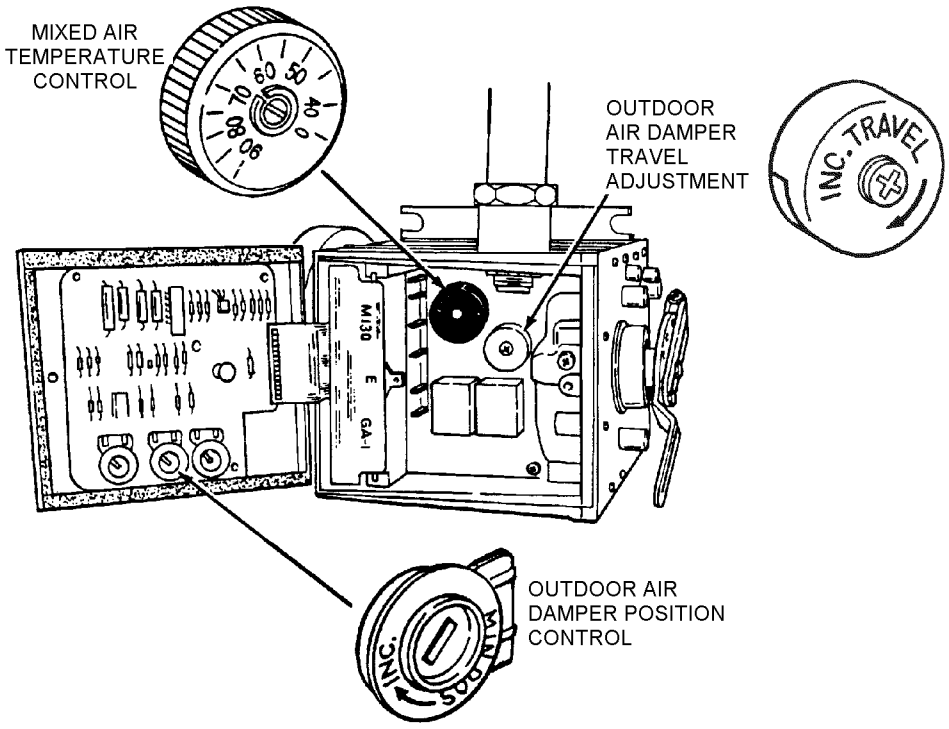
This adjustment is made using the minimum position knob. Follow the instructions below for adjustment.

1. Place the outdoor air changeover dial and mixed air control dial at their highest settings.
2. Immerse the outdoor temperature Probe “B” in the coldest medium available (bucket of ice, dry ice, etc.).
3. The outdoor air damper should be closed when the minimum position knob is in the “closed” position. Turn the knob toward “open” until the outdoor air blades are open approximately 15º. This insures that there will always be some fresh air introduced into the plant.

B. ROOM THERMOSTAT

The setting of the room thermostat will determine the maximum temperature for the space to be heat-

Figure 5-3 Actuator Travel Adjustment



ed. Set the thermostat to the desired maintained temperature for this space.

C. MIXED AIR CONTROL

Refer to Figure 5-3. Set the mixed air control using the mixed air control adjusting dial. This setting controls the temperature of the mixture of bypass and outdoor air (air to the coolers). Set it to the temperature desired to be maintained. See Figure 5-5 to determine the heated air temperature rise across the compressor for various compressor sizes and loading conditions. The temperature at which heated air will be discharged to the heated space will be the mixed air temperature plus the air temperature rise shown in Figure 5-5.

D. OUTDOOR AIR CHANGEOVER TEMPERATURE

Refer to Figure 5-2. Set this control dial at the outdoor air temperature at which it is desired to reject all heated air and to use all outdoor air for compressor cooling.

5.4 TROUBLESHOOTING

The information contained in Section 5.5, Troubleshooting Guide has been compiled from data gathered from field service reports and factory experience. It contains symptoms and usual causes for the service problems described. However, **DO NOT** assume that these are the only problems that may occur. All available data concerning the trouble should be systematically analyzed before undertaking any repairs or component replacement procedures.

A detailed visual inspection is worth performing for almost all problems. Doing so may prevent damage to the compressor. Always remember to:

1. Check for loose wiring.
2. Check for damaged piping.
3. Check for parts damaged by heat or an electrical short circuit, usually noticeable by discoloration or burnt odor.

Should your problem persist after making the recommended check, consult your nearest Sullair representative or the Sullair Corporation factory toll free at 1-800-SULLAIR.

Figure 5-4 Discharge Damper Adjustment

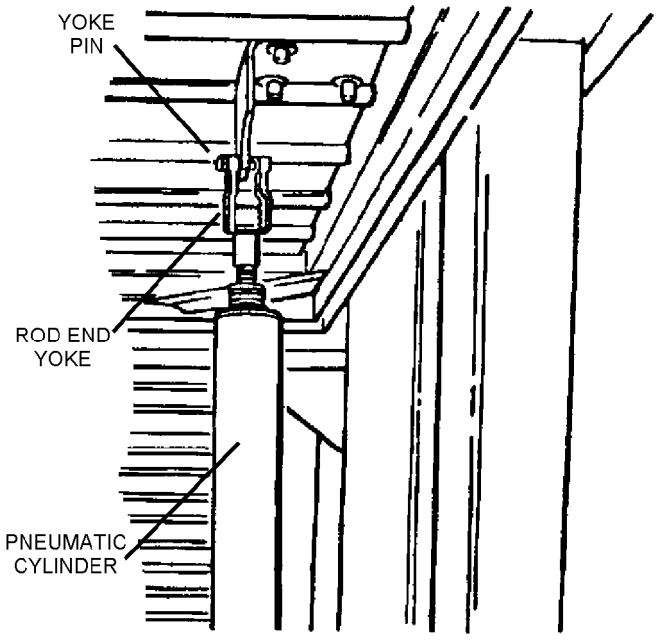
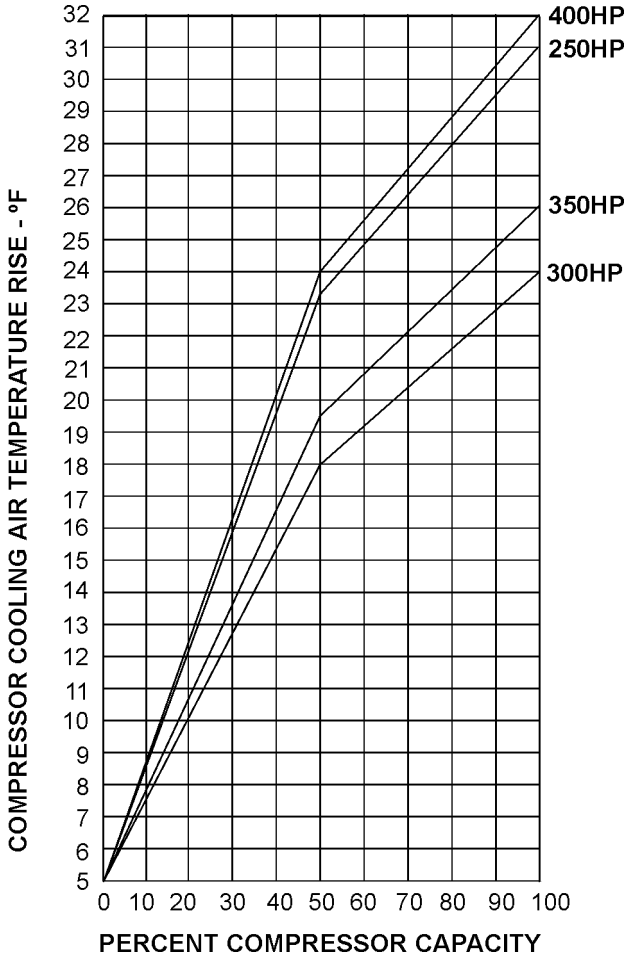


Figure 5-5 Heated Air Temperature Rise for Compressors



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5.5 TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	REMEDY
REJECTED AIR AND RECLAIMED AIR DAMPERS WILL NOT CYCLE	Defective Room Thermostat	Replace.
	Room Thermostat Improperly Wired	Rewire.
	Room Thermostat Not Wired	Wire.
	Defective Damper Motor Actuator	Replace.
	Defective Outdoor Air Changeover Switch in Temperature Controller	Check function and replace if necessary.
	Improperly Set Outdoor Air Changeover Switch	Replace.
	Defective Control Relay	Replace.
EXHAUST AIR COOLER THAN DESIRED ROOM TEMPERATURE	Too Much Outdoor Air is Being Used to Cool Compressor	Adjust outdoor air minimum position knob.
	Defective Mixed Air Temperature Control	Replace.
	Improperly Set Mixed Air Temperature Control Dial.	Reset.
	Improperly Adjusted Damper Linkage	Readjust.
EXHAUST AIR WARMER THAN DESIRED	Improperly Set Mixed Air Temperature Control	Reset.
	Defective Mixed Air Temperature Control	Replace.
	Insufficient Motor Actuator Travel	Adjust.
	Improperly Designed Ductwork	Redesign.
	Improperly Adjusted Damper Linkage	Readjust.
OUTDOOR AIR DAMPER WILL NOT OPEN OR FULLY OPEN WHEN OUTDOOR AIR CHANGEOVER SETTING IS EXCEEDED	Defective Control Relay	Replace.
	Improperly Wired Relay or Temperature Controller	Rewire.
	Improperly Adjusted Motor Actuator Travel	Reset.
	Defective Outdoor Air Changeover Switch	Replace.

5.5 TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOM	PROBABLE CAUSE	REMEDY
REJECTED AIR DAMPER WILL NOT OPEN WHEN ROOM THERMOSTAT SETTING IS EXCEEDED	Outdoor Air Changeover Setting is Too High	Reset.
	Defective Damper Motor Actuator or Room Thermostat	Replace.
	Outdoor Air Changeover Switch or Room Thermostat is Improperly Wired	Rewire.
	Defective Control Relay	Replace.
REJECTED AIR DAMPER WILL NOT CLOSE WHEN COMPRESSOR IS OFF	Defective Damper Motor Actuator	Replace.
	Insufficient Lubrication of Damper Blade Pivots Pins	Relubricate.
COMPRESSOR OIL TEMPERATURE IS TOO HIGH	Improper Ductwork Design or Installation	Correct.
	Bypass Damper Not Closing Fully	Readjust damper linkage or cable.
OUTDOOR AIR DAMPER WILL NOT CLOSE WHEN COMPRESSOR IS OFF	Broken Return Spring in Motor Actuator	Replace spring.
	Insufficient Damper Pivot Pin Lubrication	Relubricate.
	Improperly Adjusted Damper LInkage	Readjust.

NOTES

Section 6
ILLUSTRATIONS AND PARTS LIST

6.1 PROCEDURE FOR ORDERING PARTS

Parts should be ordered from the nearest Sullair Representative or the Representative from whom the compressor was purchased. If for any reason parts cannot be obtained in this manner, contact the factory directly at the address or phone numbers listed below.

When ordering parts always indicate the Serial Number of the compressor. This can be obtained from the Bill of Lading for the compressor or from the Serial Number Plate located on the compressor. For compressor unit parts only, order parts by the unit serial number place located on the compressor unit.

For ordering parts other than those pertaining to the compressor unit, use serial number located on nameplate mounted on control panel.

SULLAIR ASIA, LTD.
Sullair Road, No. 1
Chiwan, Shekou
Shenzhen, Guangdong PRV.
PRC POST CODE 518068
Telephone: 755-6851686
Fax: 755-6853473
www.sullair-asia.com

SULLAIR CORPORATION
3700 East Michigan Boulevard
Michigan City, Indiana 46360 U.S.A.
www.sullair.com
Telephone: 1-800-SULLAIR (U.S.A. Only)
or 1-219-879-5451
Fax: (219) 874-1273

PARTS DEPARTMENT
Fax: (219) 874-1835
www.sullair.com/parts.shtm

SERVICE DEPARTMENT
Fax: (219) 874-1205
www.sullaircompressors.com

SULLAIR EUROPE, S.A.
Zone Des Granges BP 82
42602 Montbrison Cedex, France
Telephone: 33-477968470
Fax: 33-477968499
www.sullaireurope.com

6.2 RECOMMENDED SPARE PARTS LIST

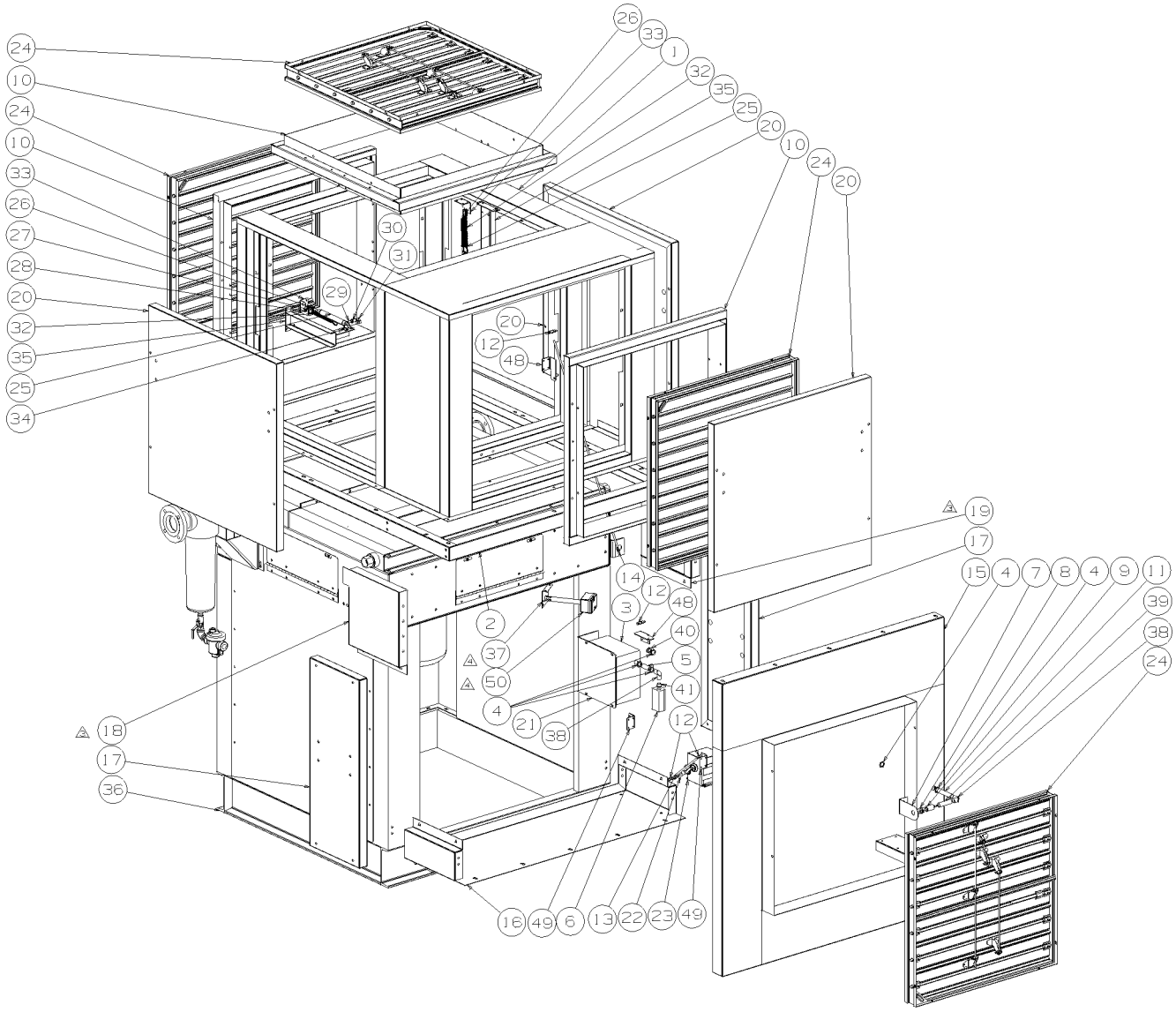
DESCRIPTION	KIT NUMBER	QUANTITY
repair kit for condensate drain no. 02250130-866	02250131-044	1
repair kit for water separator no. 02250111-105 **(I)**	-	1
repair kit for water separator no. 02250111-106 **(I)**	-	1

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.3 ASSEMBLY- EES 200-250HP/ 149-186KW



02250126-958R03

6.3 ASSEMBLY- EES 200-250HP/ 149-186KW

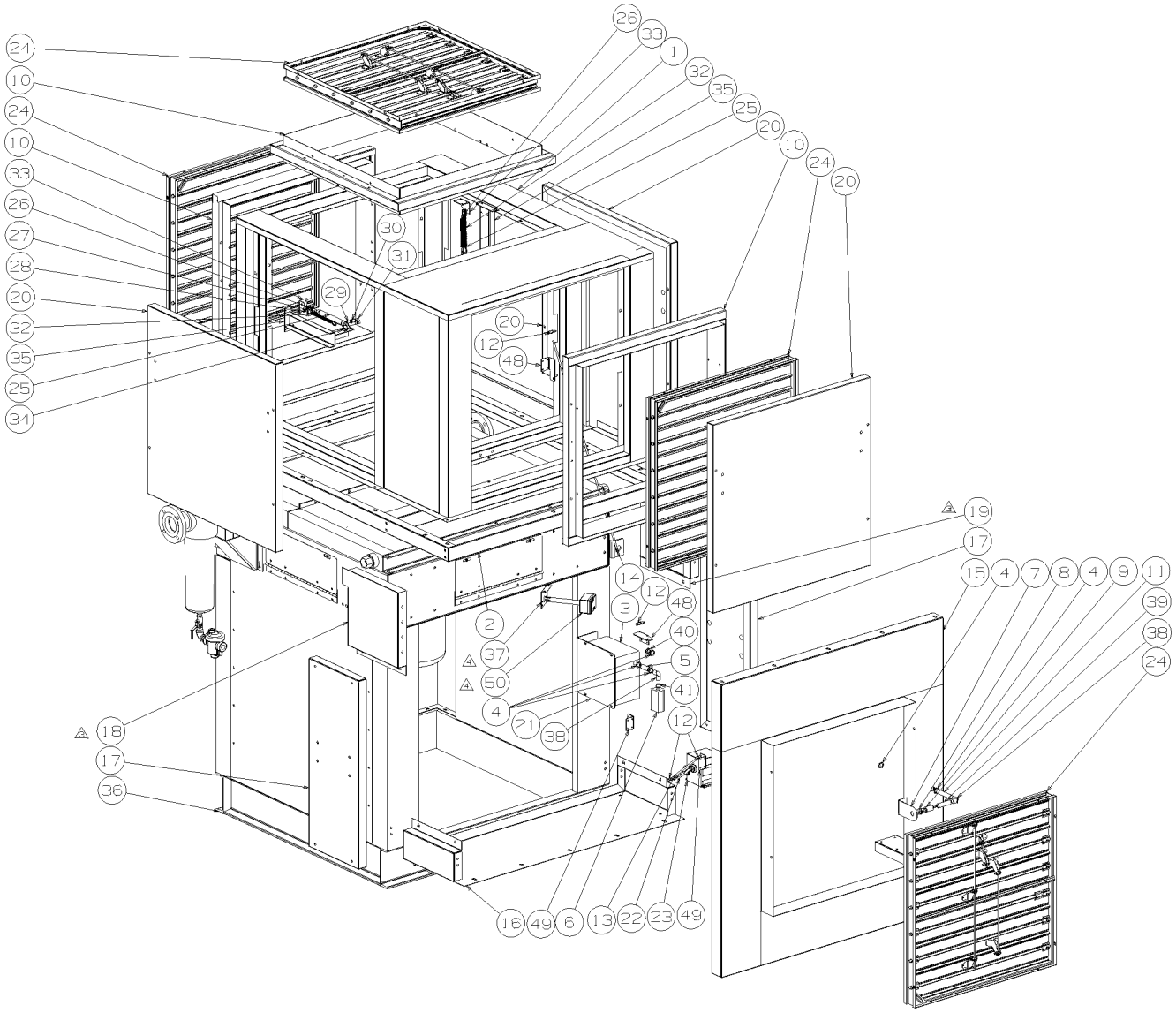
key number	*description*	*part number*	*quantity*
1	enclosure, heat rec disch 100/150hp	019949	1
2	adaptor, EES ts20-250hpac	02250123-921	1
3	enclosure, nema13 10”h x 10”w x 6”d	250002-207	1
4	locknut, n4 conduit sealing	02250071-362	5
5	nipple, conduit 1/2” x 2”	250007-170	1
6	control, temperature	250016-273	1
7	support, probe EES	02250122-542	1
8	connector, cord .312 cable x 1/2” hu	241585	1
9	coupling, conduit rigid	250007-179	1
10	damper, support panel 36 x 36	019951	3
11	nipple, conduit 1/2 x 4”	250007-172	1
12	swivel, damper control 1/4-28	409031	4
13	rod, link 5/16” dia x 11” lg	250000-993	1
14	rod, actuator link EES	02250122-546	1
15	enclosure, EES ts20 lower	02250124-259	1
16	panel, EES btm bypass	02250124-254	1
17	panel, assembly acs EES lower	02250124-362	2
18	panel, assembly EES side rh	02250124-363	1
19	panel, assembly EES side lh	02250124-364	1
20	panel, assembly access heat recovery	02250124-365	3
21	support, EES enclosure	02250124-380	1
22	crank arm lvr27a-602	250000-991	1
23	actuator, motor	250017-186	1
24	damper panel 36 x 36	408952	4
25	cylinder, pneumatic 7/8, 4” str	241906	2
26	rod-end, yoke	040138	2
27	capscr, hex gr5 1/4-20 x 3/4	829104-075	2
28	nut, hex locking 1/4-20	825504-145	4
29	nipple, pipe-xs galv 1/8 x cl	823202-000	2
30	coupling, pipe 1/8 150#	801215-005	2
31	elbow, tube-90m 1/4 x 1/8	813704-125	2
32	spring, extension	241909	2
33	bracket-damper air cylinder	224695	2

(Continued on page 27)

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.3 ASSEMBLY- EES 200-250HP/ 149-186KW



02250126-958R03

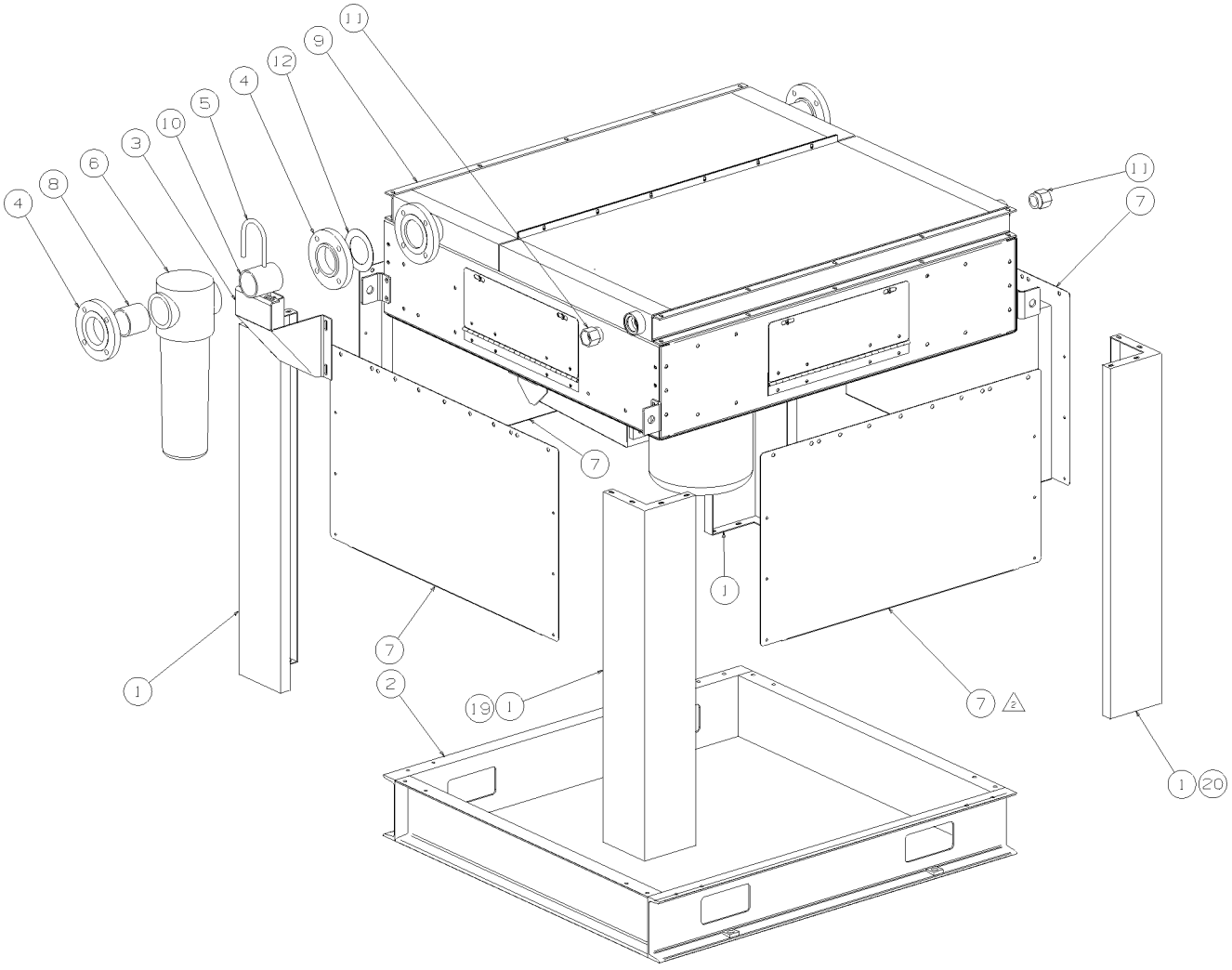
6.3 ASSEMBLY- EES 200-250HP/ 149-186KW (CONTINUED)

key number	*description*	*part number*	*quantity*
34	bracket, pivot	241907	2
35	bracket, air cyl. mtg.	016414	2
36	assy, 200/250 hp remote cooler	02250124-301	1
37	bracket, temperature control	250016-869	1
38	elbow, cor pull 90deg 1/2	846915-050	2
39	nipple, conduit 1/2 x 3”	250007-171	1
40	bushing, conduit plastic 1/2	848815-050	1
41	nipple, chase cond 1/2	847815-050	1
42	nipple, pipe-hx pltd 1/2 x 1/2	868508-050	1
43	valve, ball 1/2”npt	047117	1
44	nipple, pipe-hx pltd 3/4 x 1/2	868512-050	1
47	trap, inverted bucket type	042034	1
48	bracket, damper control	224694	2
49	bracket, actuator motor link	224696	2
50	sensor, temperature	250016-274	1

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.4 HORIZONTAL REMOTE COOLER PACK ASSEMBLY- 250HP/ 186KW



02250124-301R05

6.4 HORIZONTAL REMOTE COOLER PACK ASSEMBLY- 250HP/ 186KW

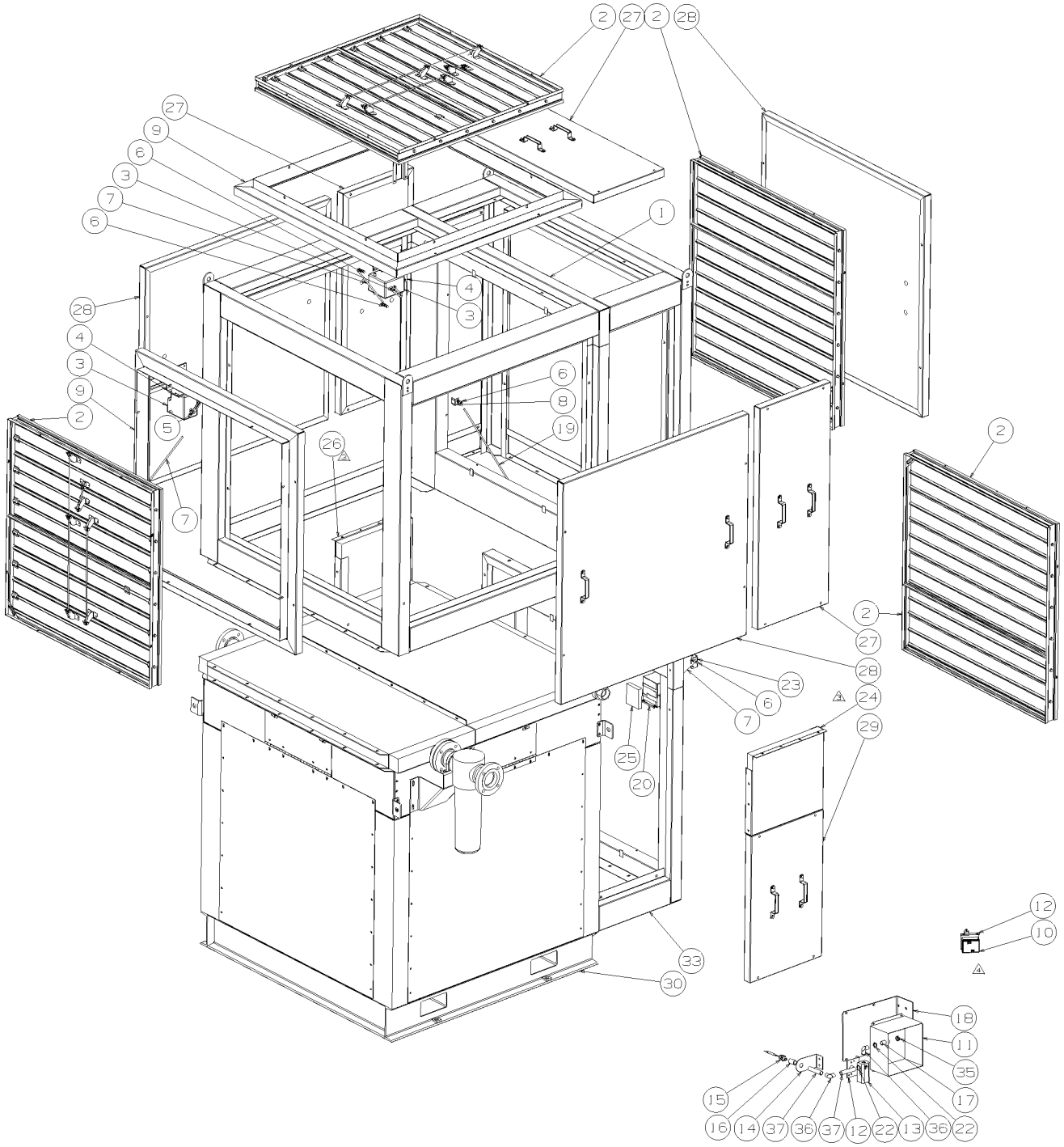
key number	*description*	*part number*	*quantity*
1	support, corner 300/400hp rc	02250121-121	6
2	frame, rem clr ts20	02250124-252	1
3	bracket, seperator mount	02250121-831	1
4	flange, thrd 3” 150# rf	819315-048	2
5	u-bolt, 1/2” x 3” pipe pltd	868308-300	1
6	separator, water dh ws800 3”npt **(I)**	02250111-105	1
7	panel, assembly cooler side 200/250hp	02250126-746	5
8	nipple, pipe 3 x 3	822148-030	1
9	assy, horiz clr integral 200/250 hp	02250125-550	1
10	nipple, pipe 3 x 4	822148-040	1
11	adapter, female pipe 1 1/2 x 1 1/2	811512-150	2
12	gasket, asa flange 150# 3”	240621-008	1
13	panel, assembly cooler side 200/250hp	02250126-983	3

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.5 HORIZONTAL REMOTE COOLER ASSEMBLY- 350HP/ 261KW



02250123-146R03

6.5 HORIZONTAL REMOTE COOLER ASSEMBLY- 350HP/ 261KW

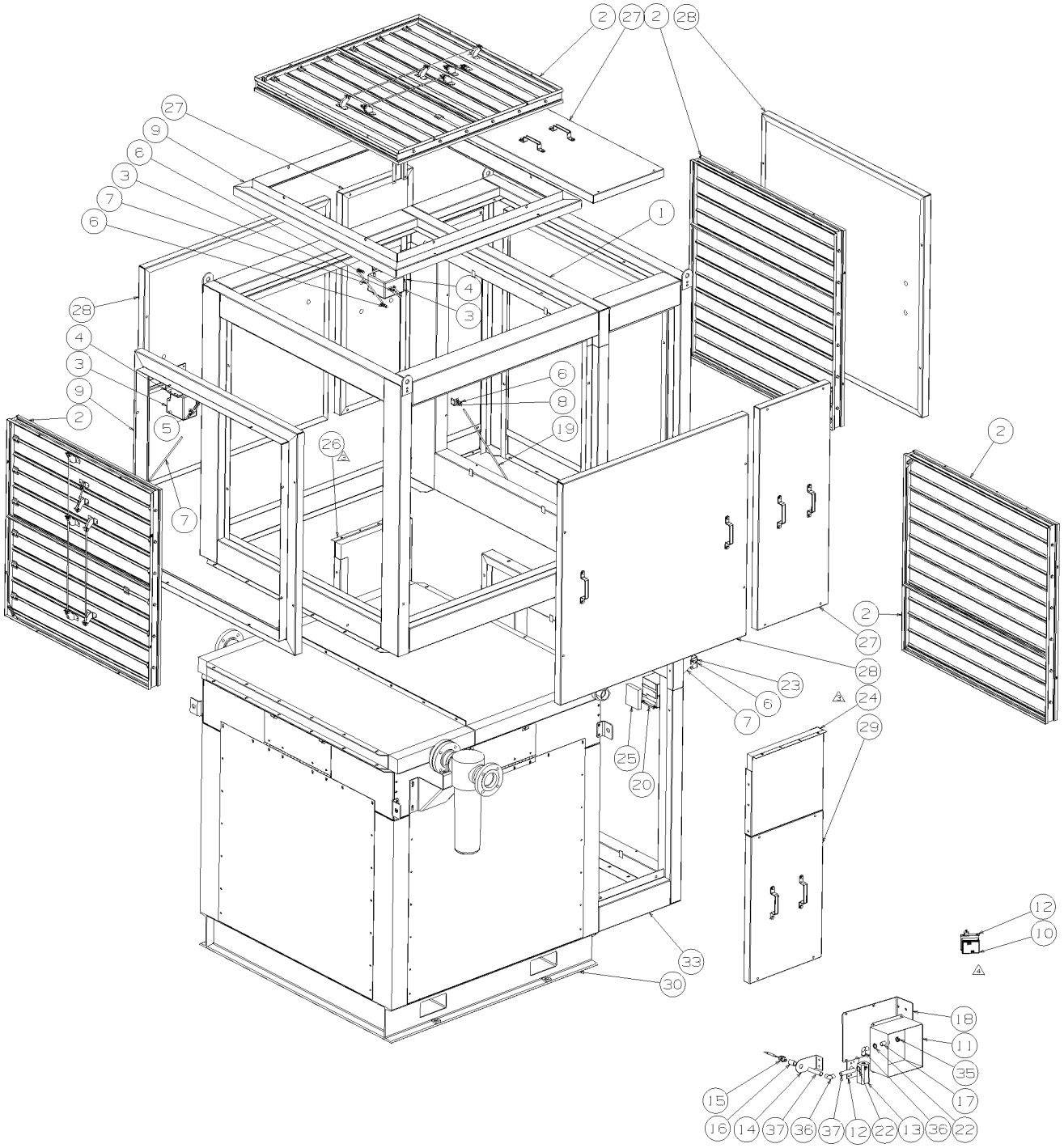
key number	*description*	*part number*	*quantity*
1	EES, upper	02250122-411	1
2	damper panel 48” x 48” nominal oppos	250000-992	4
3	positioner, damper	250001-017	2
4	angle, positioner supt	250004-793	2
5	arm, crank cas-500	408955	2
6	swivel, damper control 1/4-28	409031	8
7	rod, link 5/16” dia x 11” lg	250000-993	3
8	bracket, damper control	250001-019	4
9	panel, damper support 48” x 48”	250001-011	2
10	sensor, temperature	250016-274	1
11	enclosure, nema13 10”h x 10”w x 6”d	250002-207	1
12	bracket, temperature control	250016-869	2
13	control, temperature	250016-273	1
14	support, probe EES	02250122-542	1
15	connector, cord .312 cable x 1/2” hu	241585	1
16	coupling, conduit rigid	250007-179	1
17	nipple, conduit 1/2” x 2”	250007-170	1
18	support, EES enclosure	02250122-541	1
19	rod, actuator link EES	02250122-546	1
20	actuator, motor	250017-186	1
21	crank arm lvr27a-602	250000-991	1
22	locknut, n4 conduit sealing	02250071-362	4
23	bracket, actuator-damper blade	224696	1
24	panel, assembly side EES	02250124-332	1
25	controller, motor actuator	250016-275	1
26	panel, assembly side EES lh	02250124-337	1
27	panel, assembly access EES upper	02250124-331	3
28	panel, assembly access 54x54	02250124-330	3
29	panel, assembly access EES lower	02250124-333	2
30	assy, horiz clr 300/350 hp	02250123-120	1
31	panel, assembly EES cooler side	02250124-334	3
32	enclosure, EES TS32 lower	02250122-506	1
33	panel, EES bottom bypass	02250123-212	1

(Continued on page 33)

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.5 HORIZONTAL REMOTE COOLER ASSEMBLY- 350HP/ 261KW



02250123-146R03

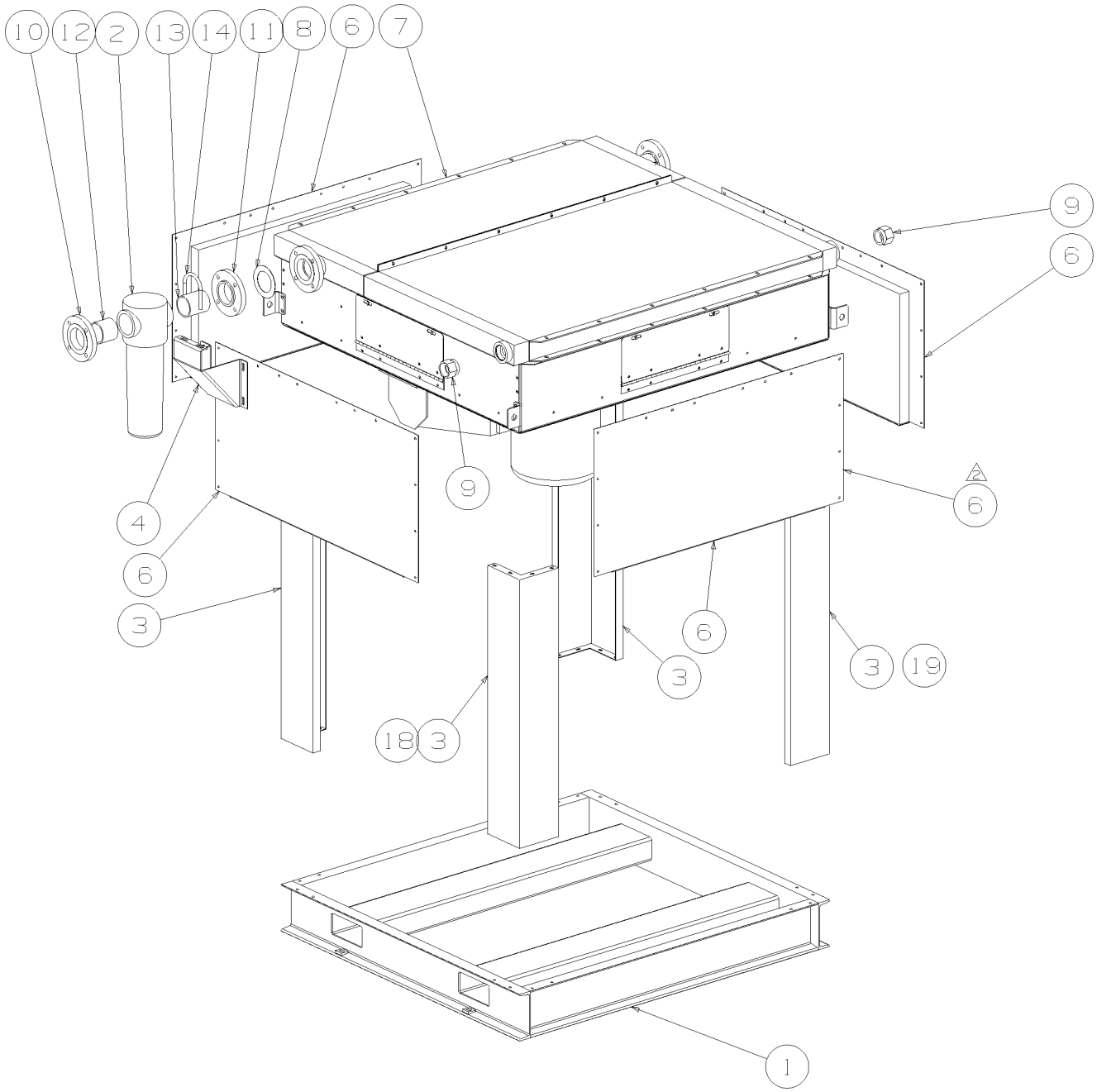
6.5 HORIZONTAL REMOTE COOLER ASSEMBLY- 350HP/ 261KW (CONTINUED)

key number	*description*	*part number*	*quantity*
34	nipple, chase cond 1/2	847815-050	1
35	bushing, conduit plastic 1/2	848815-050	1
36	elbow, cor pull 90deg 1/2	846915-050	2
37	nipple, conduit 1/2 x 4”	250007-172	2

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.6 HORIZONTAL COOLER PACK ASSEMBLY- 350HP/ 261KW (REMOTE)



02250123-120R06

6.6 HORIZONTAL COOLER PACK ASSEMBLY- 350HP/ 261KW (REMOTE)

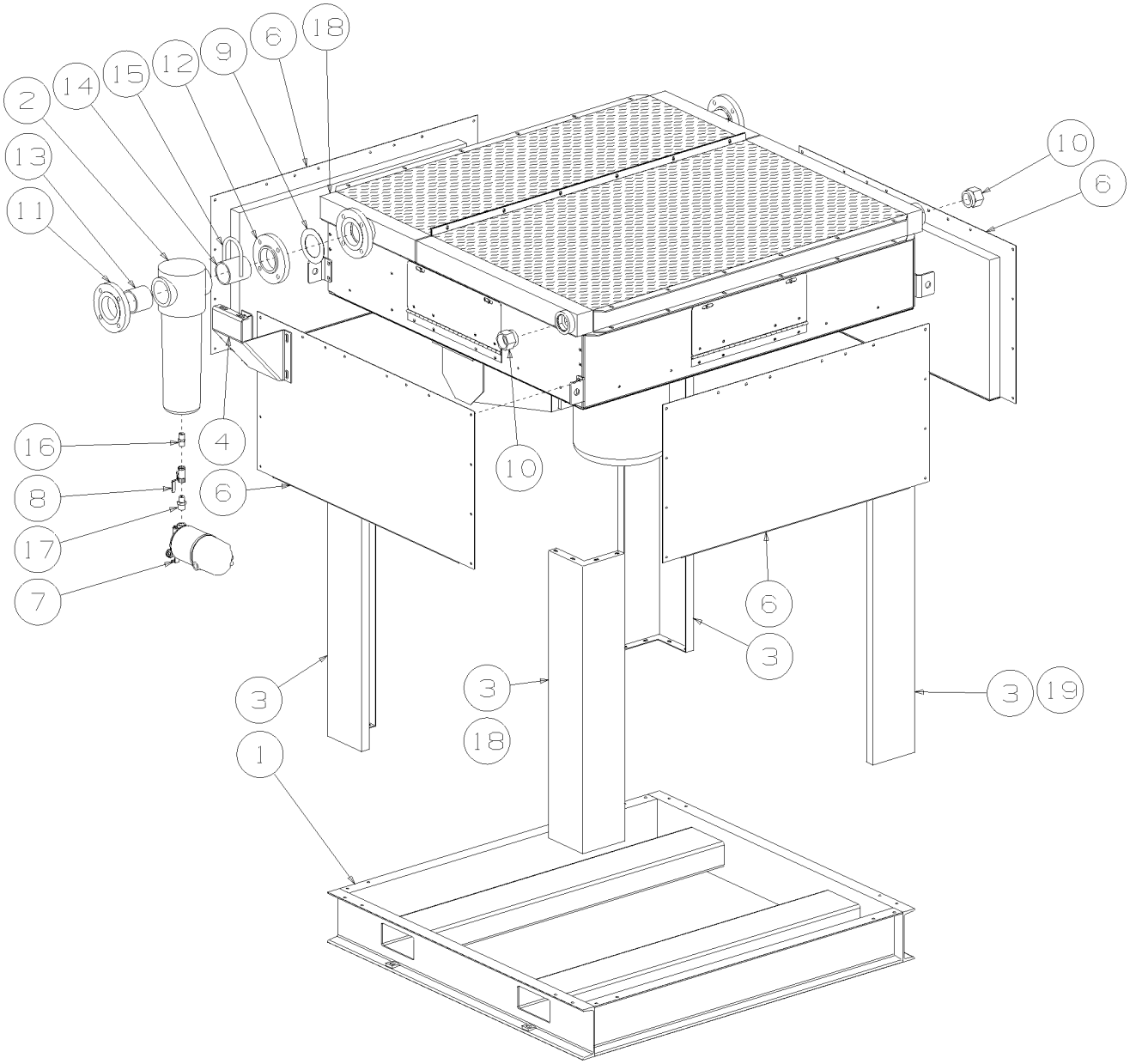
key number	*description*	*part number*	*quantity*
1	frame, rem clr 300/400 hp	02210121-124	1
2	separator, water dh ws800 3”npt **(I)**	02250111-105	1
3	support, corner 300/400hp rc	02250121-121	6
4	bracket, seperator mount	02250121-831	1
5	panel, assembly EES cooler side	02250124-334	3
6	panel, assembly side 300/400 hp rem clr	02250124-335	4
7	drawing, assy horiz clr integral 300/350	02250125-436	1
8	gasket, asa flange 150# 3”	240621-008	1
9	adapter, female pipe 2 x 2	811516-200	2
10	flange, slp-on 3” 150#	819215-048	1
11	flange, thrd 3” 150# rf	819315-048	1
12	nipple, pipe 3 x 3	822148-030	1
13	nipple, pipe 3 x 4	822148-040	1
14	u-bolt, 1/2” x 3” pipe pltd	868308-300	1

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.7 HORIZONTAL REMOTE COOLER PACK ASSEMBLY WITH DRAIN OPTION- 350HP/ 261KW



02250130-993R01

6.7 HORIZONTAL REMOTE COOLER PACK ASSEMBLY WITH DRAIN OPTION- 350HP/ 261KW

key number	*description*	*part number*	*quantity*
1	frame, rem clr 300/400 hp	02210121-124	1
2	separator, water dh ws800 3”npt **(I)**	02250111-105	1
3	support, corner 300/400hp rc	02250121-121	6
4	bracket, seperator mount	02250121-831	1
5	panel, assembly EES cooler side	02250124-334	3
6	panel, assembly side 300/400 hp rem clr	02250124-335	4
7	drain, electric condensate scd400 **(II)**	02250130-866	1
8	valve, ball 1/2”npt	047117	1
9	gasket, asa flange 150# 3”	240621-008	1
10	adapter, female pipe 2 x 2	811516-200	2
11	flange, slp-on 3” 150#	819215-048	1
12	flange, thrd 3” 150# rf	819315-048	1
13	nipple, pipe 3 x 3	822148-030	1
14	nipple, pipe 3 x 4	822148-040	1
15	u-bolt, 1/2” x 3” pipe pltd	868308-300	1
16	nipple, pipe-hx pltd 1/2 x 1/2	868508-050	1
17	nipple, pipe-hx pltd 3/4 x 1/2	868512-050	1
18	cooler pack subassembly(300/350hp) **(III)**	-	1

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

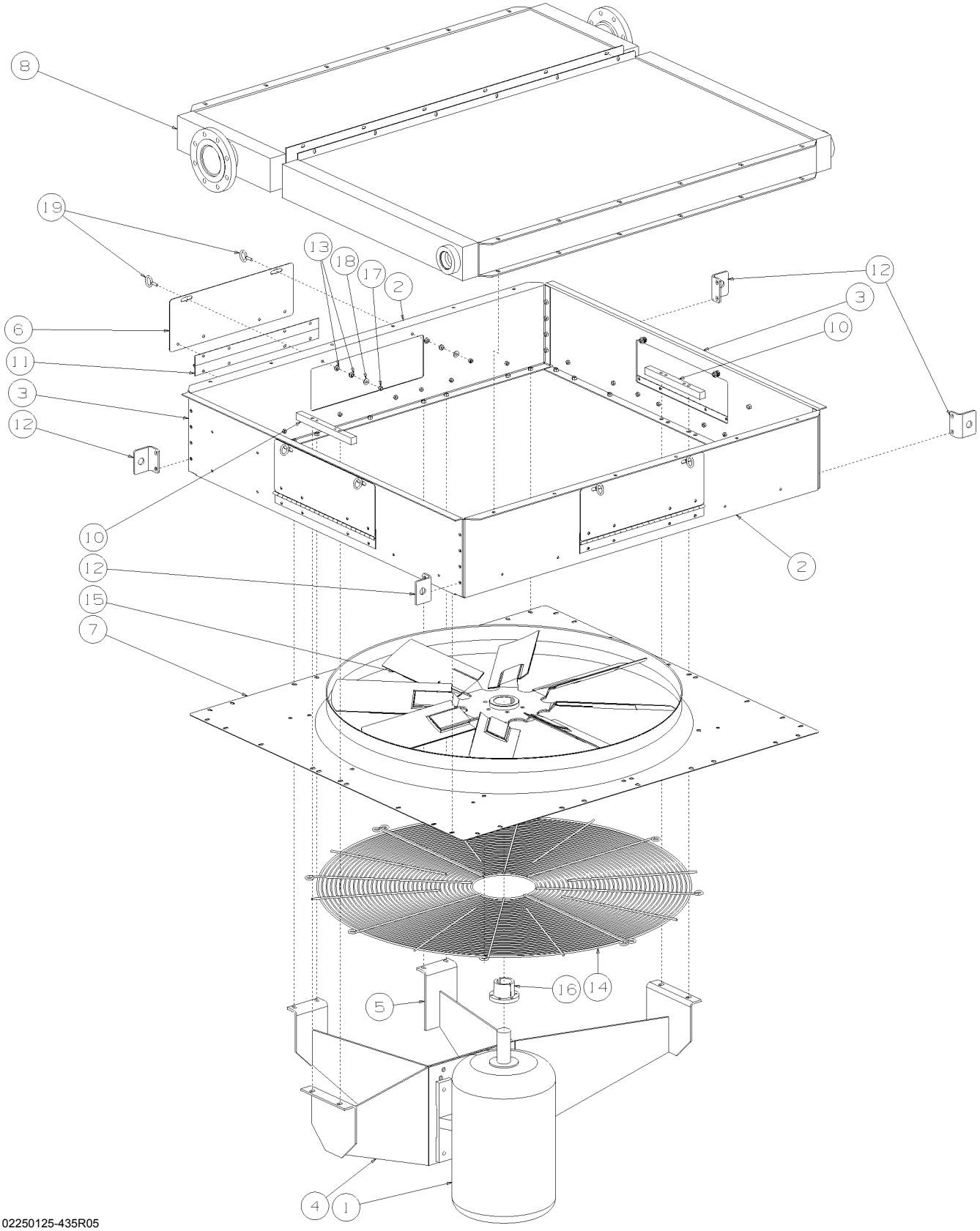
(II) For maintenance on condensate drain no. 0250130-866, order repair kit no. 02250131-044.

(III) Cooler pack assemblies may vary in accordance with machine. Consult factory to determine proper part number.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.8 HORIZONTAL COOLER ASSEMBLY- 450HP/ 336KW (INTEGRAL)



02250125-435R05

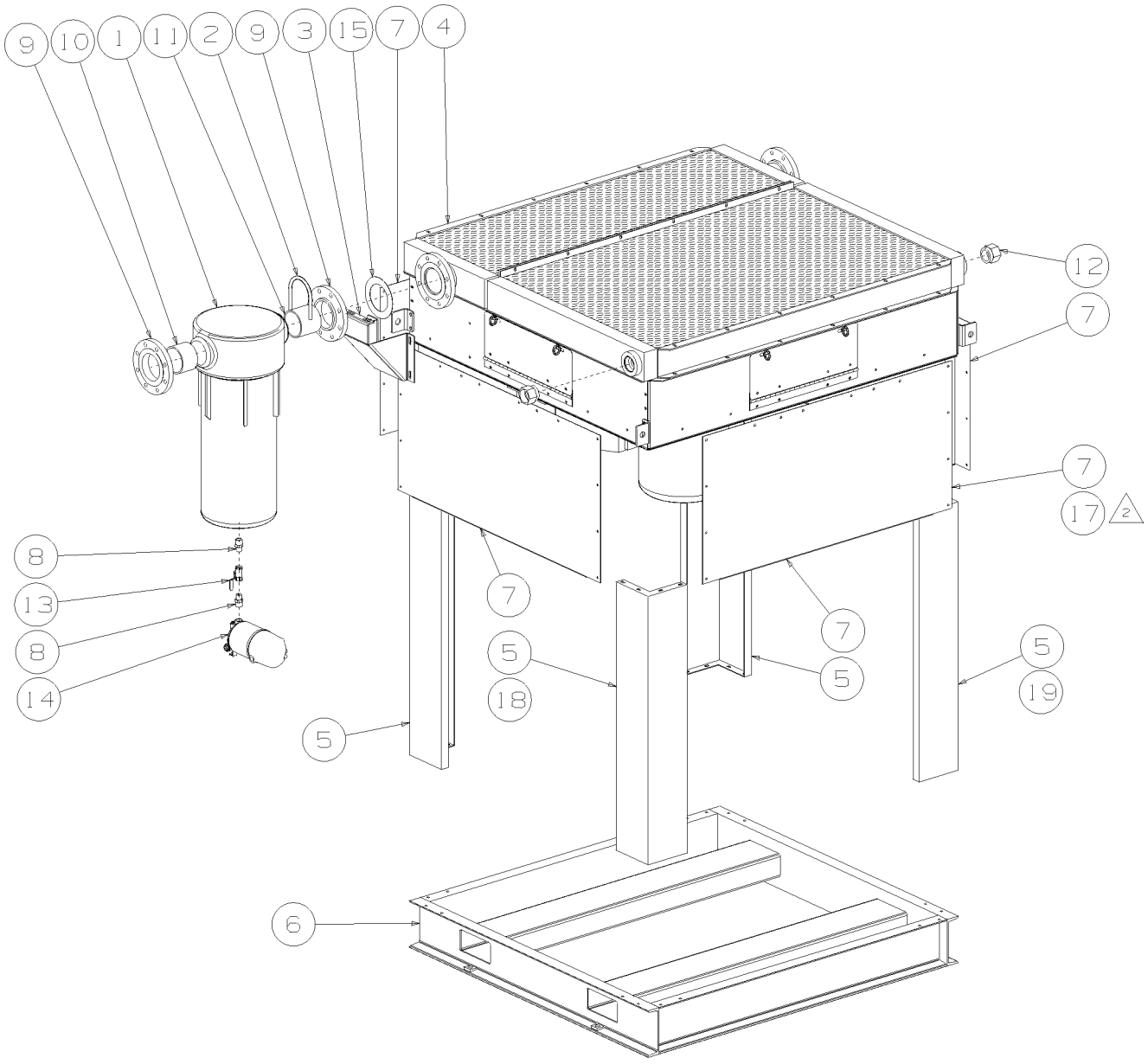
6.8 HORIZONTAL COOLER ASSEMBLY- 450HP/ 336KW (INTEGRAL)

key number	*description*	*part number*	*quantity*
1	motor, 8 pole tese toshiba	02250121-110	1
2	panel, adapter 400hp clr pk	02250121-117	2
3	panel, adapter 400hp clr pk w/clean	02250121-118	2
4	saddle, motor supt 300/400hp clr pk	02250121-119	1
5	support, mtr 300/400hp clr pk	02250121-120	1
6	plate, clean out cover	02250121-123	4
7	panel, venturi 48” TS32-300-450	02250121-343	1
8	cooler, air after 400-450 hp	02250122-215	1
9	cooler, oil 400-450 hp side x side	02250122-217	1
10	bar, back-up horizontal clr pk	02250123-797	2
11	hinge, door	02250125-402	4
12	lug, lifting clr pk - 90deg bend	02250132-040	4
13	grommet, rubber	040125	16
14	guard, fan (1600q)	241347	2
15	fan, 48” dia 25hp 1200rpm	250000-847	1
16	bushing, split taper 2-1/8” bore	250000-977	1
17	nut, hex locking 5/16-18	825505-166	8
18	washer, pl-b reg pltd 5/16	838205-071	8
19	eyebolt, 5/16-18 x 1 1/8” pltd	839105-112	8

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.9 HORIZONTAL REMOTE COOLER PACK ASSEMBLY WITH DRAIN OPTION- 400-450HP/ 298-336KW



02250131-037R01

6.9 HORIZONTAL REMOTE COOLER PACK ASSEMBLY WITH DRAIN OPTION- 400-450HP/ 298-336KW

key number	*description*	*part number*	*quantity*
1	seperator, water ws1000 **(I)**	02250111-106	1
2	u-bolt, 1/2” x 4” pipe pltd	868308-400	1
3	bracket, seperator mount	02250121-831	1
4	cooler pack subassembly (400/450hp) **(II)**	-	1
5	support, corner 300/400hp rc	02250121-121	4
6	frame, rem clr 300/400 hp	02210121-124	1
7	panel, assembly side 300/400 hp rem clr	02250124-335	4
8	nipple, pipe-hx pltd 3/4 x 1/2	868512-050	2
9	flange, thrd 4” 150# rf	819315-064	2
10	nipple, pipe 4 x 3	822164-030	1
11	nipple, pipe 4 x 4	822164-040	1
12	adapter, female pipe 2 x 2	811516-200	2
13	valve, ball 1/2”npt	047117	1
14	drain, electric condensate scd400 **(III)**	02250130-866	1
15	gasket, asa flange 150# 4”	240621-010	1

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

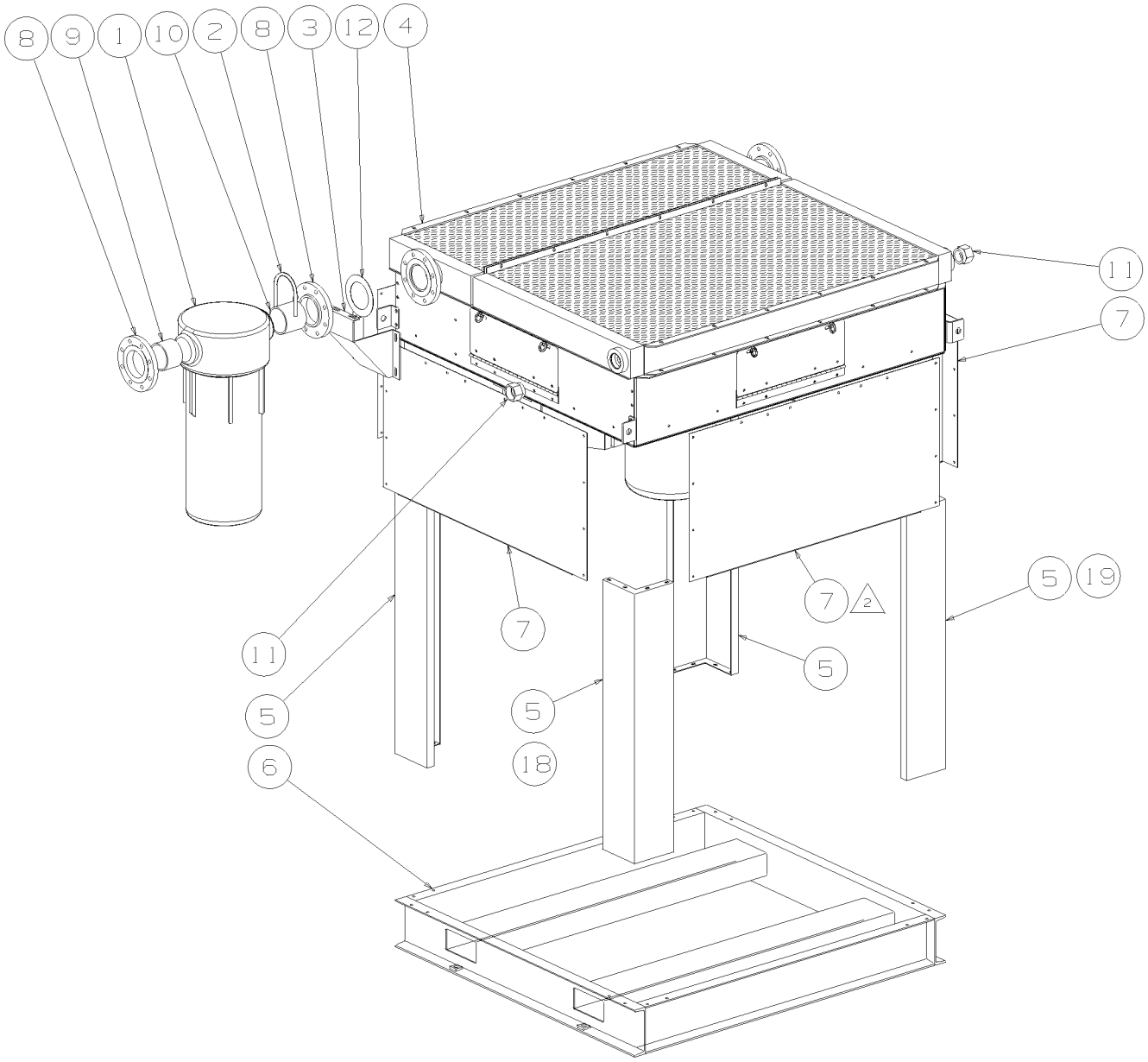
(II) Cooler pack assemblies may vary in accordance with machine. Consult factory to determine proper part number.

(III) For maintenance on condensate drain no. 02250130-866, order repair kit no. 02250131-044.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.10 HORIZONTAL REMOTE COOLER PACK ASSEMBLY- 450HP/ 336KW



02250123-443R05

6.10 HORIZONTAL REMOTE COOLER PACK ASSEMBLY- 450HP/ 336KW

key number	*description*	*part number*	*quantity*
1	seperator, water ws1000 **(I)**	02250111-106	1
2	u-bolt, 1/2” x 4” pipe pltd	868308-400	1
3	bracket, seperator mount	02250121-831	1
4	cooler pack subassembly **(II)**	-	1
5	support, corner 300/400hp rc	02250121-121	4
6	frame, rem clr 300/400 hp	02210121-124	1
7	panel, assembly side 300/400 hp rem clr	02250124-335	4
8	flange, thrd 4” 150# rf	819315-064	2
9	nipple, pipe 4 x 3	822164-030	1
10	nipple, pipe 4 x 4	822164-040	1
11	adapter, female pipe 2 x 2	811516-200	2
12	gasket, asa flange 150# 4”	240621-010	1

(I) For a breakdown of maintenance parts for this item, please consult factory with serial number of your Heat Recovery System.

(II) Cooler pack assemblies may vary in accordance with machine. Consult factory to determine proper part number.

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

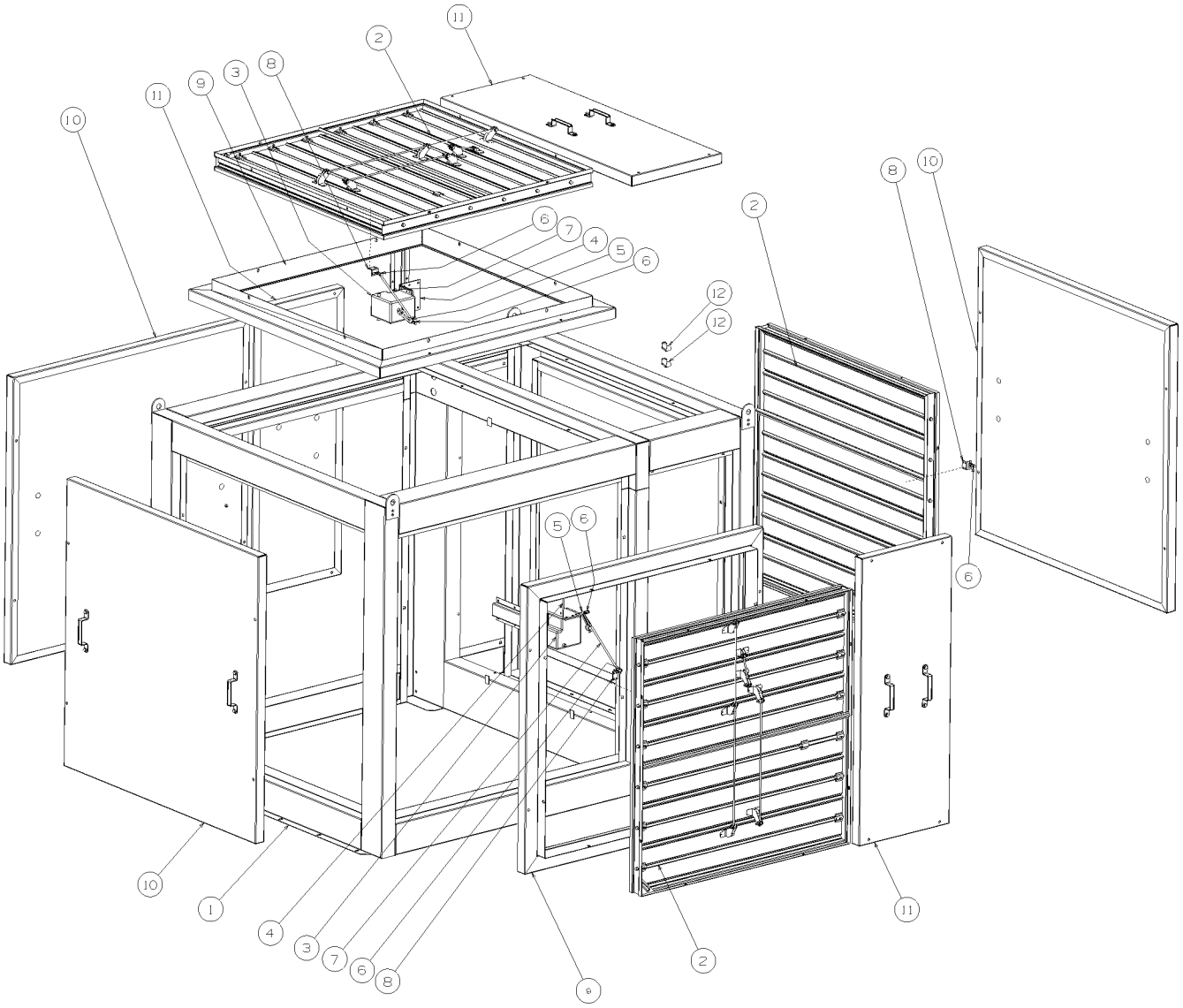
Section 6
ILLUSTRATIONS AND PARTS LIST

6.11 EES ENCLOSURE- “DOGHOUSE” ASSEMBLY (INTEGRAL)

NOTE:

1. ASSEMBLY DRAWINGS DO NOT INCLUDE ALL MOUNTING HARDWARE. REFER TO BILL-OF-MATERIALS FOR COMPLETE PARTS LISTING.

2. TEMPERATURE SENSOR TO BE MOUNTED IN LOWER CHAMBER TO THE BOTTOM OF THE FAN VENTURI PANEL. DRILL MOUNTING HOLES FOR BRACKET AT ASSEMBLY.



02250133-207R00

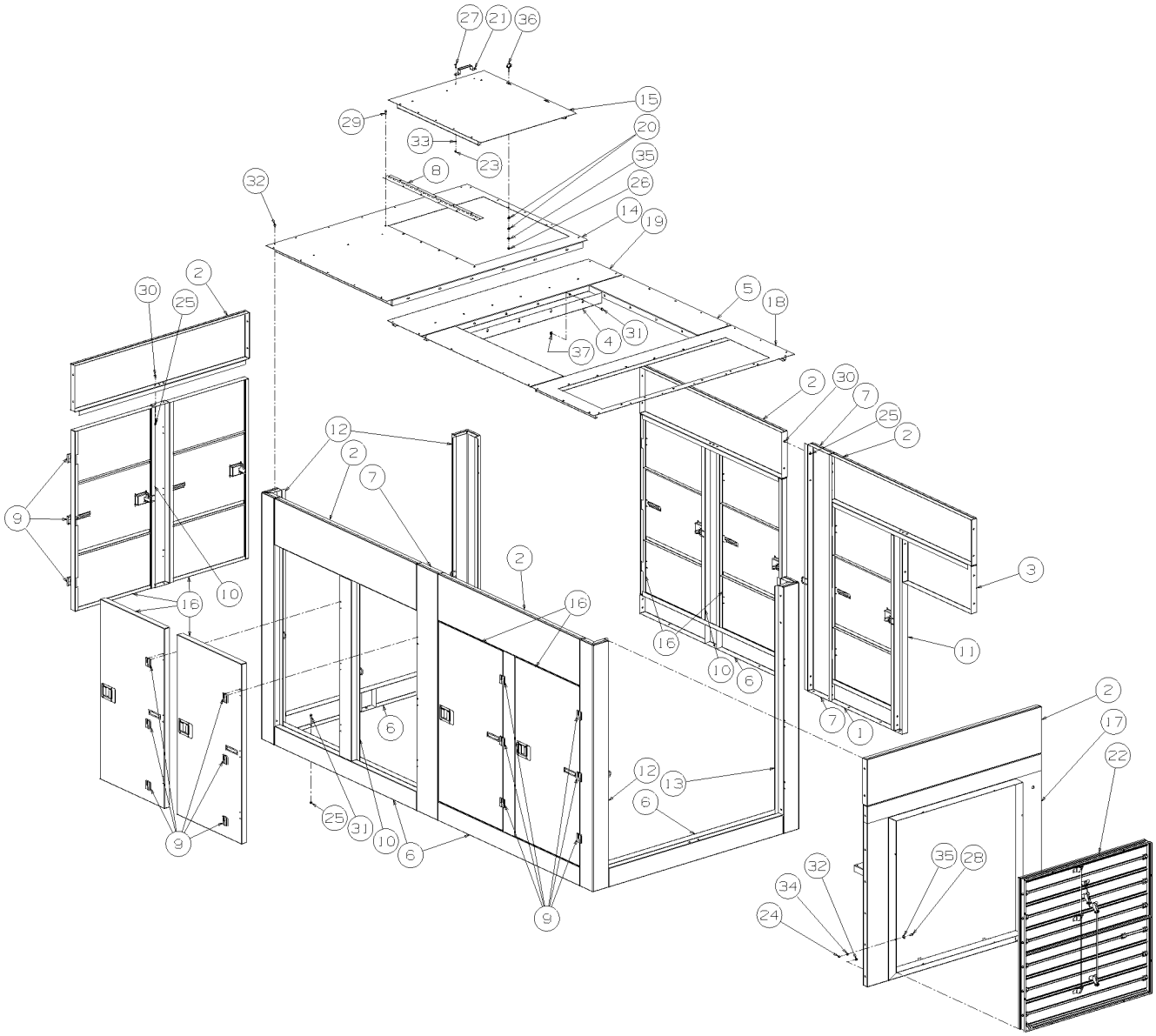
6.11 EES ENCLOSURE- “DOGHOUSE” ASSEMBLY (INTEGRAL)

key number	*description*	*part number*	*quantity*
1	EES, upper	02250122-411	1
2	panel, damper 48” x 48” nominal oppos	250000-992	3
3	positioner, damper	250001-017	2
4	angle, positioner supt	250004-793	2
5	arm, crank cas-500	408955	2
6	swivel, damper control 1/4-28	409031	5
7	rod, link 5/16” dia x 11” lg	250000-993	2
8	bracket, damper control	250001-019	3
9	panel, damper support 48” x 48”	250001-011	2
10	panel, assembly access 54x54	02250124-330	3
11	panel, assembly access EES upper	02250124-331	3
12	elbow, cor pull 90deg 1/2	846915-050	2

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.12 EES ENCLOSURE- 200-250HP/ 149-186KW (INTEGRAL)



02250133-208R01

6.12 EES ENCLOSURE- 200-250HP/ 149-186KW (INTEGRAL)

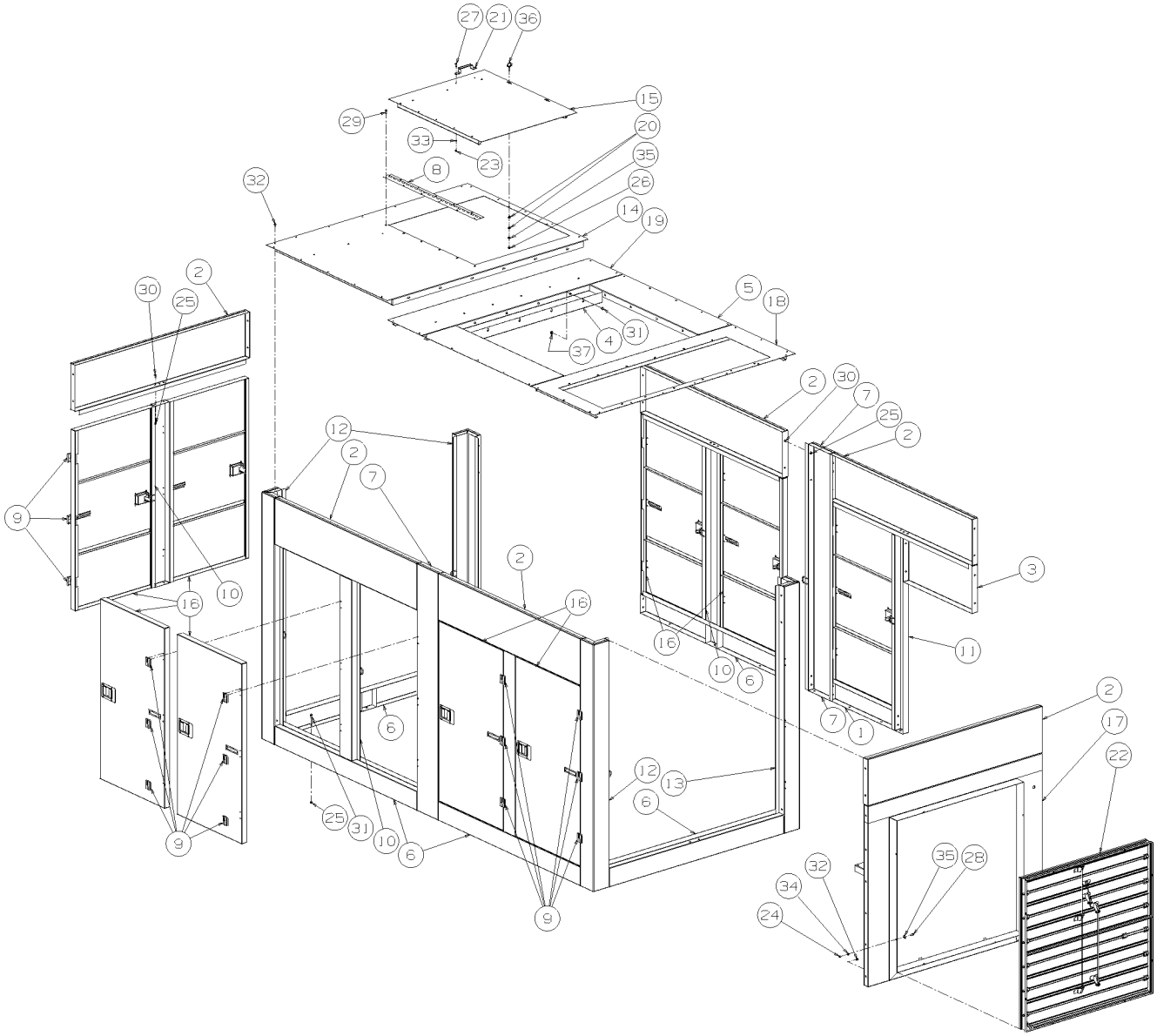
key number	*description*	*part number*	*quantity*
1	panel, sill short TS32A	02250124-938	1
2	panel, header side TS32A	02250124-939	6
3	panel, header 60” str TS32 encl	02250124-942	1
4	angle, roof seal TS32A-200/250ac	02250125-070	4
5	panel, roof side TS32A-200/250ac	02250126-925	2
6	panel, sill TS32A	02250129-475	5
7	support, center TS32A	02250129-478	2
8	hinge, separator access door	02250129-761	1
9	hinge, 180deg. screw-on lift-off rh	02250129-863	27
10	support, canopy TS32A	02250130-219	4
11	support, starter side TS32A	02250130-221	1
12	support, corner TS32A	02250130-222	3
13	support, corner spcl TS32A	02250130-223	1
14	panel, roof sump end TS32A	02250130-224	1
15	cover, separator access	02250130-226	1
16	panel, access assy 30” x 57”	02250130-227	9
17	panel, enclosure EES end TS32	02250133-011	1
18	panel, roof end TS32A-200/250 int EES	02250133-335	1
19	panel, roof mid EES TS32A-200/250ac	02250133-336	1
20	grommet, rubber	040125	4
21	handle, canopy	042262	1
22	damper panel 48” x 48” nominal oppos	250000-992	1
23	nut, hex pltd 1/4-20	825104-226	2
24	nut, hex pltd 5/16-18	825105-273	
25	nut, hex f pltd 5/16-18	825305-283	13
26	nut, hex locking 5/16-18	825505-166	2
27	capscr, hex gr8 1/4-20 x 3/4	827904-075	2
28	capscr, hex gr5 5/16-18 x 3/4	828605-075	8
29	capscr, hex gr5 5/16-18 x 3/4	829105-075	6
30	screw, hex ser washer 5/16-18 x 1/2	829705-050	86
31	screw, hex ser washer 5/16-18 x 3/4	829705-075	60
32	screw, self-drill 1/4 x 1/2	834504-050	67

(Continued on page 49)

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.12 EES ENCLOSURE- 200-250HP/ 149-186KW (INTEGRAL)



02250133-208R01

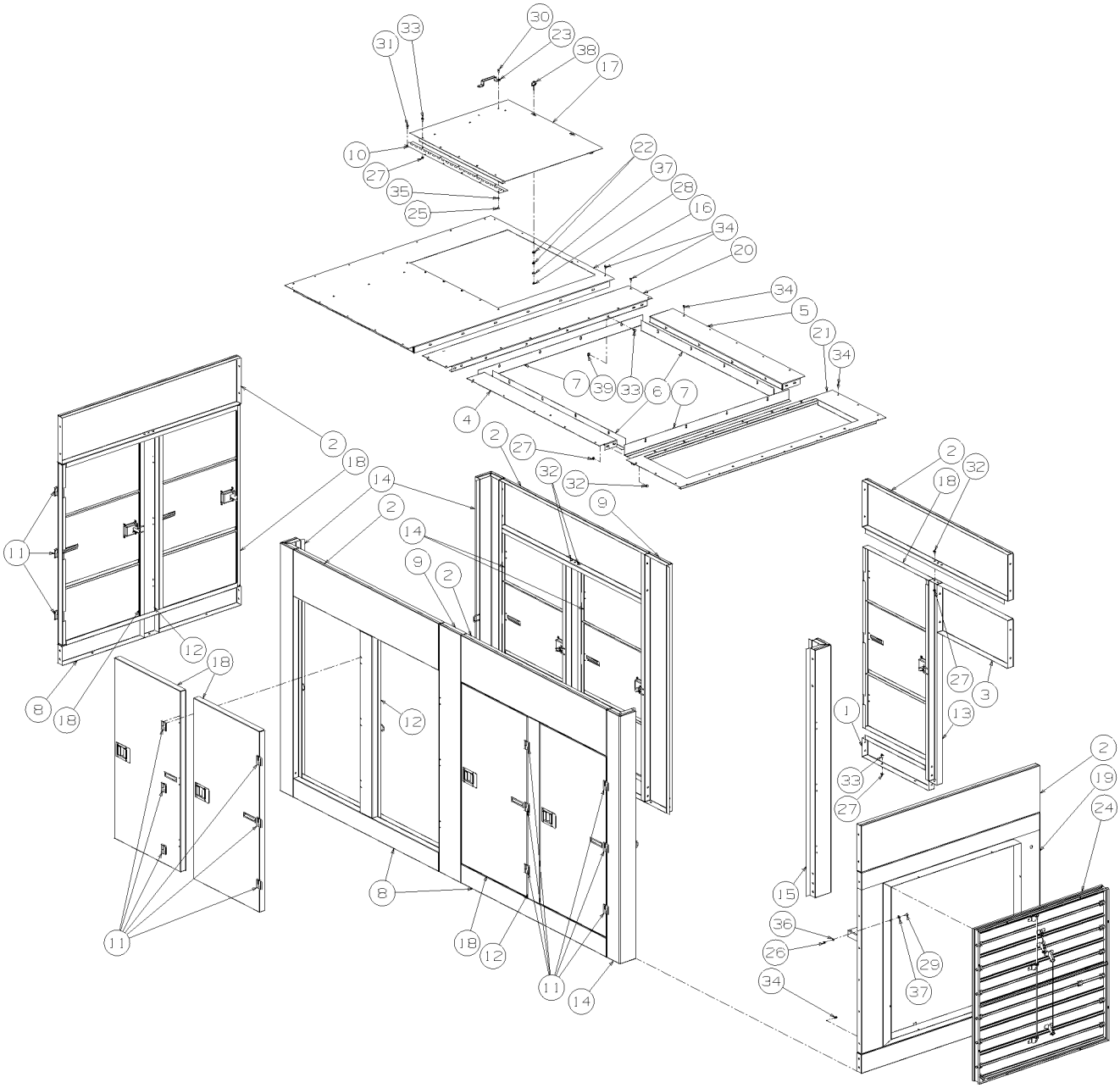
6.12 EES ENCLOSURE- 200-250HP/ 149-186KW (INTEGRAL) (CONTINUED)

key number	*description*	*part number*	*quantity*
33	washer, spr lock reg pltd 1/4	837804-062	2
34	washer, spr lock reg pltd 5/16	837805-078	8
35	washer, pl-b reg pltd 5/16	838205-071	10
36	eyebolt, 5/16-18 x 1 1/8” pltd	839105-112	2
37	nut, retainer 5/16-18 .092	861405-092	16

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.13 EES ENCLOSURE- 300-350HP/ 224-261KW (INTEGRAL)



02250133-209R01

6.13 EES ENCLOSURE- 300-350HP/ 224-261KW (INTEGRAL)

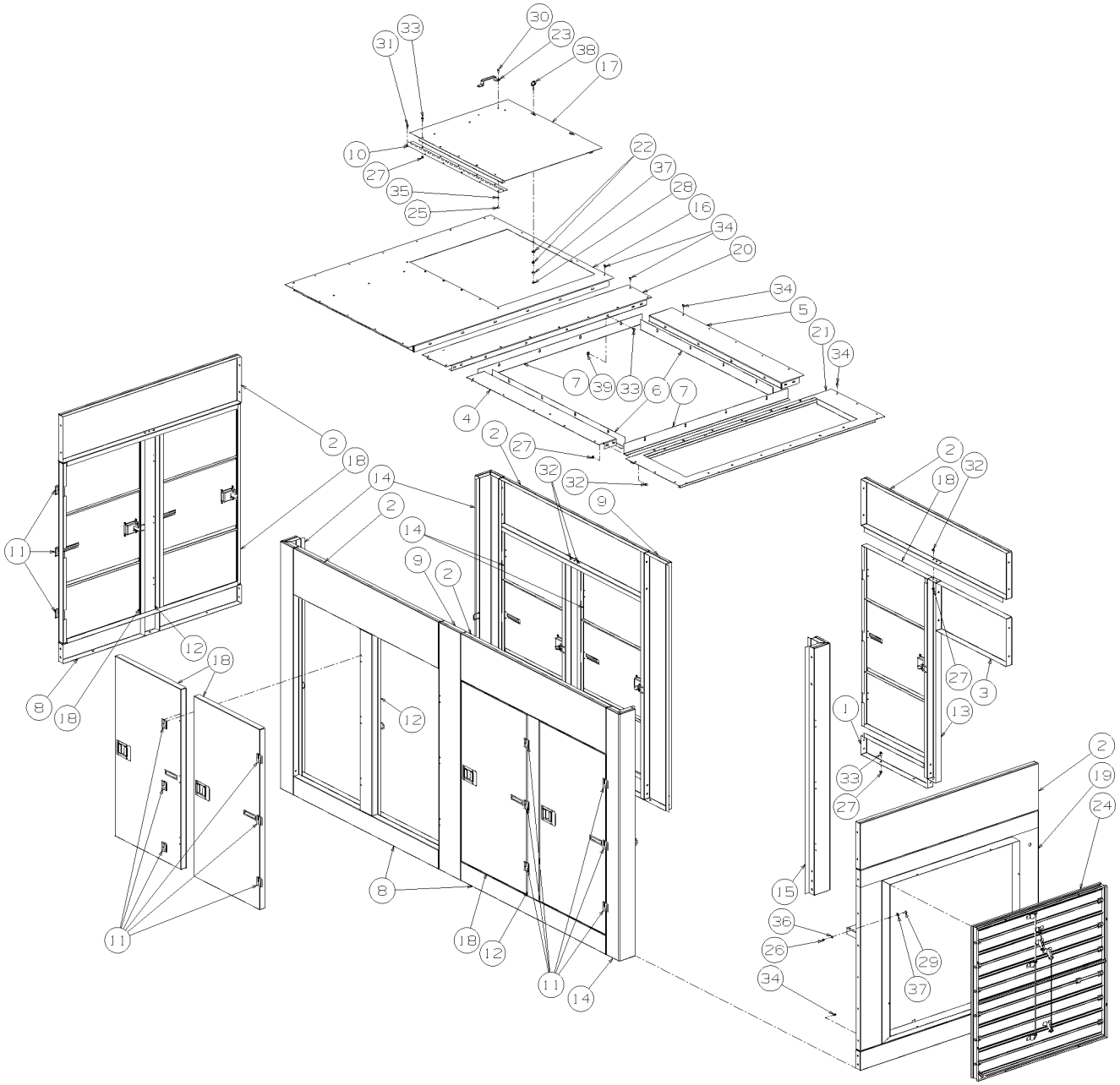
key number	*description*	*part number*	*quantity*
1	panel, sill short TS32A	02250124-938	1
2	panel, header side TS32A	02250124-939	6
3	panel, header 60” str TS32 encl	02250124-942	1
4	panel, roof motor side TS32A-300/350ac	02250127-100	1
5	panel, roof starter side TS32A-300/350	02250127-101	1
6	angle, roof seal TS32A-300/350ac	02250127-103	2
7	angle, roof seal TS32A-300/350ac	02250127-104	2
8	panel, sill TS32A	02250129-475	5
9	support, center TS32A	02250129-478	2
10	hinge, separator access door	02250129-761	1
11	hinge, 180deg. screw-on lift-off rh	02250129-863	27
12	support, canopy TS32A	02250130-219	4
13	support, starter side TS32A	02250130-221	1
14	support, corner TS32A	02250130-222	3
15	support, corner spcl TS32A	02250130-223	1
16	panel, roof sump end TS32A	02250130-224	1
17	cover, separator access	02250130-226	1
18	panel, access assy 30” x 57”	02250130-227	9
19	panel, enclosure EES end TS32	02250133-011	1
20	panel, roof center TS32A intac EES	02250133-070	1
21	panel, roof end TS32A int EES	02250133-071	1
22	grommet, rubber	040125	4
23	handle, canopy	042262	1
24	damper panel 48” x 48” nominal oppos	250000-992	1
25	nut, hex pltd 1/4-20	825104-226	2
26	nut, hex pltd 5/16-18	825105-273	8
27	nut, hex f pltd 5/16-18	825305-283	13
28	nut, hex locking 5/16-18	825505-166	2
29	capscr, hex gr5 5/16-18 x 3/4	828605-075	8
30	capscr, hex gr5 1/4-20 x 3/4	829104-075	2
31	capscr, hex gr5 5/16-18 x 3/4	829105-075	6
32	screw, hex ser washer 5/16-18 x 1/2	829705-050	84

(Continued on page 53)

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.13 EES ENCLOSURE- 300-350HP/ 224-261KW (INTEGRAL)



02250133-209R01

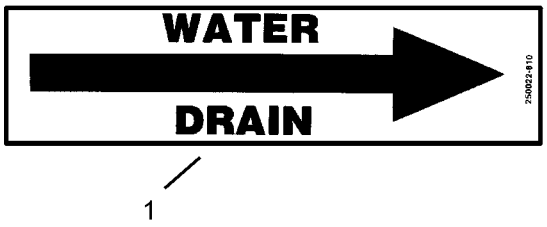
6.13 EES ENCLOSURE- 300-350HP/ 224-261KW (INTEGRAL) (CONTINUED)

key number	*description*	*part number*	*quantity*
33	screw, hex ser washer 5/16-18 x 3/4	829705-075	60
34	screw, self-drill 1/4 x 1/2	834504-050	67
35	washer, spr lock reg pltd 1/4	837804-062	2
36	washer, spr lock reg pltd 5/16	837805-078	8
37	washer, pl-b reg pltd 5/16	838205-071	6
38	eyebolt, 5/16-18 x 1 1/8” pltd	839105-112	2
39	nut, retainer 5/16-18 .092	861405-092	16

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

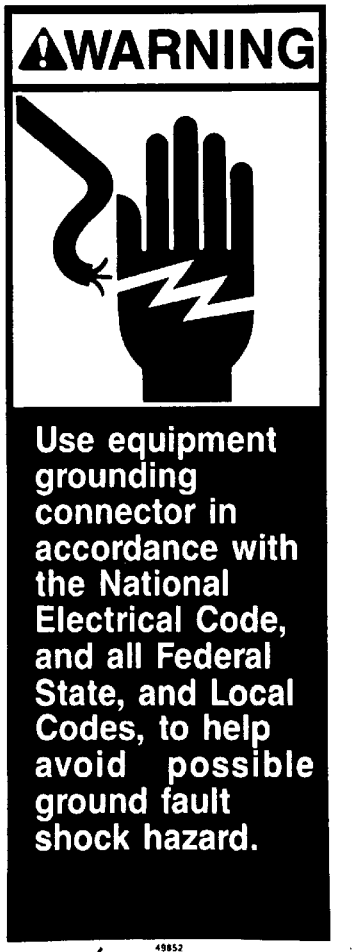
Section 6
ILLUSTRATIONS AND PARTS LIST

6.14 DECAL GROUP



1

2



3

4

5

6

SULLAIR®

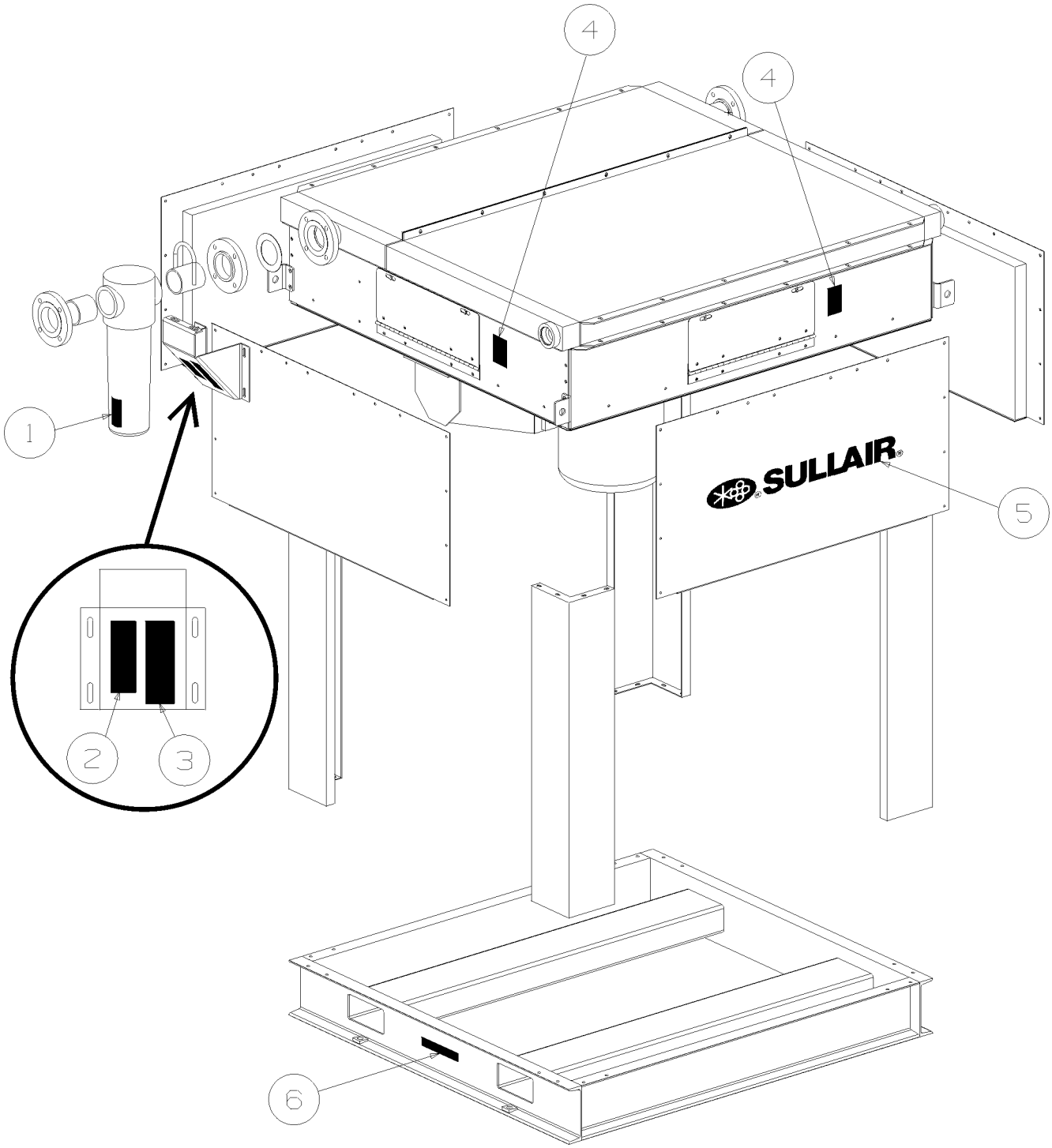
6.14 DECAL GROUP

key number	*description*	*part number*	*quantity*
1	decal, water drain	250022-810	1
2	sign, air breathing (danger)	250027-935	1
3	sign, warning “food grade” lube	250003-144	1
4	sign, warning sever fan door closed	02250131-539	4
5	decal, Sullair 4.5” X 36”	02250057-603	2
6	decal, fork lifting	241814	2

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

Section 6
ILLUSTRATIONS AND PARTS LIST

6.15 DECAL LOCATIONS



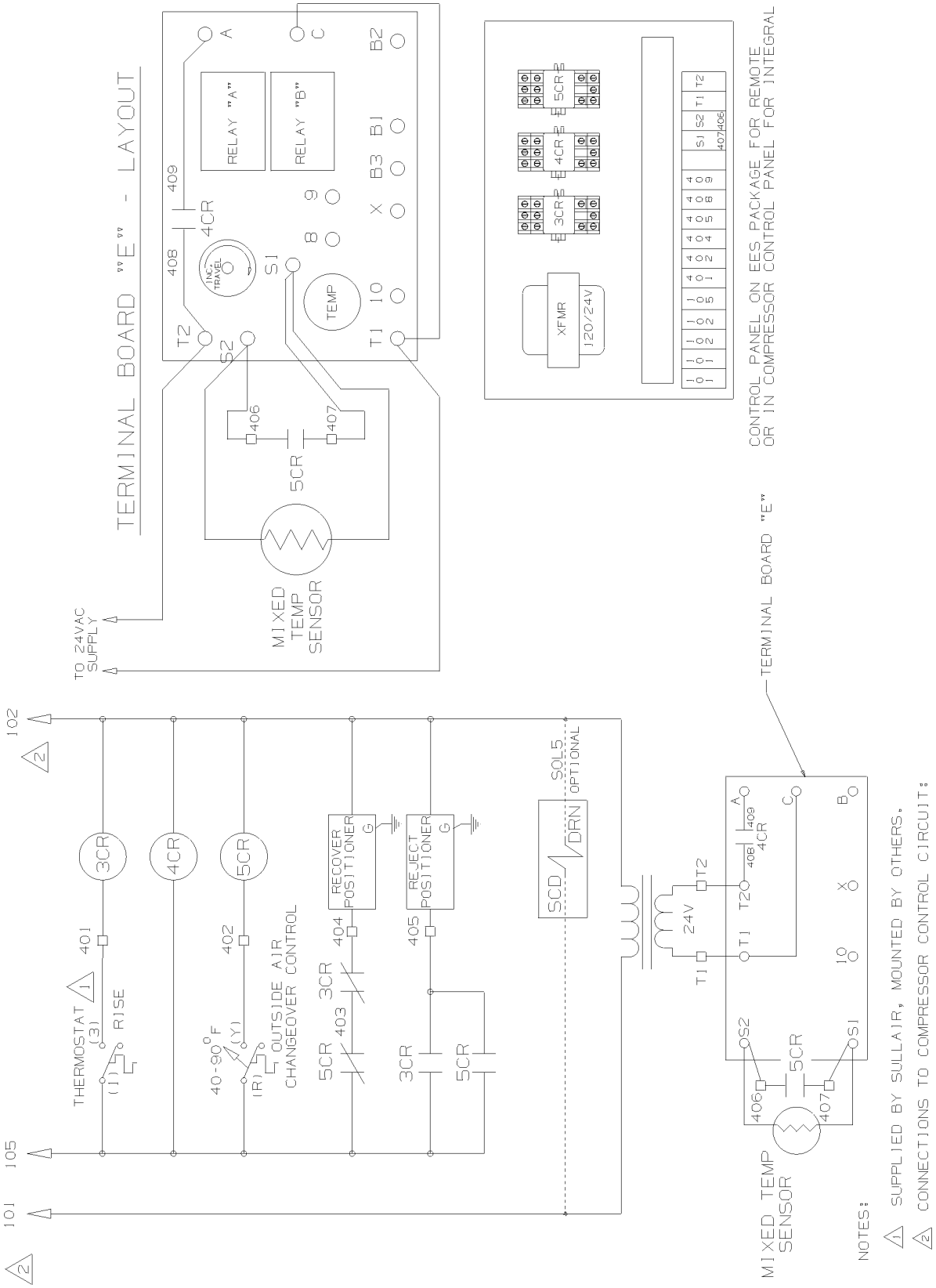
6.15 DECAL LOCATIONS

key number	*description*	*part number*	*quantity*
1	decal, water drain	250022-810	1
2	sign, air breathing (danger)	250027-935	1
3	sign, warning “food grade” lube	250003-144	1
4	sign, warning sever fan door closed	02250131-539	4
5	decal, Sullair 4.5” X 36”	02250057-603	2
6	decal, fork lifting	241814	2

PLEASE NOTE: WHEN ORDERING PARTS, INDICATE SERIAL NUMBER OF COMPRESSOR

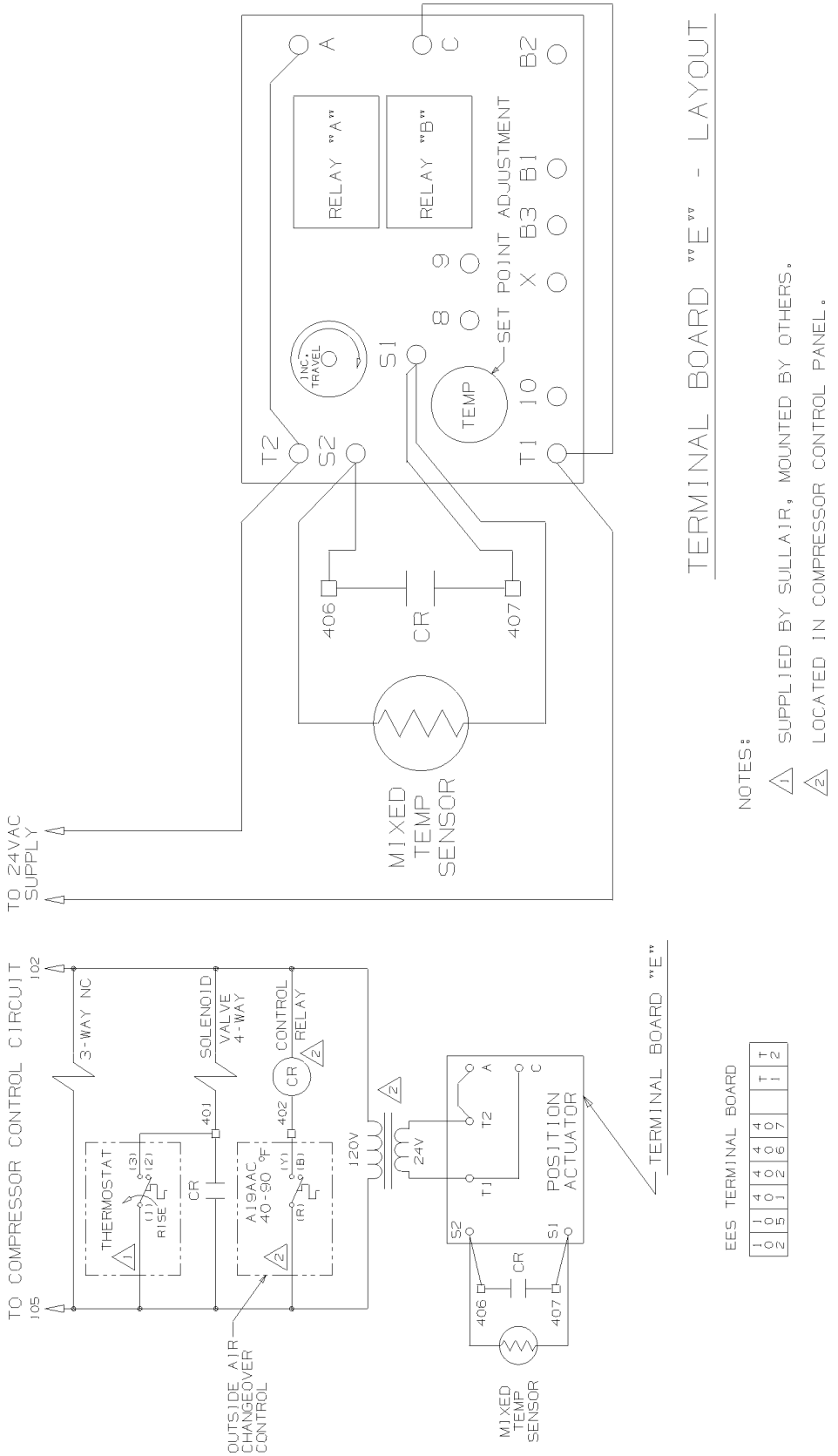
Section 6
ILLUSTRATIONS AND PARTS LIST

6.16 WIRING DIAGRAM- EES SUPERVISOR CONTROL



02250133-680R02

6.17 WIRING DIAGRAM- EES REMOTE



02250134-081R00

Section 6
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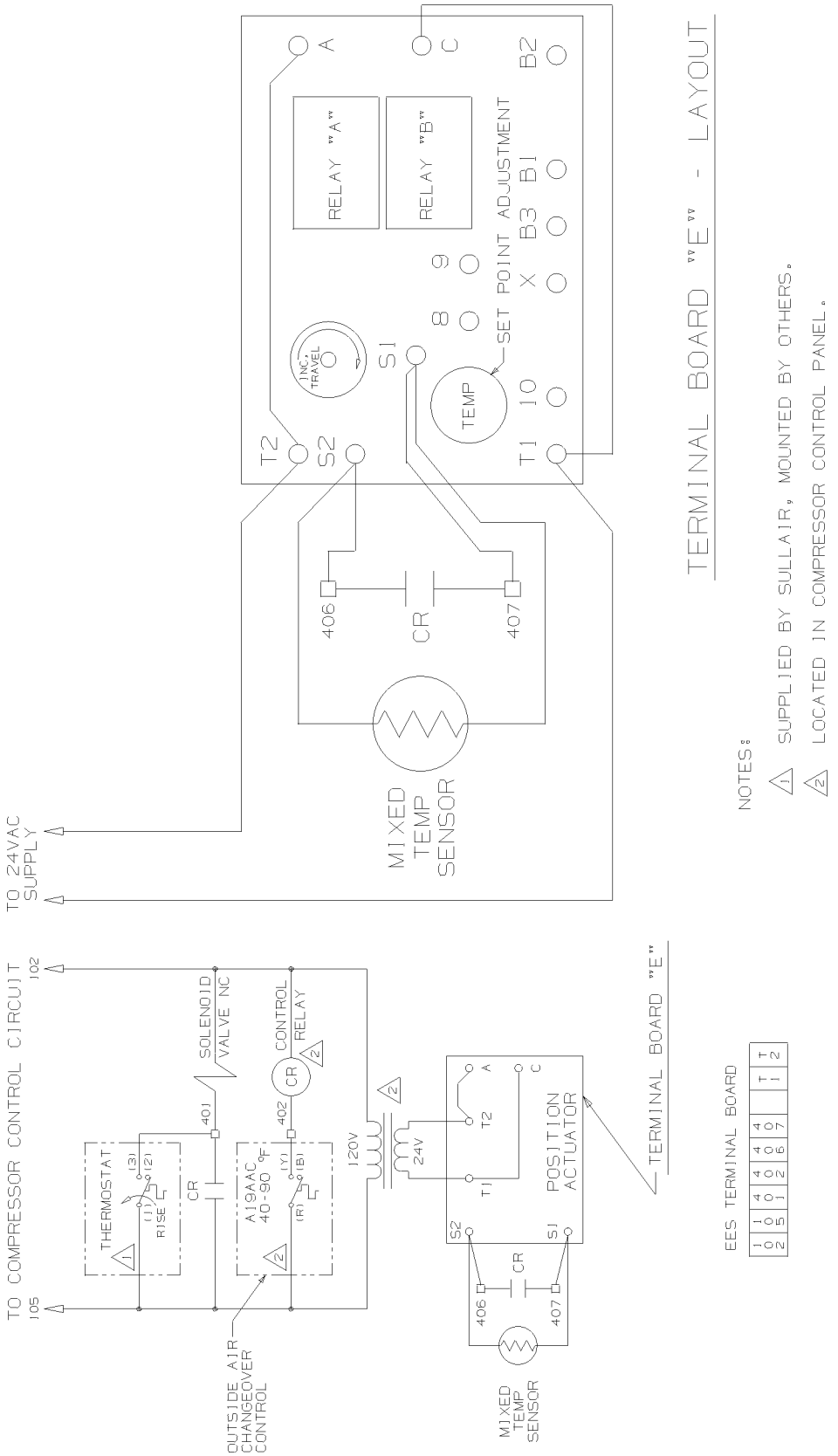
6.18 WIRING DIAGRAM- INTEGRAL HEAT RECOVERY WITH SUPERVISOR



02250064-078R04

NOTES

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