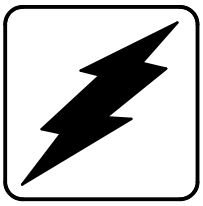
Operation and Installation

Automatic Transfer Switches



Models:

TES
TLS

Contactors:

Electrically Held
Mechanically Held

25-400 Amperes

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED
U.S.A. Plant ISO Registered

KOHLER®
POWER SYSTEMS

TP-5659 11/93a

Service Assistance

For service or information, check the yellow pages of the telephone directory under the heading GENERATORS-ELECTRIC for the authorized Kohler service distributor/dealer.

KOHLER CO., Kohler, Wisconsin 53044
Phone 920-565-3381
Fax 920-459-1646 (North American Sales)
920-459-1614 (International Sales)
For Sales and Service in U.S.A. and Canada
Phone 1-800-544-2444

In any communications regarding the automatic transfer switch, please include the MODEL and SERIAL numbers as found on the nameplate attached to the transfer switch. Enter the numbers in the spaces provided below. This information will enable the authorized Kohler service distributor/dealer to supply the correct part or data for this particular model.

Model No. _____

Serial No. _____

Table of Contents

Safety Precautions

A transfer switch, like any other electrical device, can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best way to prevent accidents is to be aware of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a transfer switch follow. Keep these in mind.

This manual contains several types of safety precautions which are explained below.

DANGER

Danger is used to indicate the presence of a hazard that *will* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

WARNING

Warning is used to indicate the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

CAUTION

Caution is used to indicate the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage if the warning is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

HAZARDOUS VOLTAGE/ ELECTRICAL SHOCK

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

NOTE

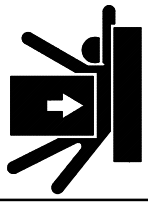
HARDWARE DAMAGE! Transfer switch may make use of both American standard and metric hardware. Be sure to use the correct size tools to prevent rounding of bolt heads and nuts.

NOTE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. American Standard hardware uses a series of markings and metric hardware uses a numeric system to indicate hardness. Check markings on bolt head and nuts for proper identification.

HEAVY EQUIPMENT

WARNING



Unbalanced weight.
Improper lift can cause severe injury, death, or equipment damage.

Use adequate lifting capacity.

Never leave automatic transfer switch standing upright unless it is securely bolted in place or properly stabilized.

Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally in the text they will appear in complete form with the abbreviation following in parenthesis the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below.

Abbreviation	Description
AC	alternating current
AHWT	anticipatory high water temp.
ALOP	anticipatory low oil pressure
AM	amplitude modulation
Amp.	ampere
Amps.	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
aux.	auxiliary
AWG	American Wire Gauge
AWM	appliance wiring material
bhp	brake horsepower
bmep	brake mean effective power
Btu	British thermal unit
℃	Celsius degree
cc	cubic centimeter
CCA	cold cranking Amps.
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
C.S.A.	Canadian Standards Association
cu. in.	cubic inch, cubic inches
cyl.	cylinder
dBA	decibels
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter

Abbreviation	Description
e.g.	example given
EMI	electromagnetic interference
etc.	etcetera, (and so forth)
ext.	external
℉	Fahrenheit degree
fl. oz.	fluid ounce, fluid ounces
FM	frequency modulation
fs	full scale
ft.	foot, feet
ft. lbs.	foot pound, foot pounds
ga.	gauge
gal., gals.	gallon, gallons
gal./hr.	gallons per hour
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust temperature
Hg	mercury (element)
H_2O	water
hp	horsepower
hr, hrs	hour
HWT	high water temperature
Hz	hertz (cycles per second)
ID	inside diameter
in.	inch(es)
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes

Abbreviation	Description
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED, LEDs	light emitting diode
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minutes
LOP	low oil pressure
LP	liquefied petroleum
LWT	low water temperature
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m^3/min	cubic meters per minute
MPa	megaPascal
mph	miles per hour
MS	military standard
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter, Newton meters
no., nos.	number, numbers
NPT	National Standard taper pipe thread per general use

Abbreviation	Description
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
OV	overvoltage
oz.	ounce, ounces
PF	power factor
pot.	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
rms	root mean square
rpm	revolutions per inch
SAE	Society of Automotive Engineers
sec.	second, seconds
SCR	silicon controlled rectifier
spec, specs	specification
sq.	square
sq. cm	square centimeters
sq. in.	square inch, square inches
tach	tachometer
TDC	top dead center
temp.	temperature
TIF	telephone influence factor
turbo	turbocharger
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter ъ Laboratories, Inc.
US	undersize
V	volt, volts
VAC	Volts alternating current
VDC	volts direct current
W	watt, watts

Notes

Section 1. Introduction

Scope and Purpose of Manual

Purpose of Manual

This manual provides operation and initial installation instructions for Kohler automatic transfer switches that use 25-400 ampere contactors as the power switching device. Read through this manual and carefully follow all procedures and safety precautions to ensure safe, reliable operation of the automatic transfer switch. Be sure to keep a copy of this manual with the automatic transfer switch for future reference.

List of Related Manuals

The group of power switching devices covered by this manual are part of a family of related units. Separate operation and installation manuals are available for each group within the overall family. Be sure this manual is the correct manual for this automatic transfer switch.

A controller is included in each automatic transfer switch. There are three types of controllers and each type of controller is covered in a separate operation and installation manual. To be complete, this power switching device manual must be accompanied by a copy of the operation and installation manual for the controller used in the automatic transfer switch. Available controllers and the related manual numbers are as follows:

Controller, E33+	TP-5662
Controller, S340+ (Solid State)	TP-5663
Controller, M340+ (Microprocessor)	TP-5664

Arrangement of Manual

Information in this manual is arranged in six sections as follows:

- **Section 1. Introduction,** defines the scope and purpose of this manual and lists related manuals as well as manuals for related automatic transfer switches. In addition, the introduction includes a description of an automatic transfer switch to familiarize the reader with the components that make up the switch.
- **Section 2. Specifications,** lists the important characteristics including electrical ratings of the automatic transfer switches covered by this manual.
- **Section 3. Installation,** provides installation information, including mechanical mounting considerations and electrical wiring data.
- **Section 4. Operation,** provides information about controls and indicators and describes operation, both automatic and manual, of the automatic transfer switch.
- **Section 5. Accessories,** provides information about accessories available for the automatic transfer switches.
- **Section 6. Drawings and Diagrams,** includes wiring diagrams and drawings for the automatic transfer switches covered by this manual.

Automatic Transfer Switch Description

Purpose of Switch

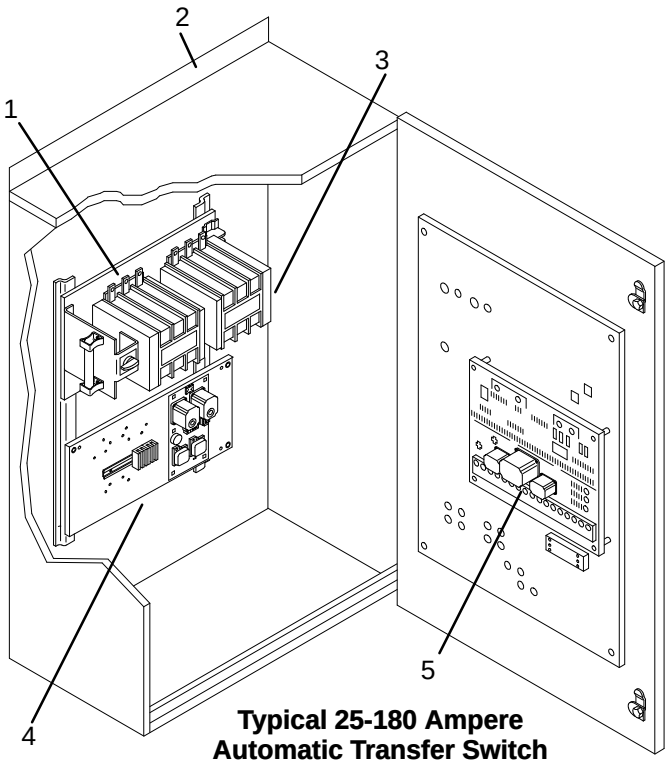
An automatic transfer switch is a switching device that automatically transfers critical electrical loads from a normal (preferred) power source to an emergency (standby) power source. The automatic transfer occurs when normal power fails or is substantially reduced. An automatic transfer switch also transfers the load back from emergency power to the normal power source when normal power is restored.

Components of Switch

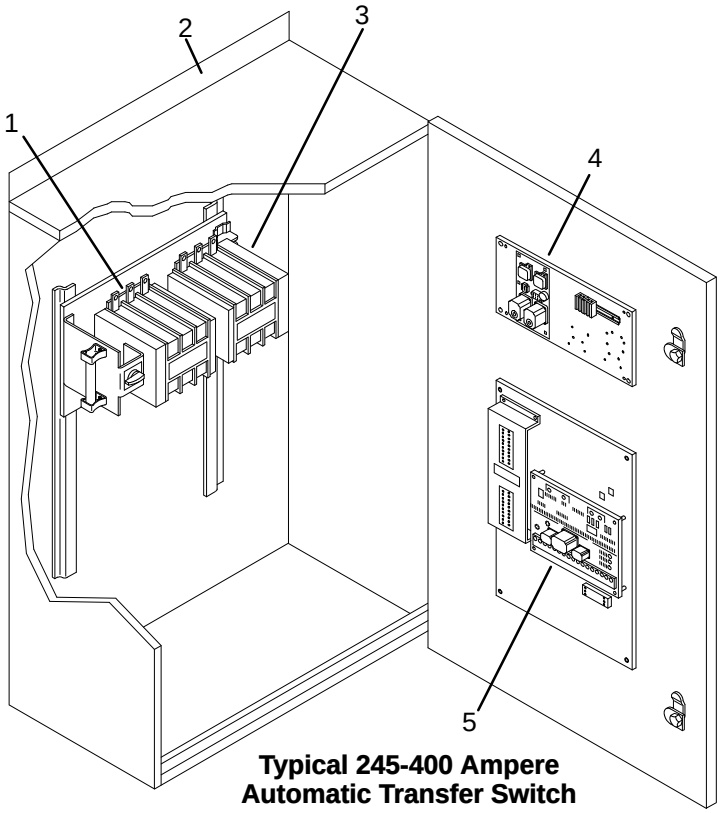
A typical automatic transfer switch (Figure 1) includes the actual power switching device and the logic controller to perform power monitoring and transfer sequencing tasks. An interface is also included to match the standard controller inputs/outputs to the levels required by a specific switching device.

The power switching device used in the models covered by this manual is made of two multi-pole line contactors. These contactors are mechanically and electrically interlocked together to avoid conditions where both contactors are closed at the same time. With this feature, it is possible to select one power source to feed the load without crosscoupling that power source to the other power source.

The three functional units that make up the automatic transfer switch are mounted in an enclosure with a hinged front door. The controller mounts on the back of the front door so its controls and indicators are available to an operator. A signal cable, with in-line connectors to facilitate component replacement and door removal, connects the controller to the interface board and the switching devices.



Typical 25-180 Ampere Automatic Transfer Switch



Typical 245-400 Ampere Automatic Transfer Switch

1. Normal Power Contactor
2. Mounting Flange
3. Standby Power Contactor
4. Interface Panel
5. Logic Controller

Figure 1. Transfer Switch Components

Sequence of Operation

Operation of the typical automatic transfer switch (Figure 2) is divided into two separate sequences: (1) failure of normal power and the resulting transfer to emergency power and (2) restoration of normal power and the resulting transfer back to normal power. A brief description of both sequences is provided below. Note that these sequences may be affected by accessories described in Section 5 of this manual or in the applicable logic controller operation and installation manual. In addition, for more specific details on circuit operation including time delays, refer to the applicable controller operation and installation manual. (See **List of Related Manuals** earlier in this Section.)

- **Failure of Normal Power,** either loss or deterioration of one or more phases, is detected by monitors within the controller. The monitor that detects the failure starts a time delay, typically called Time Delay Engine Start. If power is restored before the time delay expires, the timer is reset. But, if the failure persists and the time delay expires, the controller issues a signal to start the standby (emergency) power generator. This time delay scheme is used to prevent unnecessary starting of the generator during short power interruptions.

  A second set of monitors within the controller check the status of the emergency power. When the voltage and frequency of the emergency (generator) power is good, these monitors start a timing cycle, typically called Time Delay Normal to Emergency. At the end of the timing cycle, which is provided to allow the generator outputs to stabilize, the controller issues a signal to the transfer switch to remove normal power to the load and then connect emergency power to the load.

  Once it is switched, the transfer switch remains in the emergency position, supplying power to the load from the emergency source until normal power is restored.

- **Restoration of Normal Power** automatically begins a sequence that transfers the load back to the normal power source. The monitors within the controller continue to check the status of the normal power, even when the load is operating from emergency power. When these monitors detect a stable condition of the normal power, a time delay typically called Time Delay Emergency to Normal is started. If the normal power fails again before the time delay expires, the time delay is reset. This timing period is included to ensure that the normal power is stabilized before it is reconnected to the load.

  If the normal power remains good and the time delay expires, the controller issues a signal to the transfer switch to remove emergency power and reconnect normal power to the load. Normally, at the same time as the power transfer, the logic starts a timer, typically called Time Delay Engine Cooldown. After this time delay expires, the generator engine is stopped.

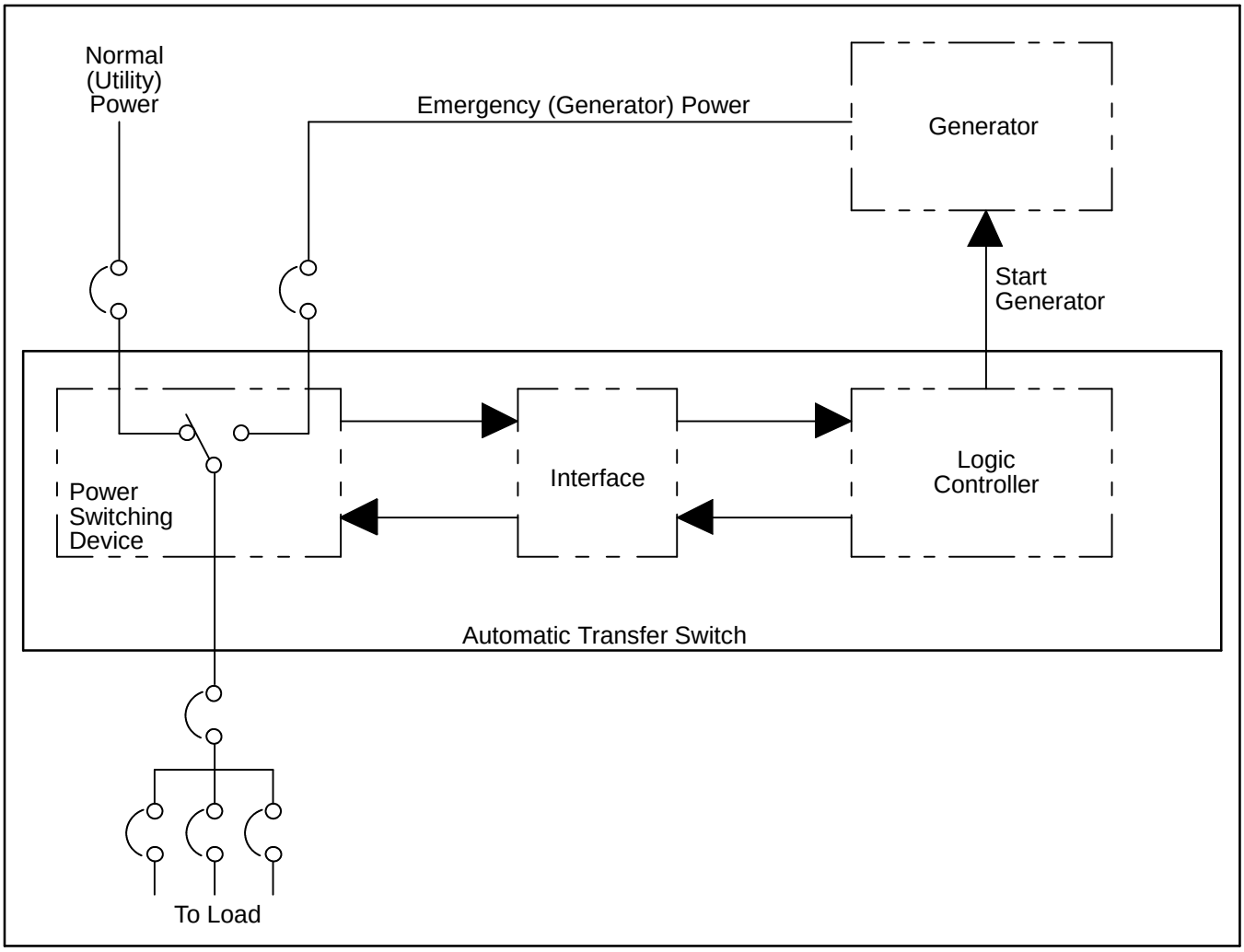


Figure 2. Transfer Switch Block Diagram

Notes

Section 2. Specifications

Ratings

A nameplate (Figure 3) is attached to the automatic transfer switch enclosure. The nameplate label includes a Kohler part number coded to provide characteristic and rating information that affects installation and operation. Copy the part number into the blank boxes provided in Figure 4 and then use the tables in Figure 4 to interpret the correct part number.

NOTE

Also copy the part number and serial number from the nameplate into the spaces provided on the inside front cover of this manual for use when requesting service or parts.

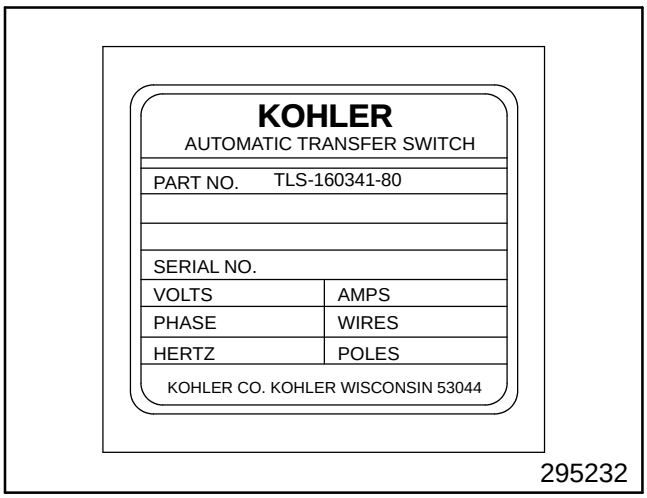
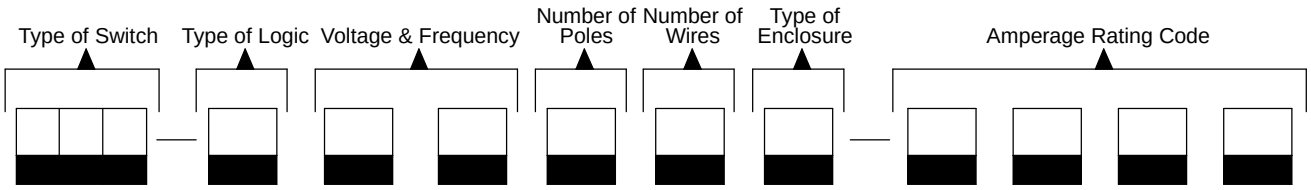


Figure 3. Transfer Switch Nameplate

Record the transfer switch part number in the boxes below. The transfer switch part number defines characteristics and ratings as explained in the accompanying chart.



Kohler Part Number Key

This chart explains the Kohler Transfer Switch part numbering code system. The sample part number shown is for a standard mechanically held contactor power switch with S340+ Logic rated at 600 Volts, 60 Hertz, 3-phase, 3-pole, and 4 wires in a NEMA 1 enclosure with an amperage rating of 80 amperes.

SAMPLE PART NUMBER

TLS-160341-0080

Classification of Power Switch
T: Electrically & Mechanically Held

Type of Power Switch
E: Electrically Held Contactor
L: Mechanically Held Contactor

Type of Switch
S: Standard

Type of Logic
1: S340+
2: E33+
3: S340+ with Program Transition
4: E33 with Program Transition
5: M340+
6: M340+ with Program Transition

Voltage Code

60: 600 Volt, 60 Hz	66: 480 Volt, 60 Hz
62: 120 Volt, 60 Hz	68: 208 Volt, 60 Hz
63: 220 Volt, 50 Hz	71: 380 Volt, 50/60 Hz
64: 240 Volt, 60 Hz	

Number of Poles
3: 3 Pole, 3 Phase
6: 4 Pole-Fully Rated Poles (No Overlapping Neutral)

Number of Wires
3: 3 Wire
4: 4 Wire

Enclosure
NEMA Type 1

Amperes
Numbers Indicate Ampere Rating of Switch

Figure 4. Transfer Switch Model Designations

Specifications

Specifications for automatic transfer switches covered by this manual are listed below:

- Provided as a complete automatic transfer switch with E33+, S340+ (solid state logic) or M340+ (microprocessor logic) controller in a NEMA Type 1 enclosure
- Meets IEC standards
- Can be turned off manually
- Three pole and four pole models
- Four pole fully rated (no overlapping neutral)
- Program Transition function available
- Switch amperage ratings from 25-400 amperes
- Rated operational voltage of contactors of 1000 VAC
- Contactor characteristics summarized in Figure 5 and Figure 6

Transfer Switch Rating (Amperes) AC-1 + AC-3 D		Rated Insulation Voltage UL/CSA	Making Capacity amps*	Breaking Capacity amps*				Short Term Current Rating* From cold (no current flow for 15mn at temp of 40°C/104°F)						
				220-380 -415 -440V	500V	660V	1000V	For 1s	For 5s	For 10s	For 30s	For 1mn	For 3mn	For 10mn
40	25	600	450	450	400	180	¾	380	290	240	155	120	80	50
50	32	600	550	550	450	180	¾	430	340	260	175	138	92	60
80	65	600	1000	1000	1000	630	¾	900	660	520	340	260	175	110
110	80	600	1100	1100	1000	640	¾	990	800	640	420	320	210	135
200	145	1000	1300	1300	1100	900	400	1100	1100	1100	640	520	400	320
270	180	1000	2100	1800	1600	1200	600	1500	1500	1500	920	740	500	400
350	245	1000	2450	2450	2200	1750	800	2200	2200	2200	1230	950	620	480
500	400	1000	4500	4000	3500	3000	1200	3600	3600	3600	2400	1700	1200	1000
*Per IEC 158-1 for transfer switches with rating of 25–80 amperes; per IEC 947-2 for transfer switches with rating of 145–400 amperes.														
All transfer switches listed in this table have a dry air operating temperature range of –5 to +55°C (+23 to +131°F).														
+ IEC AC-1 Ratings apply to all types of AC loads with a power factor of .095 or greater.														
D IEC AC-3 Ratings apply to squirrel cage motor loads or other loads generating inrush currents of 5 to 7 times full load.														

Figure 5. Characteristic Summary of Electrically- and Mechanically-Held Contactors

Transfer Switch Rating (Amperes) AC-1 + AC-3 D		Rated Insulation Voltage UL/CSA	Making Capacity amps*	Breaking Capacity amps*				Short Term Current Rating* From cold (no current flow for 15mn at temp of 40°C/104°F)						
				220-380 -415 -440V	500V	660V	1000V	For 1s	For 5s	For 10s	For 30s	For 1mn	For 3mn	For 10mn
200	145	1000	1500	1500	1200	1000	450	1200	1200	1200	700	600	450	350
270	180	1000	1800	1800	1600	1150	600	1500	1500	1500	920	740	500	400
350	245	1000	2450	2450	2200	1750	800	2200	2200	2200	1230	950	620	480
500	400	1000	4000	4000	3500	3000	1200	3600	3600	3600	2400	1700	1200	1000
*Per IEC 158-1														
All transfer switches included in this table have a dry air operating temperature range of −15 to +70°C (+5 to +158°F).														
+ IEC AC-1 Ratings apply to all types of AC loads with a power factor of .095 or greater.														
D IEC AC-3 Ratings apply to squirrel cage motor loads or other loads generating inrush currents of 5 to 7 times full load.														

Figure 6. Characteristic Summary of Magnetically-Held Contactors

Section 3. Installation

Kohler automatic transfer switches are shipped factory wired and tested, ready for installation. The actual installation process consists of mechanically mounting and electrically wiring the unit to the normal and emergency power sources, the load circuits, and the generator.

Upon Receipt of Unit

Inspection

Carefully unpack or uncrate the automatic transfer switch and check for shipping damage. If damage is discovered, file damage claims with the shipping company immediately and also notify the distributor/dealer.

Storage

Do not remove the protective packing until ready for final installation. Protect the automatic transfer switch at all times from excessive moisture, construction grit, and metal chips. Avoid storage in low-temperature, high-humidity areas where moisture could condense on the unit.

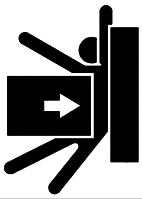
Mechanical Installation

To plan the installation, use the dimensions given on the enclosure drawings in Section 6. Select the mounting site to match local electrical code restrictions for the enclosure type. Mount the automatic transfer switch as near the load and power sources as possible. Also be sure to allow adequate space for switch servicing and full opening of the enclosure door.

Lifting

The approximate weight of each automatic transfer switch covered by this manual is given in Figure 7. For lifting, use a spreader bar. Attach the bar only to the enclosure's mounting holes or lifting eyes; do not lift the unit at any other points. Ensure the front door is in place and latched closed when moving or mounting the unit.

⚠ WARNING



Unbalanced weight.
Improper lift can cause severe injury, death, or equipment damage.

Use adequate lifting capacity.

Never leave automatic transfer switch standing upright unless it is securely bolted in place or properly stabilized.

Mounting

The automatic transfer switches covered by this manual must be mounted vertically to a rigid supporting structure such as a wall. Key hole slots for mounting purposes are provided in the mounting brackets on the top and bottom of each unit. When mounting the unit, plumb the enclosure to ensure that the door hinges are vertical to avoid any distortion of the enclosure or door. Place washers behind the mounting bracket key holes to shim the enclosure to a plumb condition.

Transfer Switch Rating Value Amperes	Approximate Weight lb (kg)
25-180	233 (106)
245 or 400	305 (139)

Figure 7. Automatic Transfer Switch Weight

Electrical Wiring

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing.
Barrier must be installed after adjustments, maintenance, or servicing.

NOTE

For easy access during installation wiring, the front door of the enclosure can be removed. Simply disconnect the cable plug that connects the front door components to the internal components and then lift the door off its hinge pins.

Power Connections

All conductors should enter the enclosure at recommended locations as shown on the enclosure dimension drawing in Section 6. When drilling entry holes for any conductors, cover the transfer switch components for protection from metal chips and construction grit. Remove any debris from the enclosure with a vacuum cleaner (*using compressed air for this purpose can lodge contaminants in components and cause damage*).

Connection points for the normal power, emergency power, and load are clearly marked on contactor assembly and are also shown on the enclosure dimension drawing in Section 6. Be sure to heed the phase markings (A, B, C, and N).

NOTE

Connect source and load phases as indicated by the markings and drawings. Improper connections may cause short circuits and can cause phase-sensitive load devices to run in reverse or prevent load devices from functioning.

Remove surface oxides from conductors by cleaning with a wire brush. When aluminum conductors are used, apply oxidation inhibitor to the conductors. Tighten lugs and carefully wipe away excess oxidation inhibitor. Lugs must be tightened to torque listed in Figure 8.

Transfer Switch Rating (Amperes)	Number of Cables	Lug Size (AWG)	Torque Value (in lb)	Lug Size (mm^2)	Torque Value (Nm)
25	1 2	18–8 18–6	15	1.5–8.4 1.5–10	1.7
32	1 2	14–6 14–6	20	2.5–10 2.5–10	2.3
65	1 2	10–3 10–3	35	4–25 4–25	4
80	1 2	10–2 10–2	75	4–35 4–35	8.5
145/150	1	6–3/0	200	10–95	22.6
180/185	1	6–3/0	200	10–95	22.6
245/265	1	6–300 MCM	275	10–150	31
400	1	4–600 MCM	500	16–304	56

Figure 8. Lug Sizes and Tightening Torque Values for Power Connections

Start Generator Connections

The generator start signal connections are located on a terminal block on the transfer switch contactor. The location of terminal block is marked by a red decal within the enclosure. Connect the generator conductors for the start signal to terminals 3 and 4 as shown in the interconnection diagrams provided in Section 6 of this manual.

Other Accessory Connections

Any external connections necessary for accessories are described in the applicable controller manual. (See **List of Related Manuals** in Section 1 of this manual.)

Notes

Section 4. Operation

Switches and Indicators

The switches and indicators on the automatic transfer switch are determined by the controller used in that switch. For details on this subject, refer to the appropriate controller operation and installation manual. (See **List of Related Manuals** in Section 1.)

Automatic Operation

Automatic operation is a function of the controller installed in the unit. For all details and procedures for both initialization and automatic operation, refer to the appropriate controller operation and installation manual. (See **List of Related Manuals** in Section 1.)

Manual Operation

Manual operation of the transfer switch, which is limited to opening of the contactors, is of use when the controller fails or when testing/troubleshooting the unit. However, those transfer switches that are electrically held are not capable of manual operation. To open contactors of a mechanically or magnetically held switch, proceed as follows:

⚠ DANGER

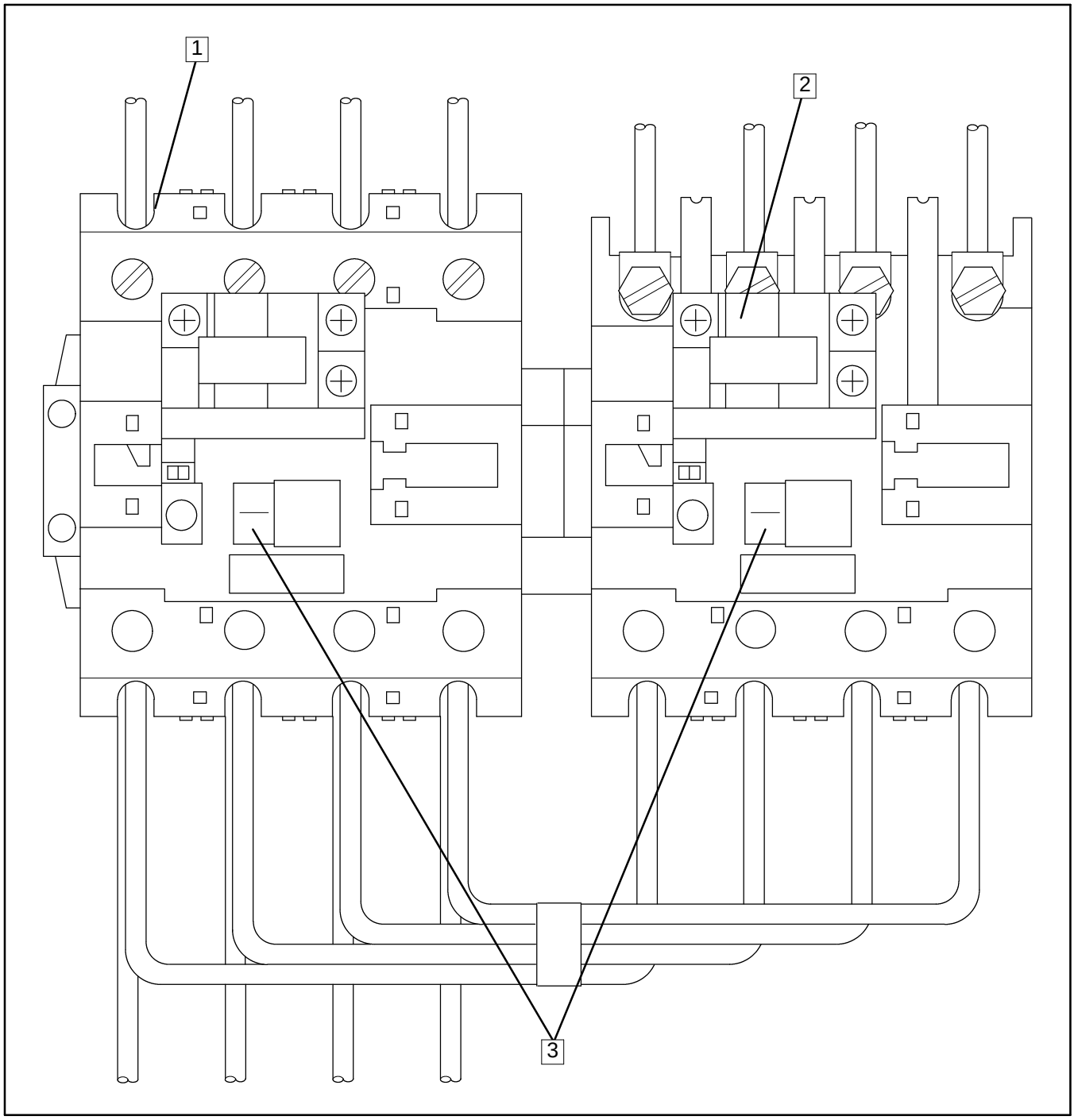
Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

1. Turn off both power sources.
2. Open enclosure door of automatic transfer switch.
3. For a mechanically held switch, press orange button on switch cover to open contactors. (See Figure 9). For a magnetically held switch, operate lever on side of switch to open contactors. (See Figure 10.)
4. Close enclosure door.

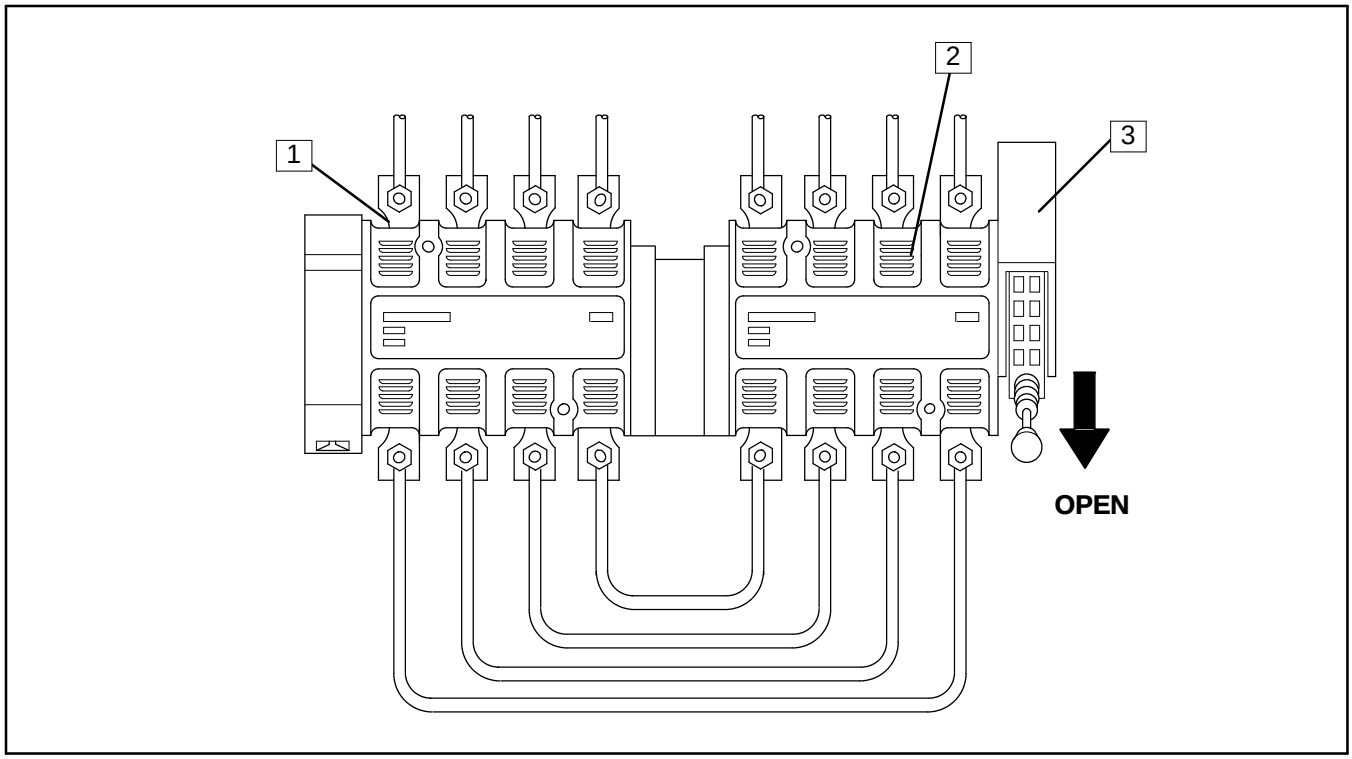
NOTE

The logic controller may cause the switch to operate and close the contactors again when the power source(s) is (are) restored.



1. Normal Contactor
2. Standby (Emergency) Contactor
3. Orange Button

Figure 9. Mechanically-Held Automatic Transfer Switch Operation



1. Normal Contactor
2. Standby (Emergency) Contactor
3. Lever

Figure 10. Magnetically-Held Automatic Transfer Switch Operation

Notes

Section 5. Accessories

Program Transition

NOTE

For ATS utilizing the M340+ logic control, the program transition function is accomplished within the microprocessor and therefore no timing relays are required. See TP-5664 for operational details. DO NOT use this section.

Description

The Program Transition accessory consists of two timing relays that plug into the interface board. (See Figure 11.) If these relays are present, power transfers from normal to emergency or emergency to normal power sources occur in three steps: (1) the switch for the previously connected power source opens, (2) there is a delay period, adjustable from 2 to 40 seconds, to allow residual voltage in the load circuit to decay, and (3) the switch for the new power source is closed.

Adjustment

Two separate timing relays are used. One relay, K4 (TDOE), produces the time delay for the normal to emergency power transfer. The other relay, K3 (TDON), produces the time delay for the emergency to normal power transfer. Each relay has a separate adjustment. To make the adjustment, proceed as follows:

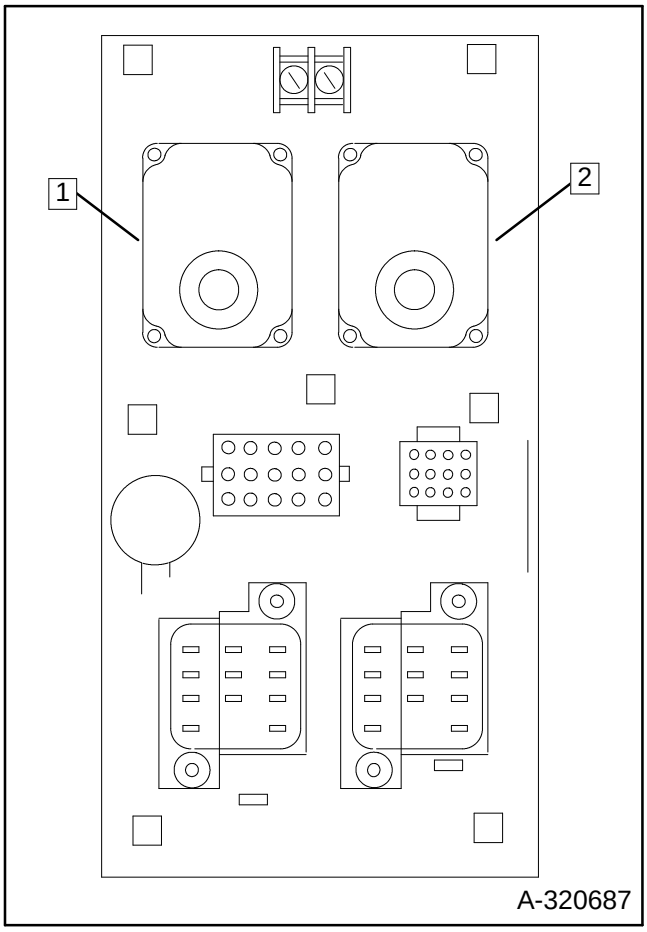
1. Disconnect or turn off both the normal and emergency power sources.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

2. Open enclosure door of automatic transfer switch.
3. Locate the appropriate relay on the interface board. (See Figure 11.)
4. Insert a screwdriver into the adjustment slot of the adjustment screw, visible through the cover of the relay, and turn the adjustment screw to the desired time delay period.
5. Close the enclosure door.
6. Reconnect or turn on the applicable (normal or emergency) power source.
7. Operate the automatic transfer switch automatically and check the time delay period to ensure that it is properly adjusted.



1. K3 (TDON) 2. K4 (TDOE)

Figure 11. Interface Board with Timing Relays

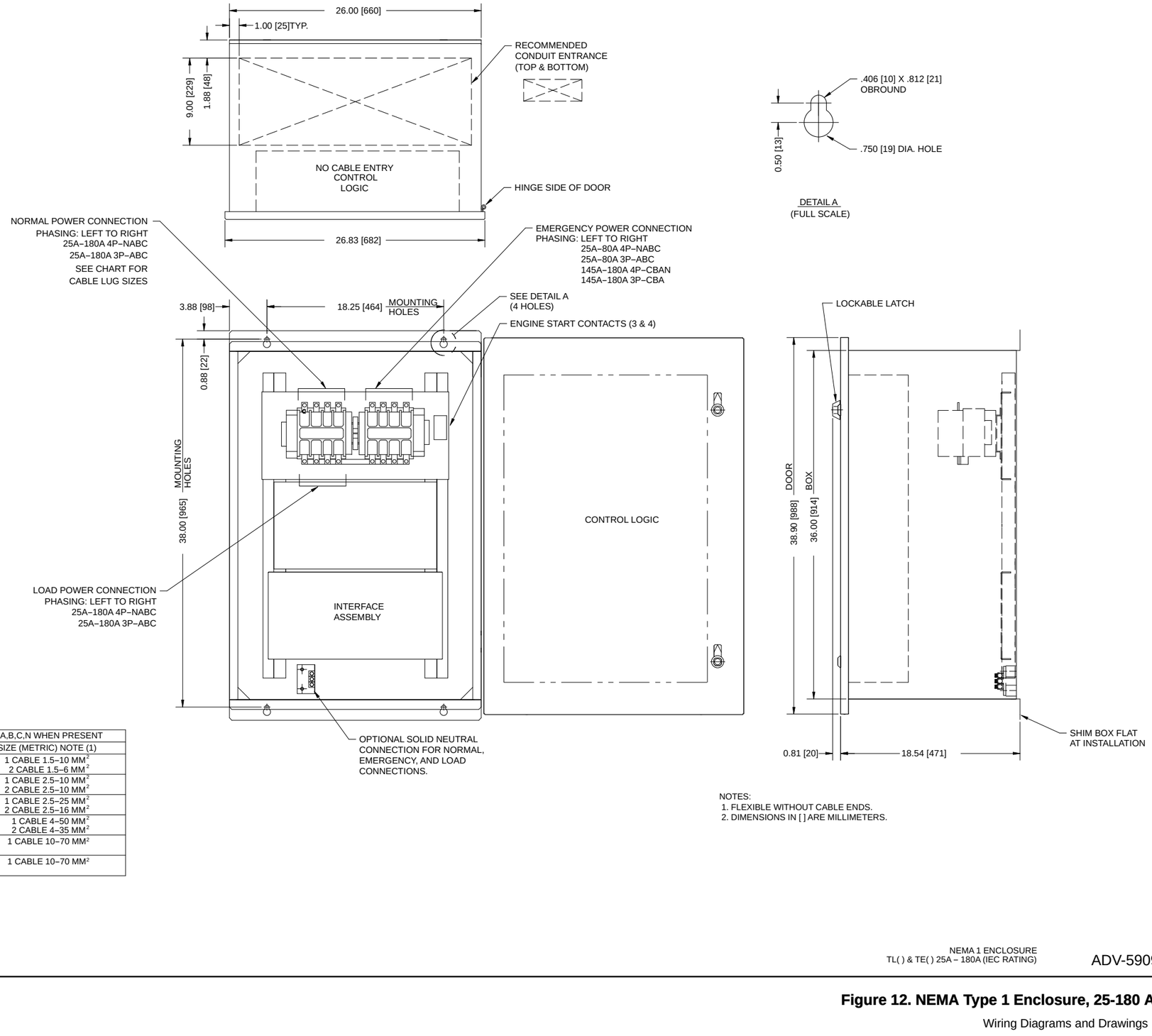
Other Accessories

All other accessories for this automatic transfer switch are controller accessories. For controller accessory information and procedures, refer to the appropriate controller operation and installation manual. (See **List of Related Manuals** in Section 1.)

Notes

Section 6. Diagrams & Drawings

Notes



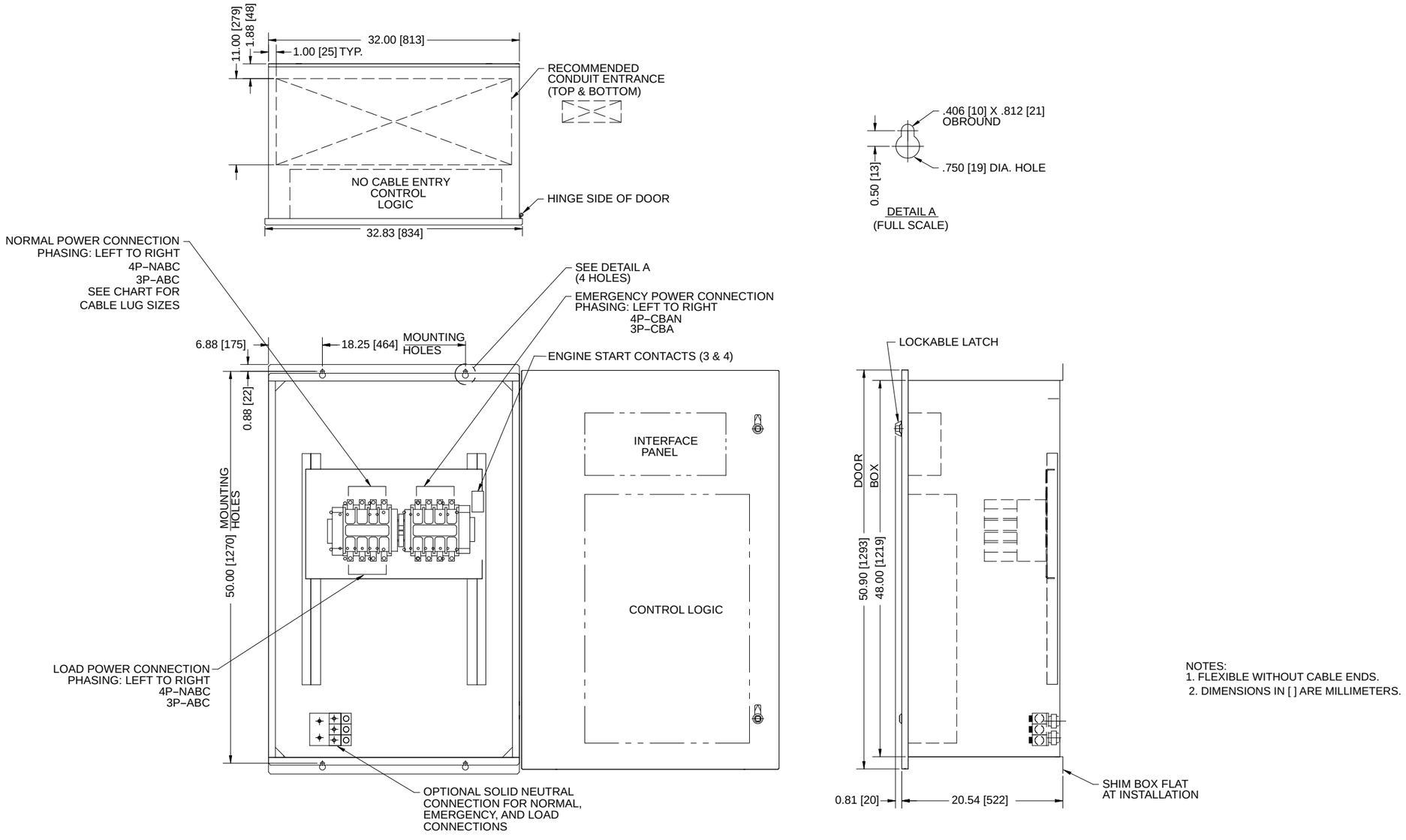
AMPERE	CABLE LUG SIZES PER PHASE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC) NOTE (1)
25	1 CABLE 18–8 AWG 2 CABLE 18–6 AWG	1 CABLE 1.5–10 MM^2 2 CABLE 1.5–6 MM^2
32	1 CABLE 14–6 AWG 2 CABLE 14–6 AWG	1 CABLE 2.5–10 MM^2 2 CABLE 2.5–10 MM^2
65	1 CABLE 10–3 AWG 2 CABLE 10–3 AWG	1 CABLE 2.5–25 MM^2 2 CABLE 2.5–16 MM^2
80	1 CABLE 10–2 AWG 2 CABLE 10–2 AWG	1 CABLE 4–50 MM^2 2 CABLE 4–35 MM^2
145/150	1 CABLE 6–3/0	1 CABLE 10–70 MM^2
180/185	1 CABLE 6–3/0	1 CABLE 10–70 MM^2

NOTES:
1. FLEXIBLE WITHOUT CABLE ENDS.
2. DIMENSIONS IN [ ] ARE MILLIMETERS.

NEMA 1 ENCLOSURE
TL( ) & TE( ) 25A – 180A (IEC RATING)

ADV-5909

Figure 12. NEMA Type 1 Enclosure, 25-180 Amp.



AMPERE	CABLE LUG SIZE PER PHASE A,B,C,N WHEN PRESENT	
	SIZE (USA)	SIZE (METRIC) NOTE (1)
245/265	1 CABLE 6–300 MCM	1 CABLE 10–150 MM^2
400	1 CABLE 4–600 MCM	1 CABLE 16–300 MM^2

Figure 13. NEMA Type 1 Enclosure, 245-400 Amp.

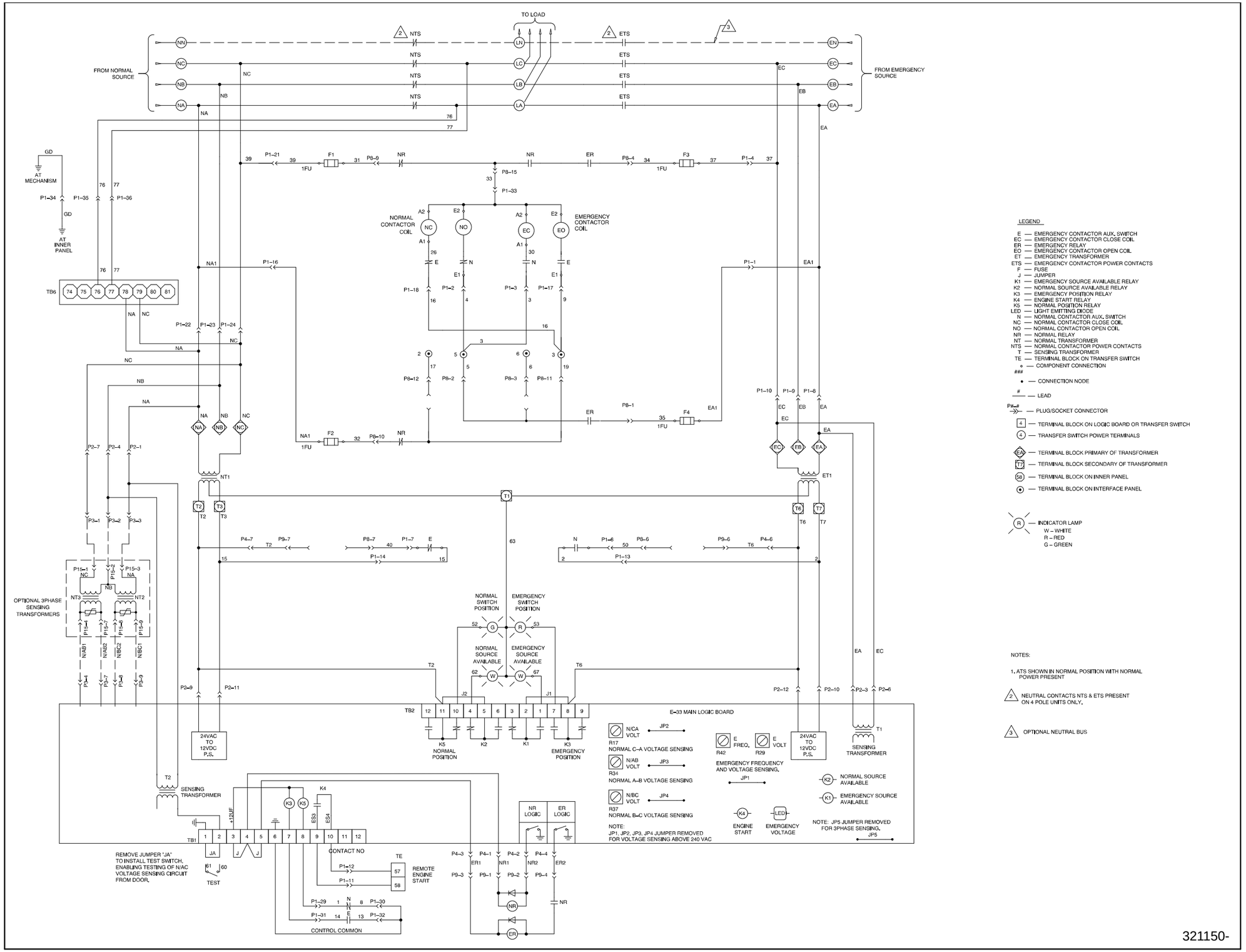


Figure 14. E33+ Logic, 25-80 Amps., Mechanically Held Contactor Without Program Transition

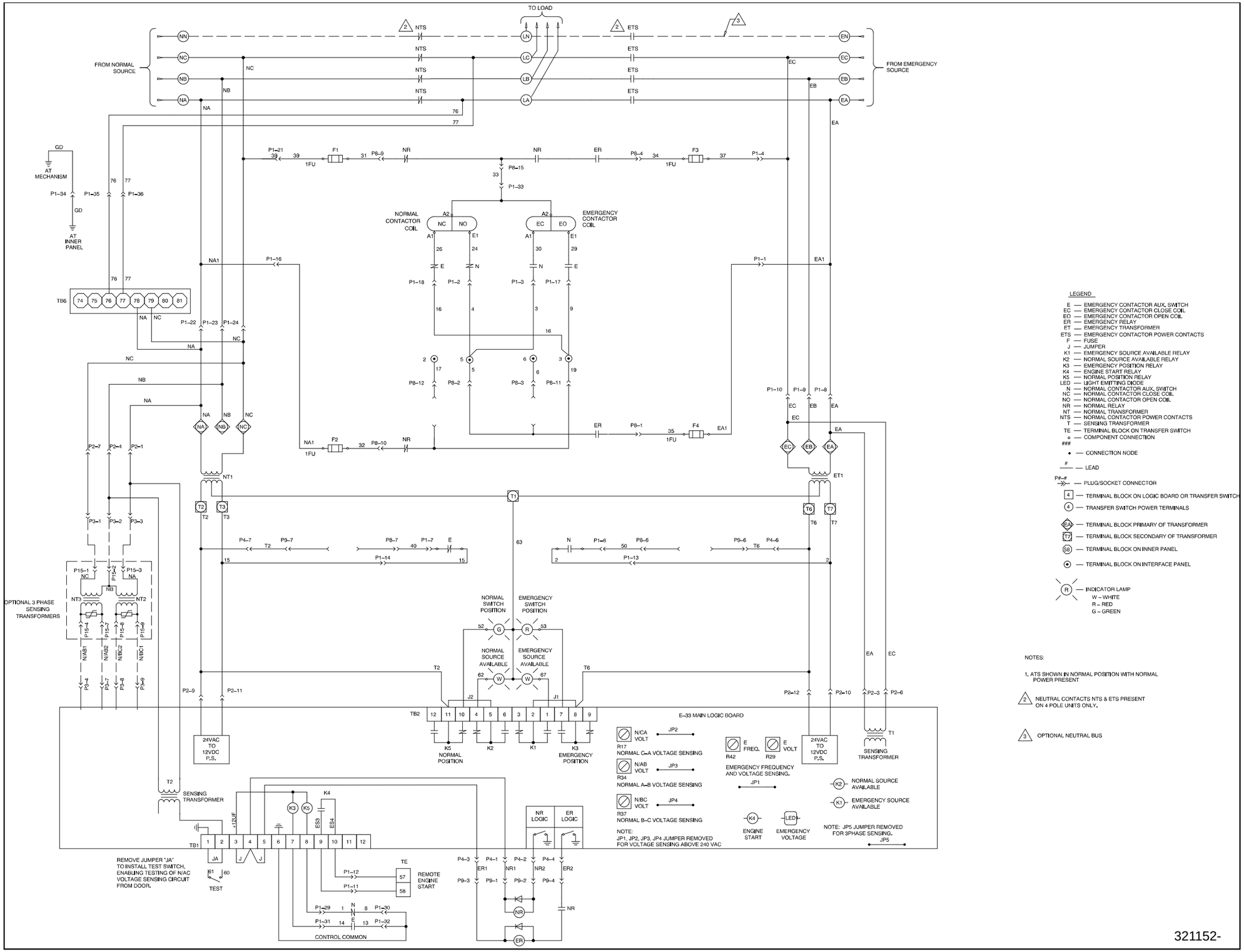


Figure 15. E33+ Logic, 145-800 Amp., Mechanically Held Contactor Without Program Transition

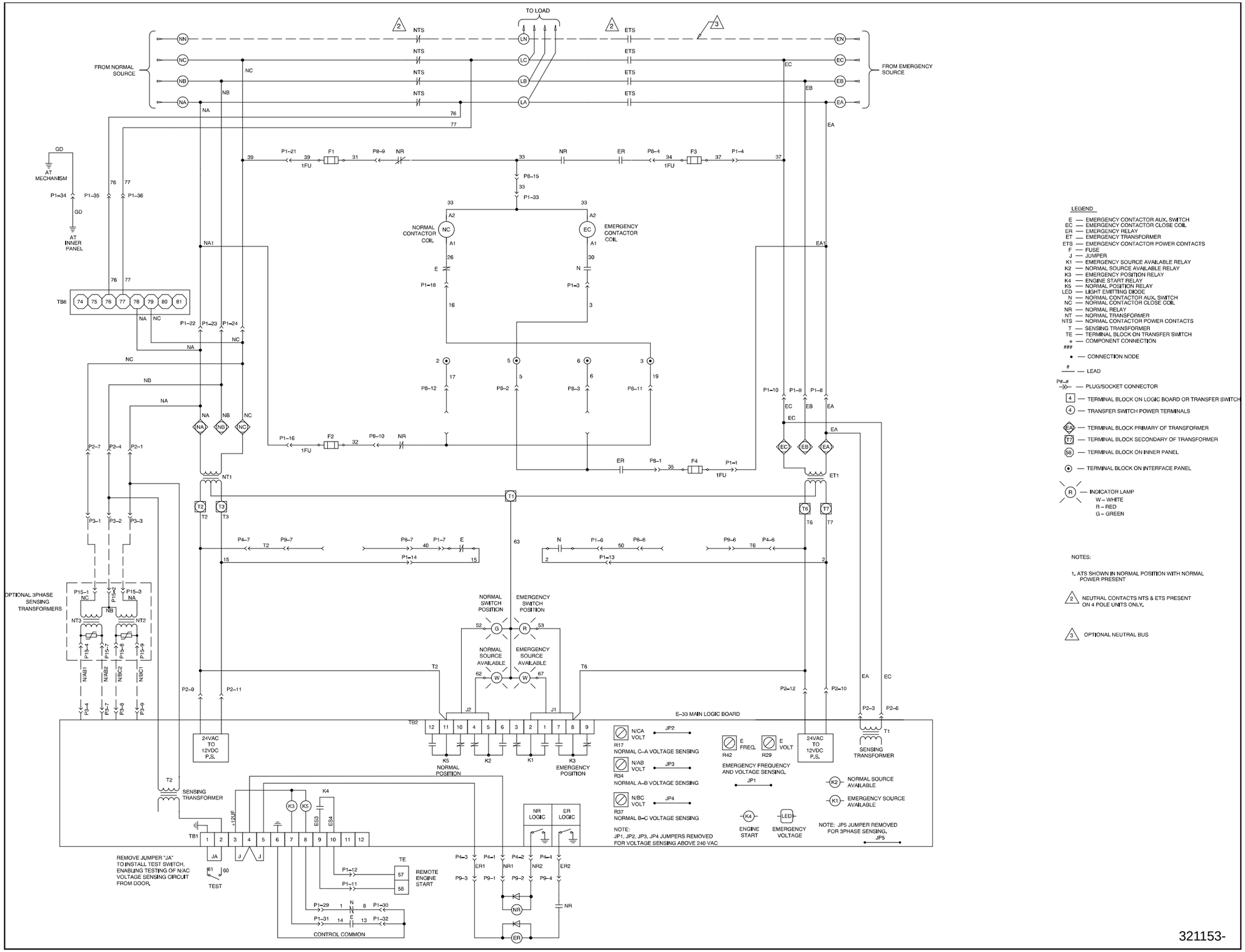


Figure 16. E33+ Logic, Electrically Held Contactor Without Program Transition

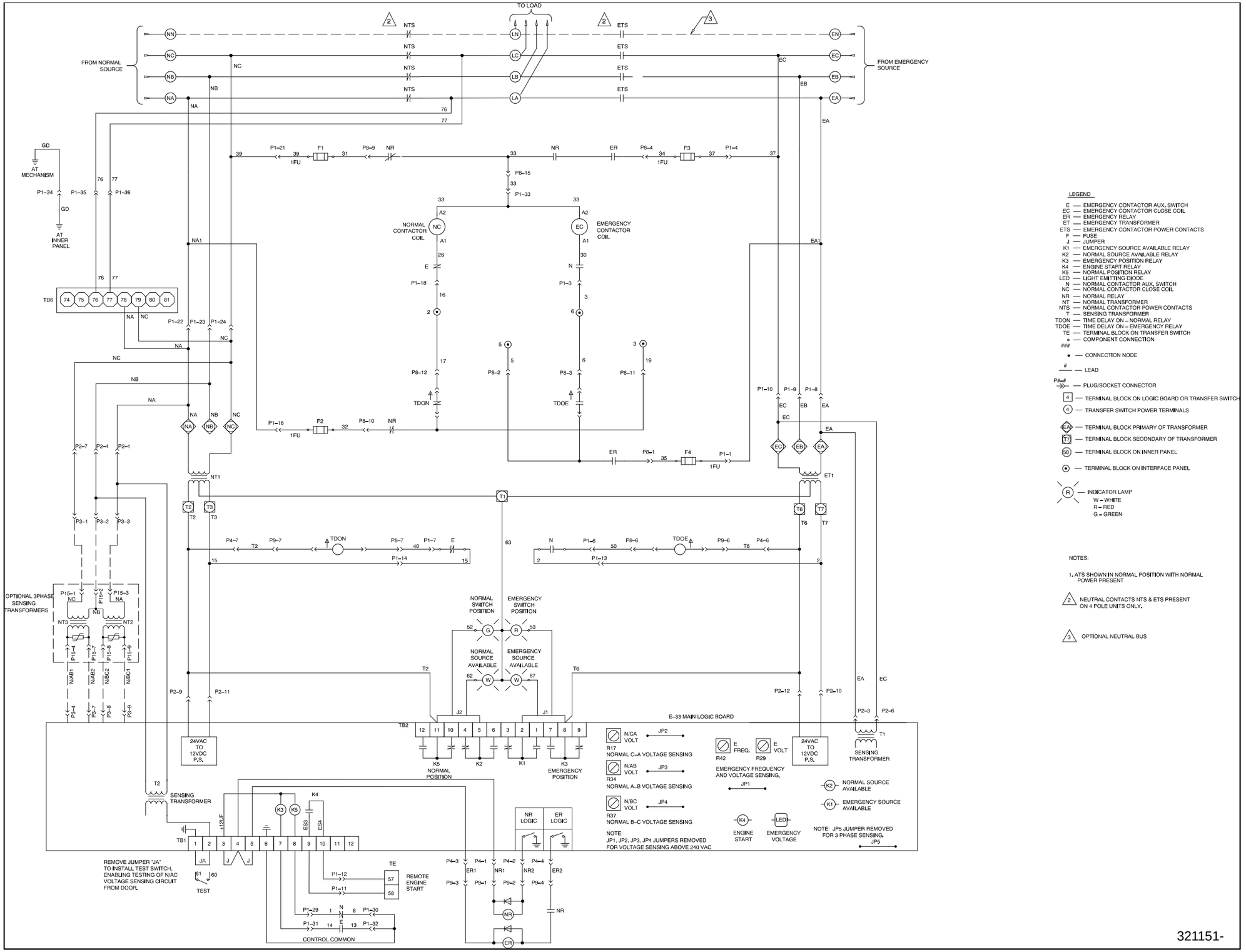


Figure 17. E33+ Logic, Electrically Held Contactor With Program Transition

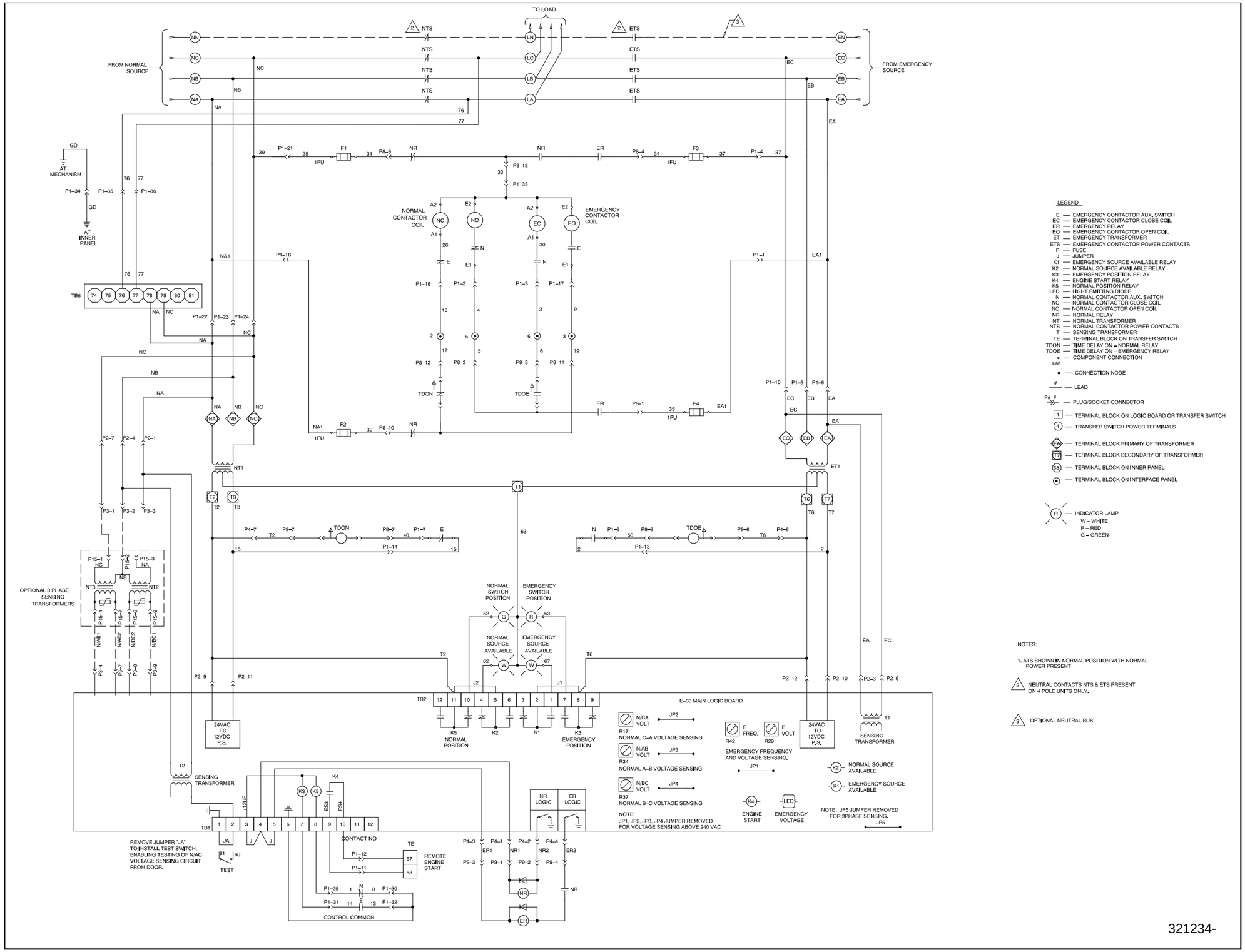


Figure 18. E33+ Logic, 25-80 Amp. Mechanically Held Contactor With Program Transition

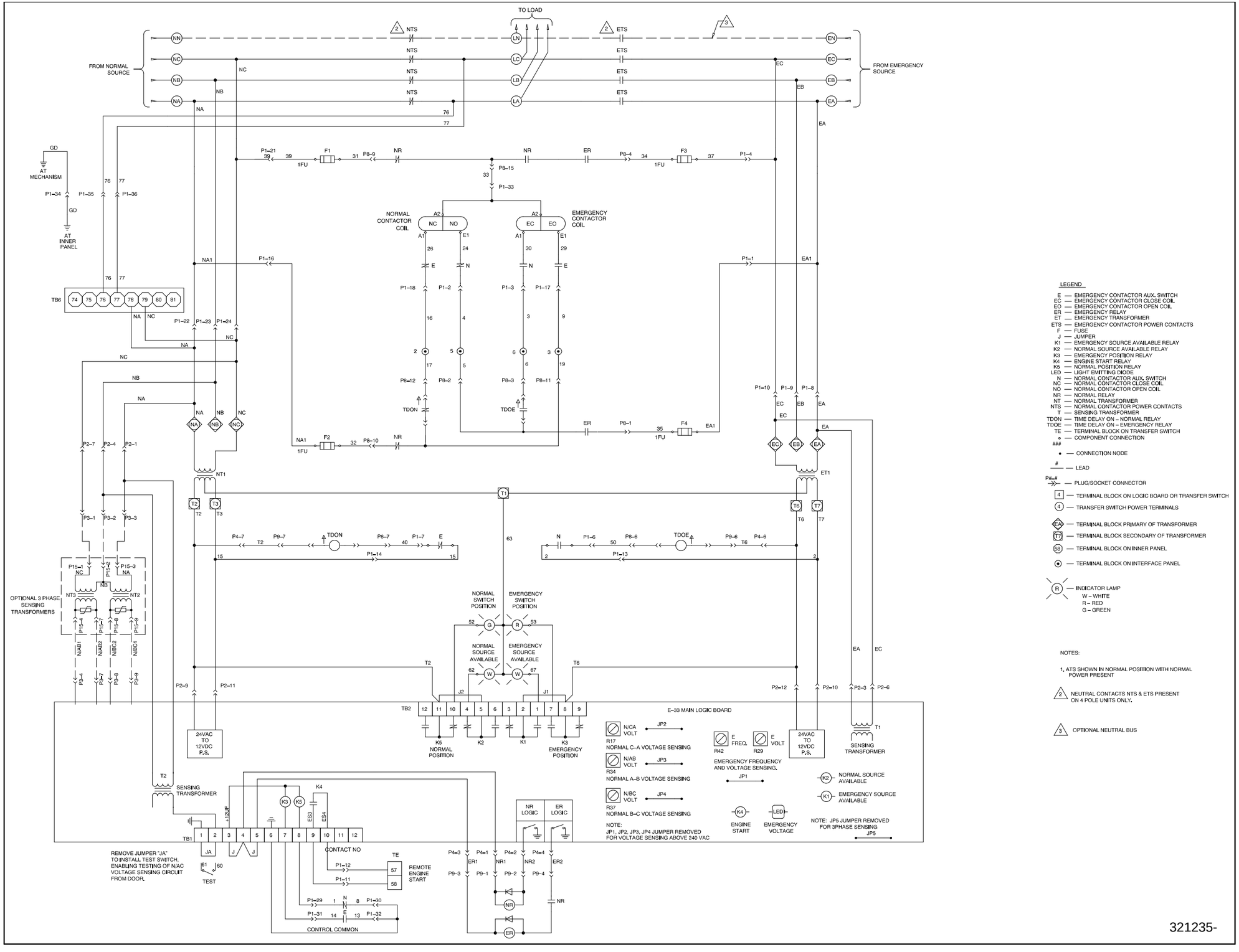
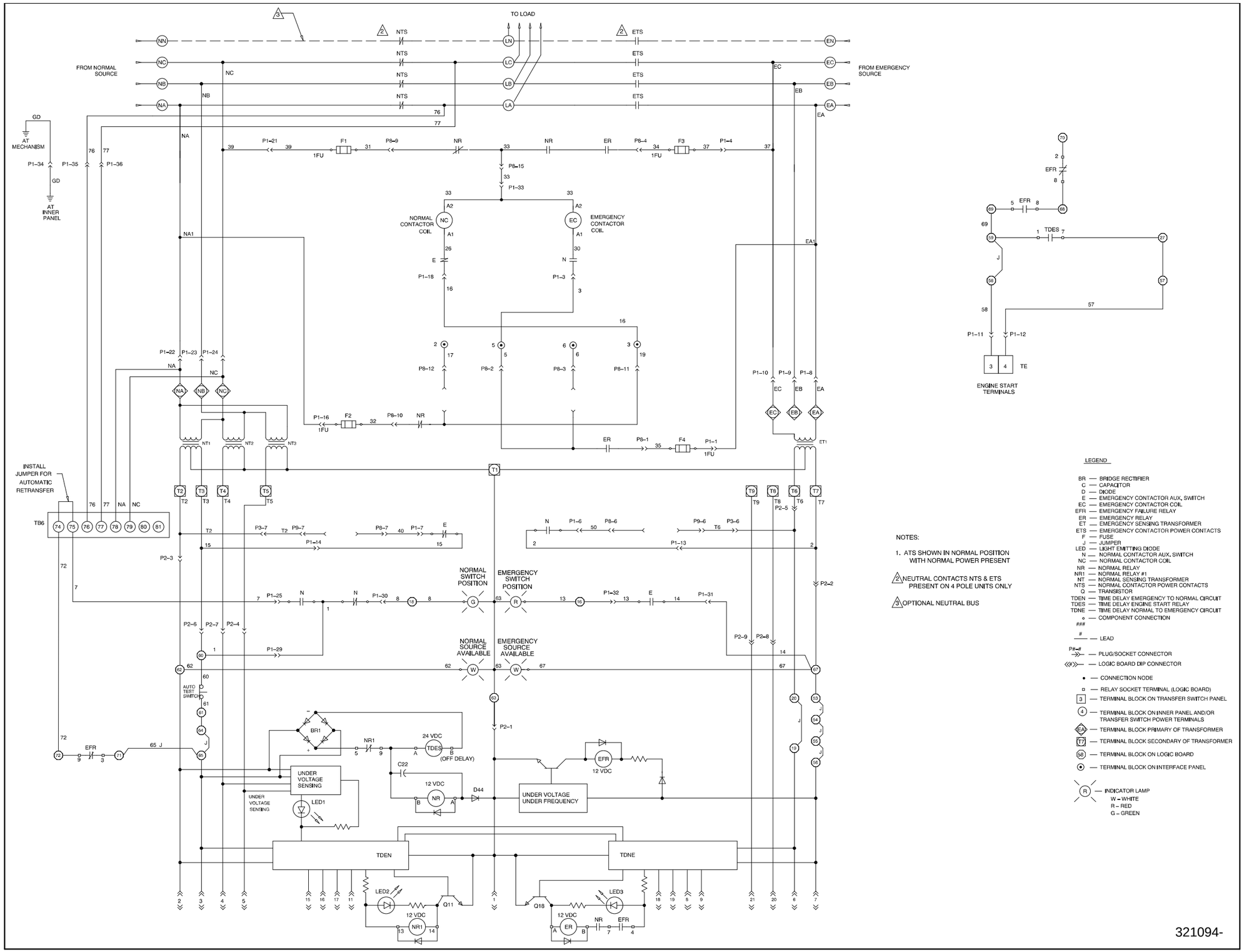


Figure 19. E33+ Logic, 145-400 Amp. Mechanically Held Contactor With Program Transition



NOTES:

1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

2. NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY

3. OPTIONAL NEUTRAL BUS

LEGEND

BR — BRIDGE RECTIFIER
C — CAPACITOR
D — DIODE
E — EMERGENCY CONTACTOR AUX. SWITCH
EC — EMERGENCY CONTACTOR COIL
EFR — EMERGENCY FAILURE RELAY
ER — EMERGENCY RELAY
ET — EMERGENCY SENSING TRANSFORMER
ETS — EMERGENCY CONTACTOR POWER CONTACTS
F — FUSE
J — JUMPER
LED — LIGHT EMITTING DIODE
N — NORMAL CONTACTOR AUX. SWITCH
NC — NORMAL CONTACTOR COIL
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT — NORMAL SENSING TRANSFORMER
NTS — NORMAL CONTACTOR POWER CONTACTS
Q — TRANSISTOR
TDEN — TIME DELAY EMERGENCY TO NORMAL CIRCUIT
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY CIRCUIT
○ — COMPONENT CONNECTION
— LEAD
P#–# — PLUG/SOCKET CONNECTOR
— LOGIC BOARD DIP CONNECTOR
• — CONNECTION NODE
▫ — RELAY SOCKET TERMINAL (LOGIC BOARD)
3 — TERMINAL BLOCK ON TRANSFER SWITCH PANEL
4 — TERMINAL BLOCK ON INNER PANEL AND/OR TRANSFER SWITCH POWER TERMINALS
EA — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T7 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
58 — TERMINAL BLOCK ON LOGIC BOARD
• — TERMINAL BLOCK ON INTERFACE PANEL
R — INDICATOR LAMP
W – WHITE
R – RED
G – GREEN

321094-

Figure 20. S340+ Logic, Electrically Held Contactor Without Program Transition

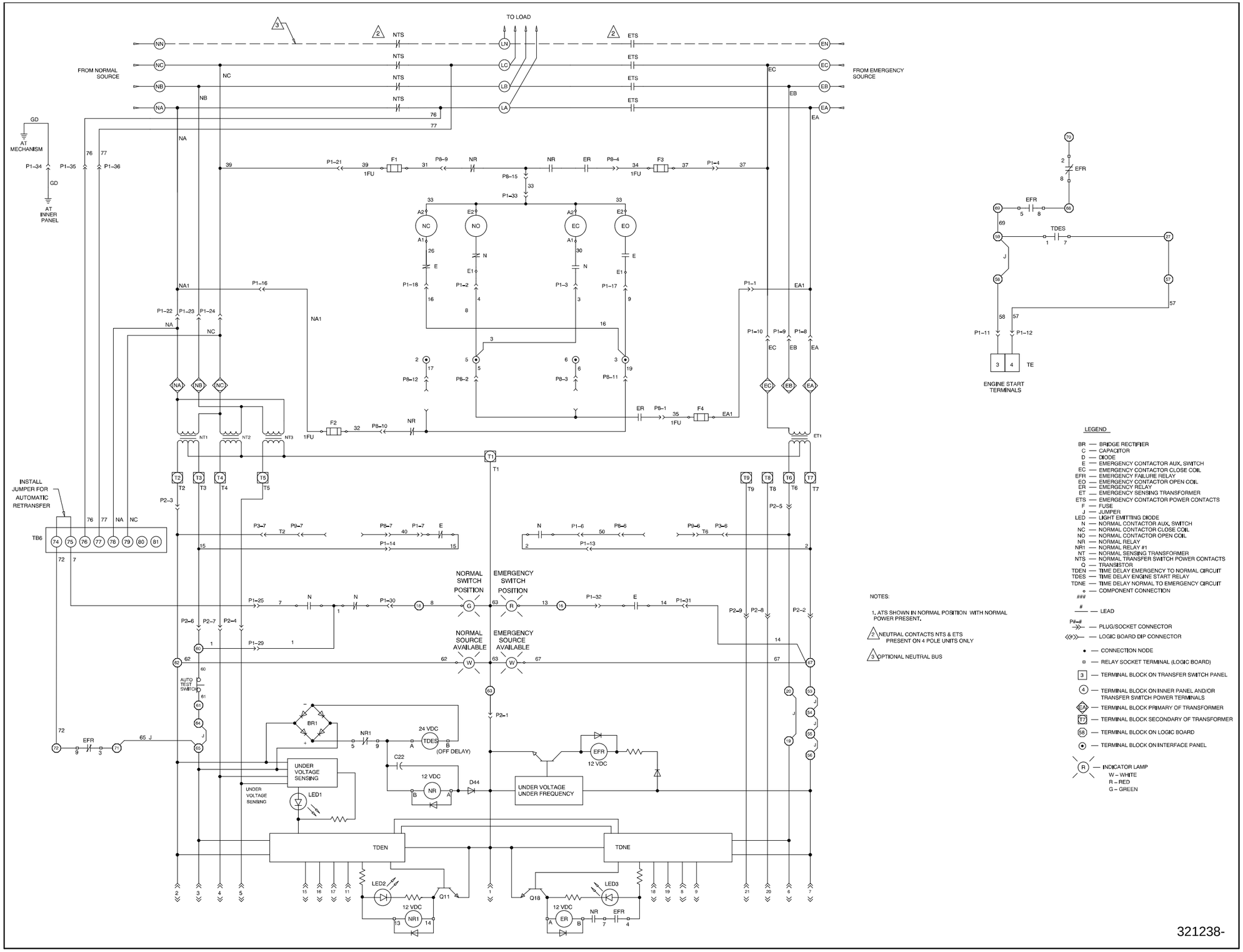
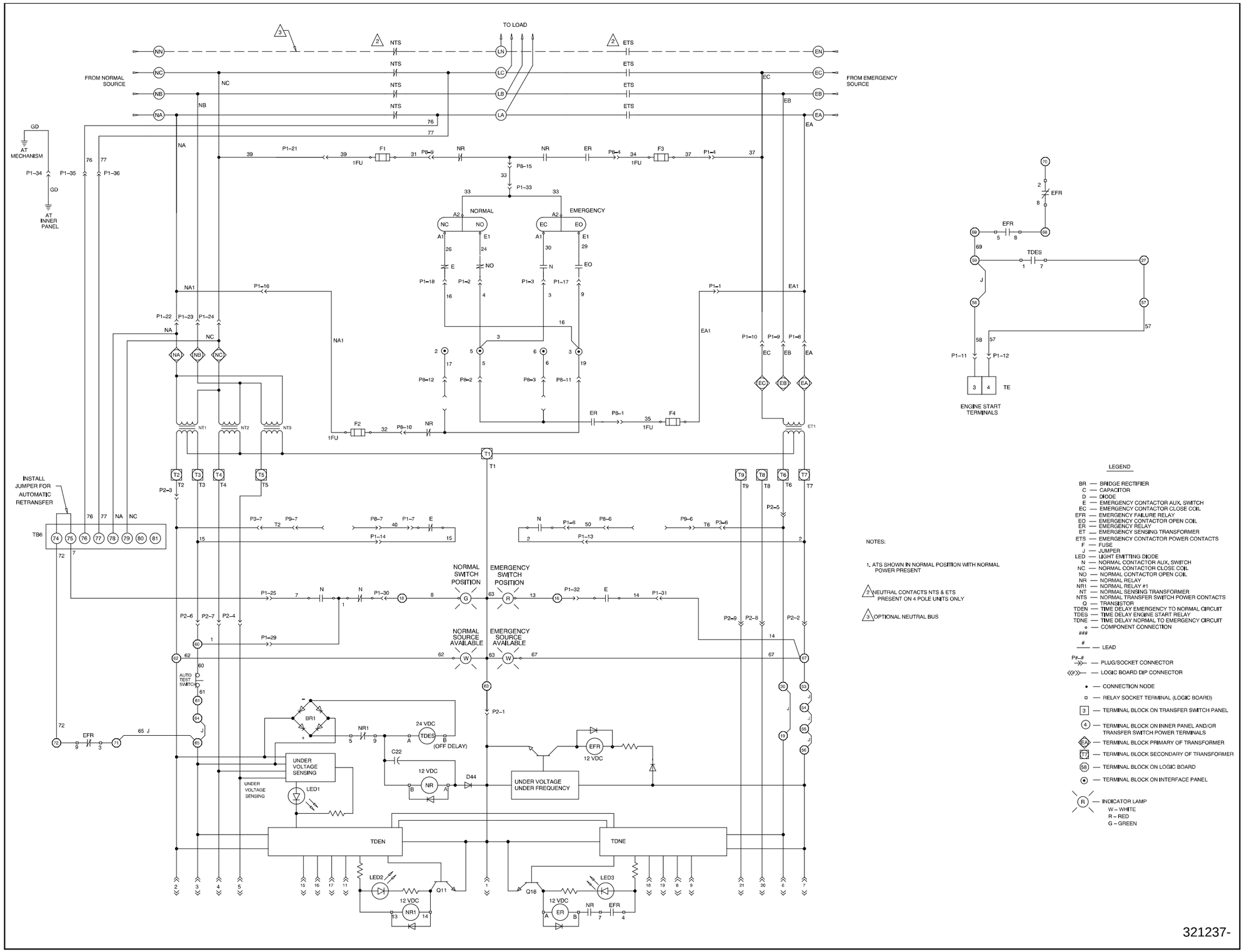


Figure 21. S340+ Logic, 25-80 Amp. Mechanically Held Contactor Without Program Transition



NOTES:

1. ATS SHOWN IN NORMAL POSITION WITH NORMAL POWER PRESENT

2 NEUTRAL CONTACTS NTS & ETS PRESENT ON 4 POLE UNITS ONLY

3 OPTIONAL NEUTRAL BUS

LEGEND

BR — BRIDGE RECTIFIER
C — CAPACITOR
D — DIODE
E — EMERGENCY CONTACTOR AUX. SWITCH
EC — EMERGENCY CONTACTOR CLOSE COIL
EFR — EMERGENCY FAILURE RELAY
EO — EMERGENCY CONTACTOR OPEN COIL
ER — EMERGENCY RELAY
ET — EMERGENCY SENSING TRANSFORMER
ETS — EMERGENCY CONTACTOR POWER CONTACTS
F — FUSE
J — JUMPER
LED — LIGHT EMITTING DIODE
N — NORMAL CONTACTOR AUX. SWITCH
NC — NORMAL CONTACTOR CLOSE COIL
NO — NORMAL CONTACTOR OPEN COIL
NR — NORMAL RELAY
NR1 — NORMAL RELAY #1
NT — NORMAL SENSING TRANSFORMER
NTS — NORMAL TRANSFER SWITCH POWER CONTACTS
Q — TRANSISTOR
TDEN — TIME DELAY EMERGENCY TO NORMAL CIRCUIT
TDES — TIME DELAY ENGINE START RELAY
TDNE — TIME DELAY NORMAL TO EMERGENCY CIRCUIT
○ — COMPONENT CONNECTION
— # — LEAD
P#-# — PLUG/SOCKET CONNECTOR
LOGIC BOARD DIP CONNECTOR
• — CONNECTION NODE
□ — RELAY SOCKET TERMINAL (LOGIC BOARD)
3 — TERMINAL BLOCK ON TRANSFER SWITCH PANEL
4 — TERMINAL BLOCK ON INNER PANEL AND/OR TRANSFER SWITCH POWER TERMINALS
EA1 — TERMINAL BLOCK PRIMARY OF TRANSFORMER
T7 — TERMINAL BLOCK SECONDARY OF TRANSFORMER
58 — TERMINAL BLOCK ON LOGIC BOARD
⊙ — TERMINAL BLOCK ON INTERFACE PANEL
R — INDICATOR LAMP
W – WHITE
R – RED
G – GREEN

321237-

Figure 22. S340+ Logic, 145-400 Amp Mechanically Held Contactor Without Program Transition

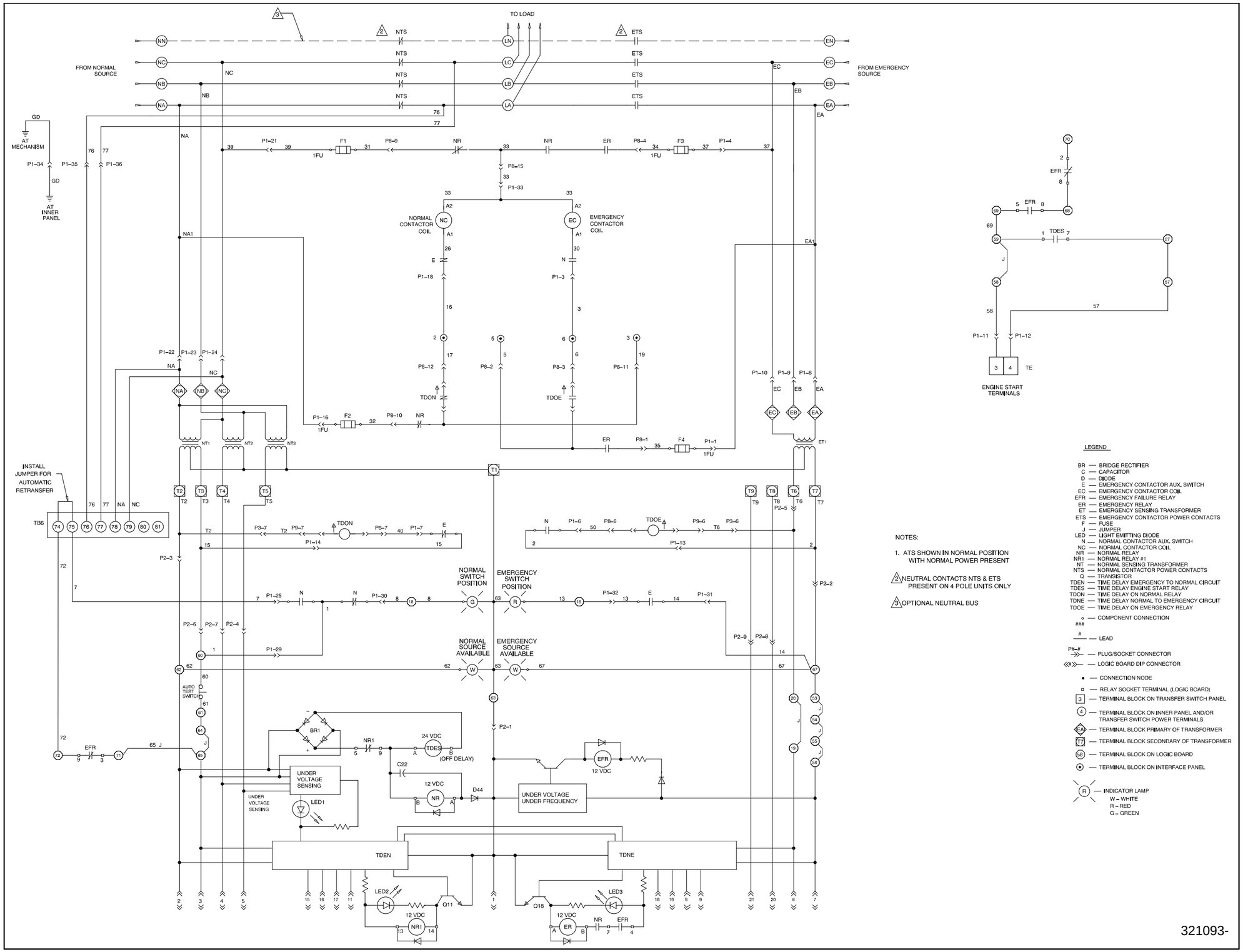


Figure 23. S340+ Logic, Electrically Held Contactor With Program Transition

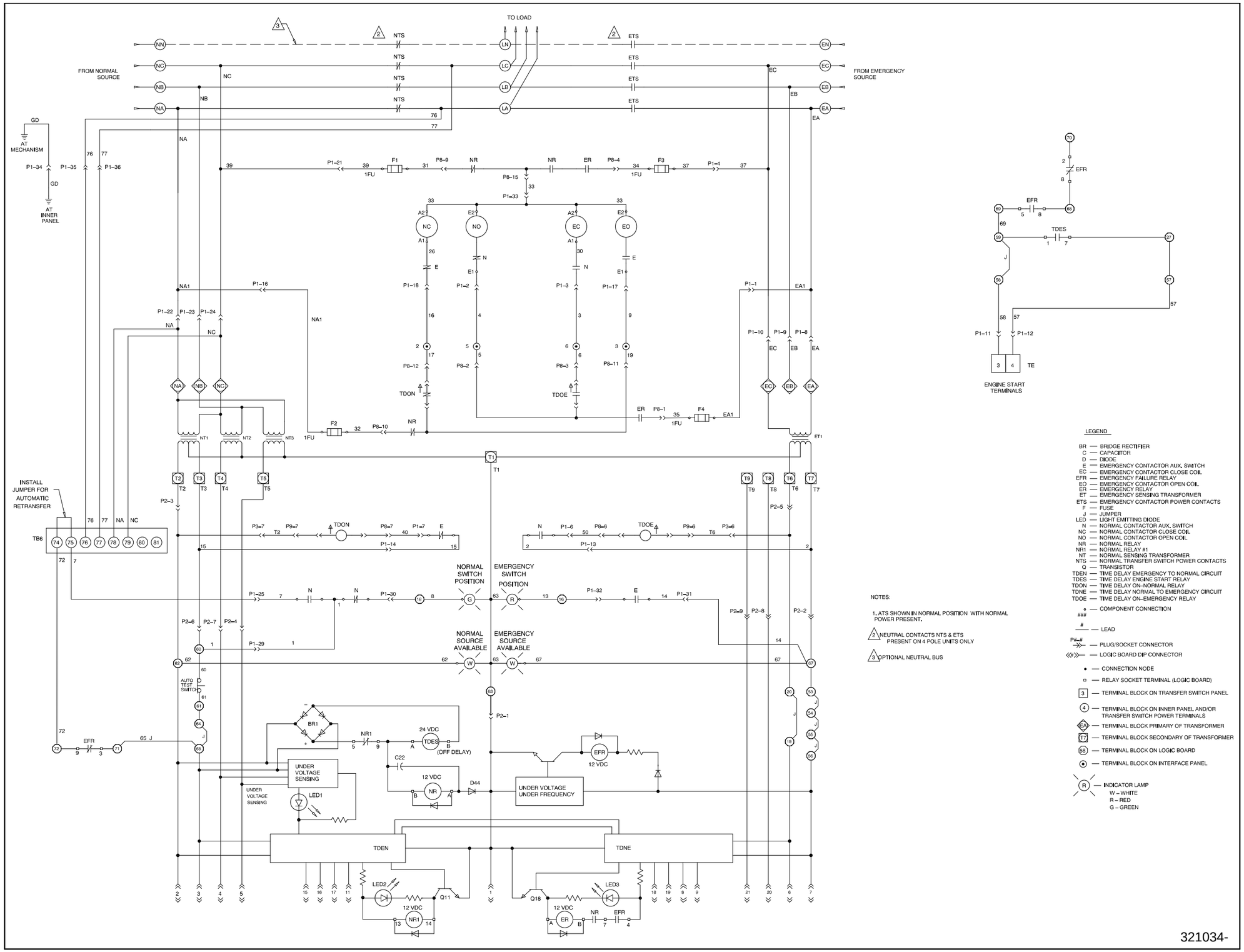


Figure 24. S340+ Logic, 25-80 Amp. Mechanically Held Contactor With Program Transition

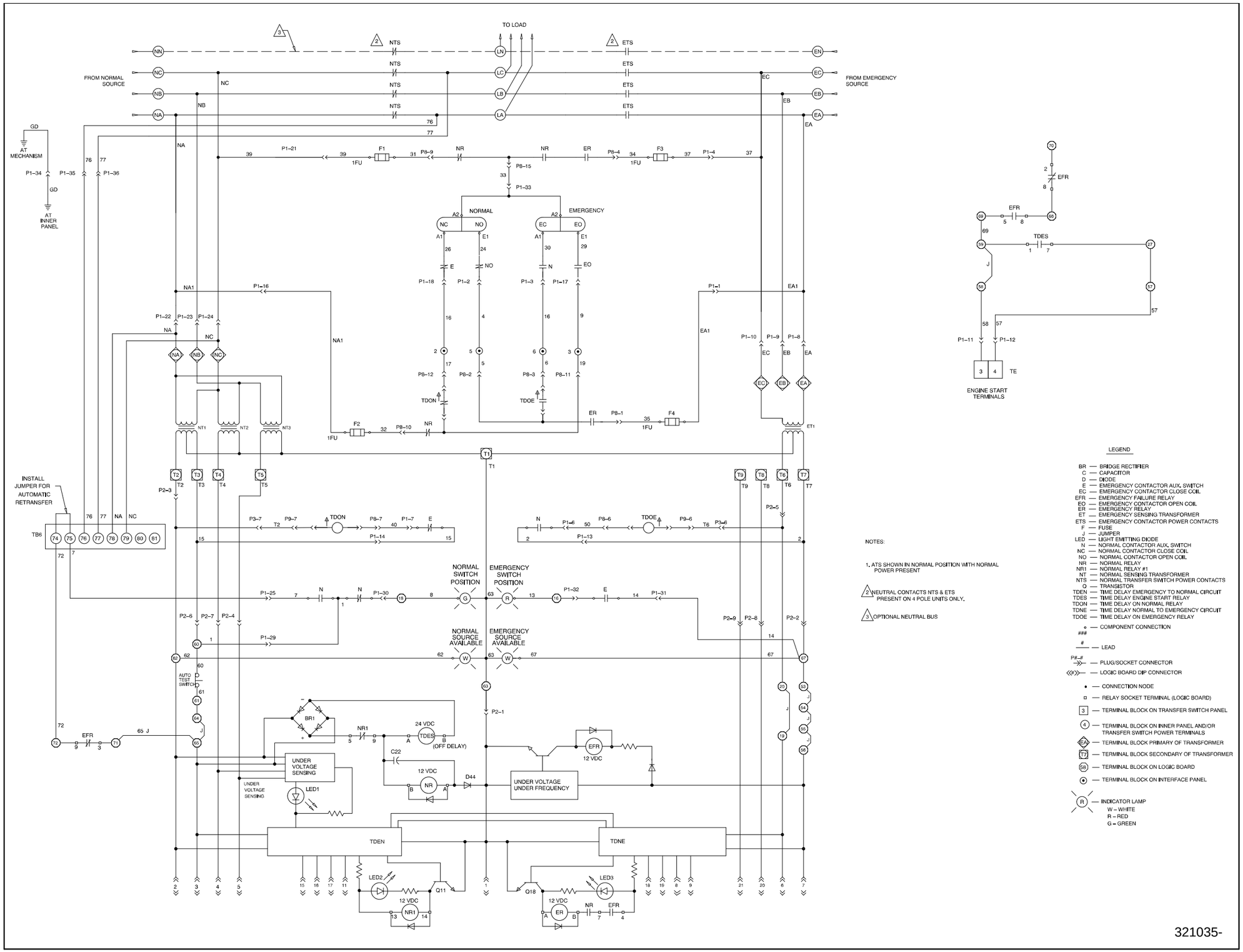


Figure 25. S340+ Logic, 145-400 Amp. Mechanically Held Contactor With Program Transition

KOHLER®
POWER SYSTEMS

KOHLER CO. Kohler, Wisconsin 53044
Phone 920-565-3381, Web site www.kohlergenerators.com
Fax 920-459-1646 (U.S.A. Sales), Fax 920-459-1614 (International)
For the nearest sales and service outlet in U.S.A. and Canada
Phone 1-800-544-2444

Kohler**r** Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65)264-6422, Fax (65)264-6455

TP-5659 11/93a