

NFPA110 Requirements / compliance Review 02 11 2013 (2010 version)		
Evaluated By: Shane Samson		
Date: 02/11/2013 (Final Review)		
Firmware Reviewed: TG410 V1.30 firmware review, RA400 User Manual R1.4 review		
Overall Result: Pass (Compliant)		
Requirement	TG410/RA400 Feature Included	Comments
Over-crank Shutdown	Yes	TG410/RA400 compliant. Over-crank Warning is not required however has been implemented when the generator has not started on the first cranking attempt. Over-crank failure must also have remote audible alarm and provide visual indication.
Low coolant Temperature Warning	Yes	TG410/RA400 Compliant works with engine running and also when not running (AUTO) TG410 compliant. Low coolant temperature warning must also sound remote audible alarm and provide visual indication.
High Engine Temperature Warning	Yes	TG410/RA400 compliant. This warning works when engine is running. High Engine Temperature warning must sound a remote audible alarm and provide visual indication.
High Engine Temperature Shutdown	Yes	TG410/RA400 compliant. This failure works when engine is running. High Engine Temperature Failure must sound a remote audible alarm and provide visual indication.
Low Oil Pressure Warning	Yes	Works when engine is running. This is not an NFPA requirement as NFPA only requires Shutdown. Currently the low oil pressure warning sounds a remote audible alarm and provides visual indication.
Low Oil Pressure Shutdown	Yes	TG410/RA400 compliant. This failure works when engine is running. Low Oil Pressure Failure must sound a remote audible alarm and provide visual indication.
Overspeed Warning	Yes	This is not an NFPA requirement however we have implemented on TG410/RA400. This warning works when engine is running. Overspeed warning also sounds remote audible alarm and has visual indication.
Overspeed Shutdown	Yes	TG410/RA400 compliant. This failure works when the engine is running. Overspeed failure sounds a remote audible alarm and provides visual indication.
Low Fuel Level Warning	Yes	TG410/RA400 compliant. Must Work with engine running and not running (AUTO). Low Fuel Level Warning requires remote audible alarm as well as visual indication.
Low Coolant Level	Yes	TG410/RA400 compliant. Must Work with engine running and not running (AUTO), warning must provide audible alarm as well as visual indication. Shutdown on this sensor is optional, however a warning is mandatory.
EPS Supplying Load	Yes	TG410/RA400 compliant Local indication is via AC Current display on LCD, remote indication is via fixed %(5%) setting on overcurrent warning. If Overcurrent warning is disabled then feature is disabled on RA400. This feature is visual indication only.
Not-In-Auto	Yes	TG410/RA400 compliant. Local Indication is Via LCD. Both remote

		audible alarm as well as visual indication is required.
High Battery Voltage	Yes	TG410/RA400 compliant. Must work when engine is running and not running in AUTO. This is a visual indication only, no audible alarm required.
Low Cranking Voltage	Yes	Works when engine is cranking and voltage lower than threshold voltage. Local indication is via LCD and remote indication is via LED on RA400. This feature is required to have remote audible alarm as well as visual indication.
Low Battery Voltage	Yes	TG410/RA400 compliant. Must work when engine is running and not running in AUTO. This is a visual indication only, no audible alarm required.
Battery Charger Fault	Yes	TG410/RA400 compliant. Dedicated Digital switched input for battery charge failure. Visual indication only.
Local and remote Common Alarm Output	Yes	TG410/RA400 compliant. Common Failure outputs compliant with failures in common output list as per review of NFPA110 table. TG410 controller allows the capability for user to pick which warnings/failures/events are tied with remote common failure visual indication as well as remote contact.
Local and remote Common Warning Output	Yes	TG410/RA400 compliant. Common Failure outputs compliant with warnings in common output list as per review of NFPA110 table. TG410 controller allows the capability for user to pick which warnings/failures/events are tied with remote common warning visual indication as well as remote contact.
Remote Emergency Stop	Yes	TG410/RA400 Digital Input for Emergency Stop. RA400 also provides digital input for remote emergency stop which is Modbus register to TG410 controller.
System Ready	Yes	TG410/RA400 compliant. Not specifically required by NFPA however required to support RA400 functionality on System ready. If there are no warnings or failures present and the TG410 controller is in AUTO the system status LED is green, otherwise if any warnings or failures are present or the TG410 controller is OFF the LED will be RED.
Common Fault	Yes	See Notes #1-2
Lamp test	Yes	TG410/RA400 compliant. Supported Locally via external digital input or via menu. RA400 provides feature for LAMP test.
Audible Alarm Silence Means	Yes	RA400 compliant. Only required to be supported remotely. Supported via RA400 panel. No requirement for local controller silencing means.
Low Starting Air Pressure	Yes	TG410/RA400 compliant. Supported via programmable Digital Input on TG410 and via programmable text on RA400.
Low Starting Hydraulic Pressure	Yes	TG410/RA400 compliant. Supported via programmable Digital Input on TG410 and via programmable text on RA400.
Air Shutdown Damper (ETS)	Yes	TG410/RA400 compliant. Support locally via LCD display. Remote indication is supported via common Modbus events if Air shutdown damper is used.
AC Parameter Display (AC voltage, AC frequency, AC current)	Yes	TG410 compliant. Required on genset controller only, we are compliant with display on LCD.
Front panel switch labelled AUTO, OFF, Manual/Run	Yes	TG410 compliant. TG410 Front Panel has buttons for these functions.
Two means of crank termination to prevent unnecessary crank engagement.	Yes	TG410 compliant. There are two options: 1) Customer installs magnetic pickup which is the primary means and the AC Frequency becomes the secondary means. Secondary means disconnect frequency is based on disconnect RPM percentage to

NFPA110 Notes Below

The TG410 is required to meet NFPA110 Level 2 requirements. NFPA 110 provides performance requirements for emergency and standby power systems to provide reliable auxiliary power to supply critical and essential needs during outages of the primary power source.

1. Low Starting Air pressure if Equipped (CV only). **This can be accommodated for by using one of the programmable digital inputs for warning.**
2. Low starting Hydraulic pressure If Equipped (CV only). **This can be accommodated for by using one of the programmable digital inputs for warning.**
3. Air Shutdown Damper If Equipped (energize to stop). This is accommodated for in our local control unit. Requires Energize to stop remote indication. **Remote Indication can be configured via the use of the Common Event Modbus configurable settings.**
4. Battery charger failure alarm is required for local indication however we can accommodate this feature with a programmable digital input. This is a global monitoring feature. **There is already a dedicated digital input for Battery charge failure.**
5. Contacts shall be required for low battery voltage alarms. It is assumed that Digital inputs can be used for the use of low charger voltage. **This can be accommodated by using one of the common outputs and setting to low Battery voltage. The RA400 supports the remote contacts by using the Programmable Digital outputs on RA400.**
6. Contacts for Local and remote common alarm. (Remote alarm not required when facility is staffed 24 hours a day).

Audible Alarm silencing switch only required for remote panel.

5.6.6 Remote Controls and Alarms. A remote, common audible alarm shall be provided as specified in 5.6.5.2(4) that is powered by the storage battery and located outside of the EPS service room at a work site observable by personnel.

5.6.6.1 An alarm-silencing means shall be provided, and the panel shall include repetitive alarm circuitry so that, after the audible alarm has been silenced, it reactivates after the fault condition has been cleared and has to be restored to its normal position to be silenced again.

(p) Contacts for local and remote common alarm X NA X X NA X
(q) Audible alarm silencing switch NA NA X NA NA O
(r) Low starting air pressure X NA NA O NA NA
(s) Low starting hydraulic pressure X NA NA O NA NA
(t) Air shutdown damper when used X X X X X O
(u) Remote emergency stop NA X NA NA X NA
CV: Control panel-mounted visual. S: Shutdown of EPS indication. RA: Remote audible. X: Required.
O: Optional. NA: Not applicable.

Notes:

- (1) Item (p) shall be provided, but a separate remote audible signal shall not be required when the regular work site in 5.6.6 is staffed 24 hours a day.
- (2) Item (b) is not required for combustion turbines.
- (3) Item (r) or (s) shall apply only where used as a starting method.
- (4) Item (i) EPS ac ammeter shall be permitted for this function.
- (5) All required CV functions shall be visually annunciated by a remote, common visual indicator.
- (6) All required functions indicated in the RA column shall be annunciated by a remote, common audible alarm as required in 5.6.5.2(4).
- (7) Item (g) on gaseous systems shall require a low gas pressure alarm.
- (8) Item (b) shall be set at

Common outputs are suitable for addressing requirement for local common warning and alarm contacts.

7. EPS supplying load. An AC ammeter shall be permitted for this function for local control so as long as we display AC amps we do not need separate indication for EPS supplying load.

EPS supplying load is not required for remote alarm or indication. We do however have this feature implemented on our RA400 annunciator.

8. Low Fuel local indication is warning only so this can be accommodated with our controller sensor input for fuel level.
9. Control Switch not in AUTO local and remote alarm.

We will need to implement a Local and remote alarm for NOT in AUTO. The Alarm does not have to be audible locally (needs to be visible alarm) but does need to be remote audible.

Message is displayed on Screen Not in AUTO.

10. High and Low battery voltages are required for indication. Currently we have high and low battery LED's on our RA400 annunciator which. Low battery voltage during cranking is a feature that is required for both local and remote indication.

TG410 compliant

11. Battery charger failure alarm is required for local indication however we can accommodate this feature with a programmable digital input. This is a global monitoring feature.

TG410 compliant via Switched input for battery charge failure.

12. There is a requirement for lamp test switch. Currently our Lamp test function is in a menu and not part of the front panel buttons. (see 5.6.5.2 4d) which is compliant by providing means for Lamp test functionality.

TG410 compliant with feature in Menu system.

13. Instruments

Instruments shall be provided for the following: (5.6.3.3)

- A. Oil pressure gauge (splash lubed engines do not require this indication)
- B. Temperature gauge (air cooled engines do not require this indication)
- C. Hour meter (total running hours)
- D. Battery charging meter. We assume to be supplied with Battery charger manufacturer.
- E. Other instruments as recommended or provided by the manufacturer.

TG410 compliant.

14. Contacts shall be required for low battery voltage alarms. It is assumed that Digital inputs can be used for the use of low charger voltage.

Common Output can be used for low voltage common contacts.

15. Dual means for cranking termination shall be provided. Currently we only use one primary means for crank disconnect from what I see. NFPA requires one more backup for crank disconnect. This means the customer would say have to program disconnect for mag pickup and then they would use the generator output as a secondary means or vice versa. We do not currently have this feature.

TG410 is compliant when setting to Magnetic pickup as it uses AC voltage as backup, or by using J1939 and AC voltage as backup.

16. There is a requirement for a remote manual stop to meet NFPA 110 requirements. Currently we do not have this feature on the RA400 however we might be able to use the programmable digital inputs to accommodate this feature on the RA400. (5.6.5.2 3e)

TG410 compliant as we have emergency stop switched input.

17. AC instrumentation provided as follows: (5.6.9.9)

- A. AC voltmeter for each phase
- B. AC ammeter for each phase
- C. Frequency meter
- D. Voltage adjusting rheostat to allow +-5% adjustment on voltage. Not sure if this is to adjust the AC voltage or to calibrate the AC voltage measurement.

Rheostat supplied on AC voltage regulator.

18. An alarm silencing means shall be provided (5.6.6.4) and the panel shall provide repetitive alarm circuits so that after silencing an alarm, a new alarm re-activates the alarm.

Alarm silence only required on Remote unit. TG410 compliant.

- Overcrank
- Overspeed
- Emergency Stop
- High Engine Temperature
- Low Oil Pressure
- Low Coolant Level (Aux)
- Low Coolant Temperature
- Low Fuel Level
- Communication Status
- Not In Auto
- High Battery Volts
- Low Battery Volts
- Common Fault
- Low Cranking Volts
- Battery Charge Failure
- System Ready
- Generator Running
- EPS Supplying Load



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Table 1 – Front Panel LED Indicators

LED Description	Alarm Status	LED Status / Description
Over Crank	ON	Solid Red - Failure condition on the final crank attempt. Solid Amber - Warning condition which occurs after the first unsuccessful starting attempt when there are crank attempts still remaining.
Over Speed	ON	Solid Red / Solid Amber - Failure / Warning condition.
Emergency Stop	ON	Solid Red - Emergency Stop Active.
High Engine Temperature	ON	Solid Red / Solid Amber - Failure / Warning condition. Also used to indicate Low Engine Temperature Shorted or Open sender warning/failure.
Low Oil Pressure	ON	Solid Red / Solid Amber - Failure / Warning condition.
Low Coolant Level (Aux)	ON	Solid Red - Failure condition.
Low Coolant Temperature	ON	Solid Amber - Warning condition. Note: This is called Low Engine Temperature on the TG410.
Low Fuel Level	ON	Solid Red / Solid Amber - Failure / Warning condition.
Communication Status	ON	Flashing Red - no communication with TG410 (takes up to 8 seconds to transition from green to red).
	OFF	Solid Green - communication with TG410 ok
Not In Auto	ON	Solid Red – TG410 is in the OFF mode. Automatic start is disabled.
	OFF	Solid Green – TG410 is in the AUTO mode.
High Battery Volts	ON/OFF	Solid Red / Solid Amber - Failure / Warning condition.
Low Battery Volts	ON/OFF	Solid Red / Solid Amber - Failure / Warning condition.
Common Fault	OFF	Flashing Amber – Event condition.
	ON	Solid Amber – Warning condition.
	ON	Solid Red – Failure condition. Check the TG410 for programmed events. Common Fault Indicator uses the <u>Common Fault 1</u> feature of the TG410. With this feature you can set single or multiple failures, warnings, and/or events to trigger this indicator.
Low Cranking Volts	OFF	Solid Amber – Warning condition.
Battery Charge Failure	ON	Solid Red - Failure condition. Battery Charge Failure is lit if either or both of the TG410 Charger 1 Fault or Charger 2 Fault configurable switched input features are active.

Configurable Indicator 1	ON OFF	<p>Solid Red – Failure condition Solid Amber – Warning condition</p> <p>Configurable Indicator 1 uses the TG410 Config Warn 1 and Config Fail 1 configurable switched input features. Configurable Indicator 2 uses the TG410 Config Warn 2 and Config Fail 2 configurable switched input features.</p>
Configurable Indicator 2		<p>Configurable Indicators 1 and 2 each have a white area on the label for writing the desired text. Configurable Indicator 1 is above Configurable Indicator 2. <u>Use any permanent marker with an ultra fine tip or a fine tip.</u></p>
System Ready	OFF	Solid Green / Solid Red – System Ready / System Not Ready.
Generator Running	OFF	Flashing Green – Generator is preparing to run. Solid Green – Generator is running.
EPS Supplying Load	OFF	Solid Green – EPS is supplying load.