

**CPN Flare Load Reduction Phase III And OLA-2X SRR HAZOP T/A Items Projects**

9/21/2003

<p align="center"><b>TRICONEX I/O CAUSE &amp; EFFECT MATRIX</b></p>			<p align="center"><b>ACTION</b></p>		<p align="center"><b>Function</b></p>																
					<p align="center"><b>Tag No.</b></p>																
<p align="center"><b>CAUSE</b></p>			<p align="center">                     Close 67% Fuel Gas Header Valve                      Change Main Fuel Gas Control Valve (KBP133-VA1) from TDC to Local Control                      Close Nox Steam Valve                      Close Main Fuel Gas Valve                      Alarm - Bridgwall High - Trip Timer Started                      Alarm - High Bridgwall Trip                      Alarm - Fuel Gas LPOCO                      Alarm - Transfer Line Temperature High - Trip Timer Started                      Alarm - Transfer Line Temperature High Trip                      Alarm - Transfer Line Temperature High Trip @ 800 Deg. F                      Alarm - Flare Hdr Pressure High Trip                      Alarm - KJT-01 Fractionator Overhead Pressure High Trip                      Alarm - Auto Trip Main Fuel Gas Trip                      Alarm - Triconex General Problem                      Alarm - SOV Fault, Transmitter Fault or Deviation                      Alarm - Flare Hdr/Fract. Ovhd Pressure Set Point Comm. Fault                      Alarm - Auto Trip Bypassed                 </p>																		
Service	Set Point	Tag No.	Notes	KBM419A/B (KBM419-VA1)	KBP133C/D	KBF130A/B (KBF130-VA1)	KBP133A/B (KBP133-VA1)	KBP219HA	KBP219HT	KBP233LT	KBT700HA	KBT700HT	KBT800HT	KBP230HT	KBP226HT	KBM533A	KZM451A	KZM452A	KBM200	KZM450	
Bridgwall High Pressure ≥ 5 Seconds & < 65 Seconds	+ 0.2" WC	KBP219A/B/C	1 & 9	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	
Bridgwall High Pressure ≥ 65 Seconds & < 95 Seconds	+ 0.2" WC	KBP219A/B/C	2, 4 & 9	X	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	
Bridgwall High Pressure ≥ 95 Seconds	+ 0.2" WC	KBP219A/B/C	3 & 9	-	-	X	X	-	-	-	-	-	-	-	-	X	-	-	-	-	
Transfer Line to KJT-01 High Temp. < 30 Seconds	700 Deg. F	KBT700A/B/C	5 & 9	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	
Transfer Line to KJT-01 High Temp. ≥ 30 Seconds & < 1 Minute	700 Deg. F	KBT700A/B/C	4, 5 & 9	X	X	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	
Transfer Line to KJT-01 High Temp. ≥ 1 Minute	700 Deg. F	KBT700A/B/C	5 & 9	-	-	X	X	-	-	-	-	-	-	-	-	X	-	-	-	-	
Transfer Line to KJT-01 High Temp. < 30 Seconds	800 Deg. F	KBT700A/B/C	5 & 9	X	X	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	
Transfer Line to KJT-01 High Temp. ≥ 30 Seconds	800 Deg. F	KBT700A/B/C	5 & 9	-	-	X	X	-	-	-	-	-	-	-	-	X	-	-	-	-	
Flare Header to KZD-30 High Pressure	*9 PSIG Incr.	KZP230A/B/C	4, 6 & 9	X	X	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	
<b>KJT-01 Overhead High Pressure</b>	<b>*18 PSIG Incr.</b>	<b>KJP226A/B/C</b>	<b>4, 9 &amp; 15</b>	<b>X</b>	<b>X</b>	<b>X</b>	-	-	-	-	-	-	-	-	<b>X</b>	-	-	-	-	-	
Low Fuel Gas Pressure	3 PSIG Decr.	KBP233A/B/C	7, 8 & 9	-	-	X	X	-	-	X	-	-	-	-	-	X	-	-	-	-	
Automatic Trip Bypass	Bypass	KBM450-SW1	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	
Manual Shutdown - 67% FG C.V.	Shutdown	KBM419-SW1	4	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Manual Shutdown - Main FG C.V.	Shutdown	KBP133-SW1	---	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	
Triconex Internal / Hardware Alarm	n/a	n/a	---	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	
2 out of 3 Transmitter Deviation	n/a	n/a	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
Transmitter Fault Detection	n/a	n/a	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
Main FG Va SOV Open Coil/Ckt Detection	n/a	KBP133AF/BF	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
TDC/Lcl Cntl SOV Open Coil/Ckt Detection	n/a	KBP133CF/DF	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
67% FG Va SOV Open Coil/Ckt Detection	n/a	KBM419AF/BF	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
NOx Stm FG Va SOV Open Coil/Ckt Detection	n/a	KBF130AF/BF	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	
Set Point Communication Fault	n/a	n/a	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	

**Note:** All services shown without time delays will have a 0.5 second time delay before trip per IP 15-7-2 paragraph 6.5 except for the manual trip switches.

\* Default set point shown - See notes 6 & 15

## **AF-01 Fuel Gas Trips**

### **Cause & Effect Matrix Notes**

#### **General Notes:**

1. Trip Timer actuated at positive draft pressure
  - Timer started at +0.2" w.g. with 5 second time delay.
2. If the bridgewall draft pressure  $\geq$  +0.2" w.g. for 60 seconds after the trip timer has started the 67% fuel gas trip will be initiated.
3. The TRIDENT shall verify safe operation. If the bridgewall draft pressure  $\geq$  +0.2" w.g. for 30 seconds after the 67% fuel gas trip command has been issued, then total fuel gas trip will be initiated.
4. When the 67% fuel gas trip has been initiated by either the TRIDENT or the Manually Operated Emergency 67% Fuel Gas Trip selector switch, the Main Fuel Gas Control Valve, KAP133V, will be switched from TDC control to local pressure control. The local pressure control will maintain 12 PSIG downstream pressure on the fuel gas header.
5. The transfer line high temperature cutout is initiated when:
  - The transfer line temperature is at 700° F.
    - Alarm with no time delay.
    - 67% fuel gas header trip with 30 second time delay.
    - Main fuel gas header trip with 1 minute time delay.
  - The transfer line temperature is at 800° F.
    - 67% fuel gas header trip with 0.5 second time delay.
    - Main fuel gas header trip with 30 second time delay.
6. The 67% fuel gas trip is initiated when the flare header pressure is at:
  - 9 PSIG Increasing if the first set point is selected (DO – TDC KAM201); or
  - 11 PSIG Increasing if the second set point is selected (DO – TDC KAM202); or
  - 13 PSIG Increasing if the third set point is selected (DO – TDC KAM203); or
  - 15 PSIG Increasing if the fourth set point is selected (DO – TDC KAM204); or
  - 13 PSIG Increasing if no set point or more than one set point is selected (Default set point).
7. The low main fuel gas pressure cutout is initiated when the main fuel gas pressure is at 3 PSIG decreasing.
8. The main fuel gas low pressure cutout trips the main fuel gas control valve with 0.5 second time delay.
9. Uses the median of the three transmitted inputs. (2 out of 3 voting logic).
10. The Automatic Trip Bypass only prevents TRIDENT from initiating a trip. The manual 67% fuel gas trip and the manual main fuel gas trip may still be used to shutdown the furnace.

11. 2 out of 3 Transmitter Deviation: Occurs when one or more of the 2 out of 3 transmitters vary greater than that shown on the following table. It is used to identify bad transmitters.

Instrument Function	Deviation Set Point	Time Delay
Bridgewall Draft Press.	0.1" H <sub>2</sub> O	30.0 seconds
Transfer Line Temp.	50 ° F.	0.0 seconds
Flare Header Press.	2 PSI	0.0 seconds
Fractionator Ovhd. Press.	2 PSI	0.0 seconds
Main Fuel Gas Press.	2 PSI	0.0 seconds

12. Transmitter Fault Detection: Occurs when a transmitter signal is outside the expected 4-20 mA signal range. The following table shows the Out Of Range (OOR) Action for each of the instrument functions:

Instrument Function	OOR Low	OOR High	Time Delay
Bridgewall Draft Press.	NVTT	VTT	0.5 seconds
Transfer Line Temp.	NVTT	NVTT	0.0 seconds
Flare Header Press.	NVTT	NVTT	0.5 seconds
Fractionator Ovhd. Press.	NVTT	VTT	0.5 seconds
Main Fuel Gas Press.	VTT	NVTT	0.5 seconds

NVTT = No Vote To Trip      VTT = Vote To Trip

13. Set Point Communication Fault: Occurs when Trident receives no set point signal from TDC or more than one set point signal from TDC. This is used so that Trident will have a set point to use for the flare header pressure to activate a 67% trip.

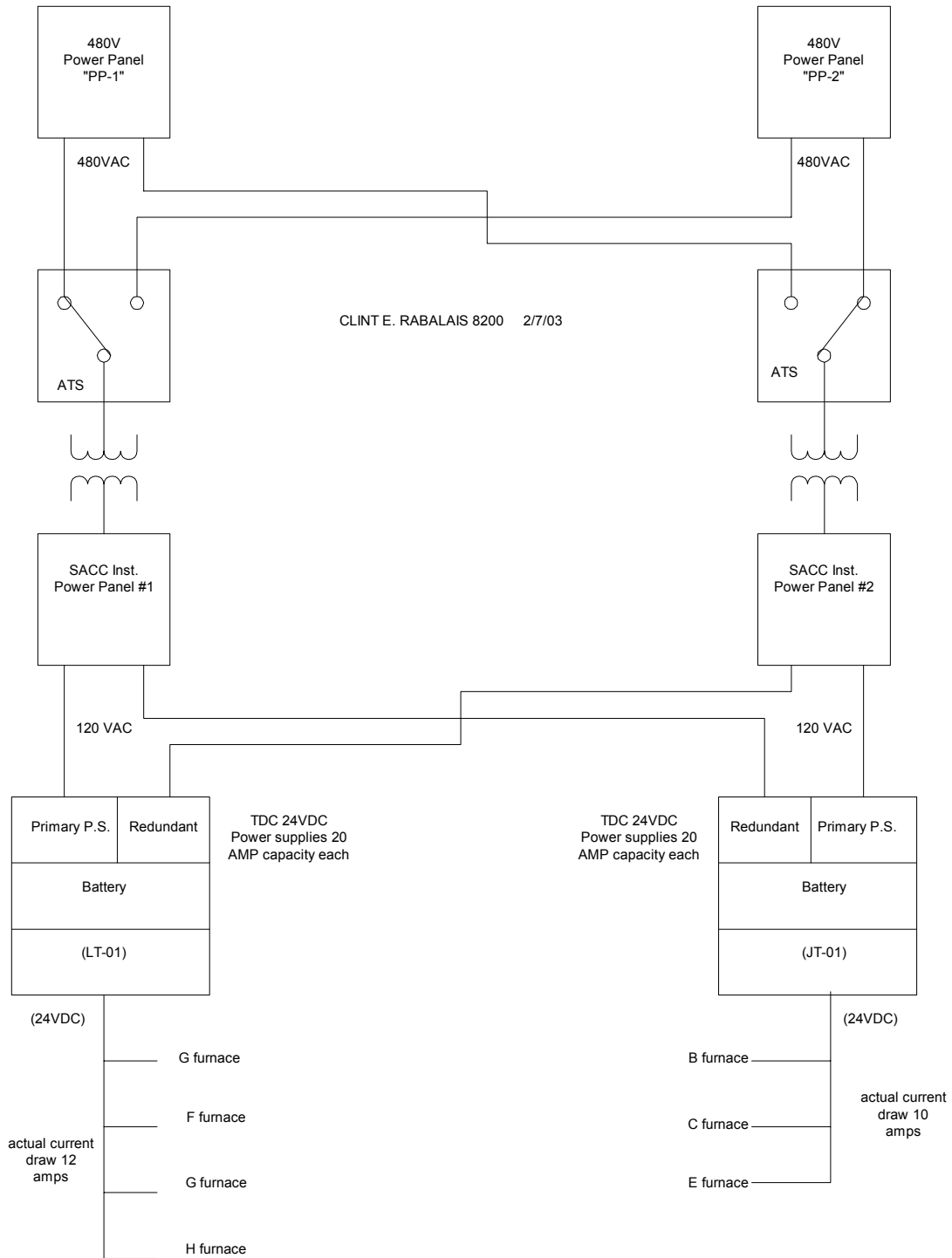
14. Permissives for startup:

- Main Fuel Gas Valve:
  - Fuel Gas Pressure > trip set point
  - Bridgewall draft pressure < trip set point
  - Transfer Line Temperature < trip set point
- 67% Fuel Gas Header Valve:
  - Bridgewall draft pressure < trip set point
  - Transfer Line Temperature < trip set point
  - Flare Header Pressure < trip set point
  - KLT-01 Fractionator Overhead Pressure < trip set point

15. The 67% fuel gas trip is initiated when the KLT-01 Fractionator overhead pressure is at:

- 18 PSIG Increasing if the first set point is selected (DO – TDC KAM201); or
- 20 PSIG Increasing if the second set point is selected (DO – TDC KAM202); or
- 22 PSIG Increasing if the third set point is selected (DO – TDC KAM203); or
- 24 PSIG Increasing if the fourth set point is selected (DO – TDC KAM204); or
- 22 PSIG Increasing if no set point or more than one set point is selected (Default set point).

16. SOV Fault: Occurs when the trip SOV's have a burned out coil, broken wire, lifted or loose wire or other open circuit condition.



## KAF-01 FURNACE FUEL GAS TRIP STATUS

Value	Tag	Service
<b>MAIN FUEL GAS</b>		
53.65	KAP233A	MAIN FUEL GAS PRESS "A"
53.68	KAP233B	MAIN FUEL GAS PRESS "B"
53.56	KAP233C	MAIN FUEL GAS PRESS "C"
53.63	AVG. MAIN FUEL GAS PRESSURE	
<b>BRIDGEWALL DRAFT</b>		
-0.247	KAP219A	BRIDGEWALL DRAFT PRESS "A"
-0.231	KAP219B	BRIDGEWALL DRAFT PRESS "B"
-0.228	KAP219C	BRIDGEWALL DRAFT PRESS "C"
-0.235	AVG. BRIDGEWALL DRAFT PRESSURE	
<b>TRANSFER LINE TEMPERATURE</b>		
611	KAT700A	TRANSFER LINE TEMP "A"
614	KAT700B	TRANSFER LINE TEMP "B"
606	KAT700C	TRANSFER LINE TEMP "C"
610	AVG. TRANSFER LINE TEMPERATURE	
<b>FLARE HEADER PRESSURE</b>		
0.501	KZP252A	FLARE HEADER PRESS "A"
0.504	KZP252B	FLARE HEADER PRESS "B"
0.497	KZP252C	FLARE HEADER PRESS "C"
0.501	AVG. FLARE HEADER PRESSURE	
<b>LT-01 FRACTIONATOR OVERHEAD</b>		
5.501	KLP226A	L FRACT OVHD PRESS "A"
5.504	KLP226B	L FRACT OVHD PRESS "B"
5.497	KLP226C	L FRACT OVHD PRESS "C"
5.501	AVG. L FRACT OVHD PRESS	

Value	Tag	Service
OKAY	KAP233LT	FG LOW PRESS C/O ALM
OKAY	KAP219HA	67% TRIP TIMER STARTED
OKAY	KAP252HT	FLARE HEADER PHCO ALM
OKAY	KAT700HA	TRANSFER LINE TEMP HI ALM
<b>MAIN TRIP</b>		
OKAY	KAM533A	MAIN FG AUTO TRIP ALM
NORMAL	KAP133DI	MANUAL MAIN SHUTDOWN
NORMAL	KAP133A	MAIN FG SOLENOID "A"
NORMAL	KAP133B	MAIN FG SOLENOID "B"
<b>67% TRIP</b>		
NORMAL	KAM419A	67% FG SOLENOID "A"
NORMAL	KAM419B	67% FG SOLENOID "B"
NORMAL	KAM419DI	MANUAL 67% SHUTDOWN
NORMAL	KAP133C	MAIN FG SOLENOID "C" trips tdc to local
NORMAL	KAP133D	MAIN FG SOLENOID "D" trips tdc to local
NORMAL	KAF130A	NOx STM SOLENOID "A"
NORMAL	KAF130B	NOx STM SOLENOID "B"
<b>TRIDENT</b>		
OKAY	KAM451A	TRIDENT HARDWARE ALM
NORMAL	KAMDOALM	SOV FAIL/OPEN COIL
NORMAL	KAP219PA	BW DRAFT PR XMTR FAIL/DEV
NORMAL	KAP233PA	MAIN FG PR XMTR FAIL/DEV
NORMAL	KAT700PA	XFER LINE TEMP XMTR FAIL/DEV
NORMAL	KLP226PA	FRACT OVHD PR XMTR FAIL/DEV
NORMAL	KZP252PA	FLARE HDR PR XMTR FAIL/DEV
NORMAL	KAM200A	SETPOINT COMMUNICATION ALM
OKAY	KZM217A	L FRACT P/S 1 TROUBLE
OKAY	KZM218A	L FRACT P/S 2 TROUBLE
NORMAL		L TRIDENT ON BATTERY
NORMAL	KAM450A	AUTOTRIP BYPASS ALARM