

ELECTRIC STARTERS



Installation Instructions

305 - 27 St SE
Calgary, AB
(403) 207-0700

8403 - 51 Ave
Edmonton, AB
(780) 468-5463

11419 - 98 Avenue
Grande Prairie, AB
(780) 539-1161

300B MacKenzie Blvd.
Ft. McMurray, AB
(780) 790-0440

475 Maxwell Cres
Regina, SK
(306) 721-6925

206B, 2750 Faithful Ave
Saskatoon, SK
(306) 934-3484

104, 19329 Enterprise Way
Surrey, B.C.
(604) 539-7250

9603 - 112 Street
Fort St. John, B.C.
(250) 785-0285

INSTALLATION:

Install starter on the engine using proper bolts and washers.

The starter comes with an ex-proof enclosure which houses the Solenoid / contactor.

This may be mounted directly onto side of starter and wiring would be done in this enclosure.

Care should be used when removing this enclosure to ensure no damage to the wires of the starter.

The Solenoid enclosure could be remotely mounted from the starter. In this case a junction box would be needed at the starter.

If Remote Mounting of Solenoid.

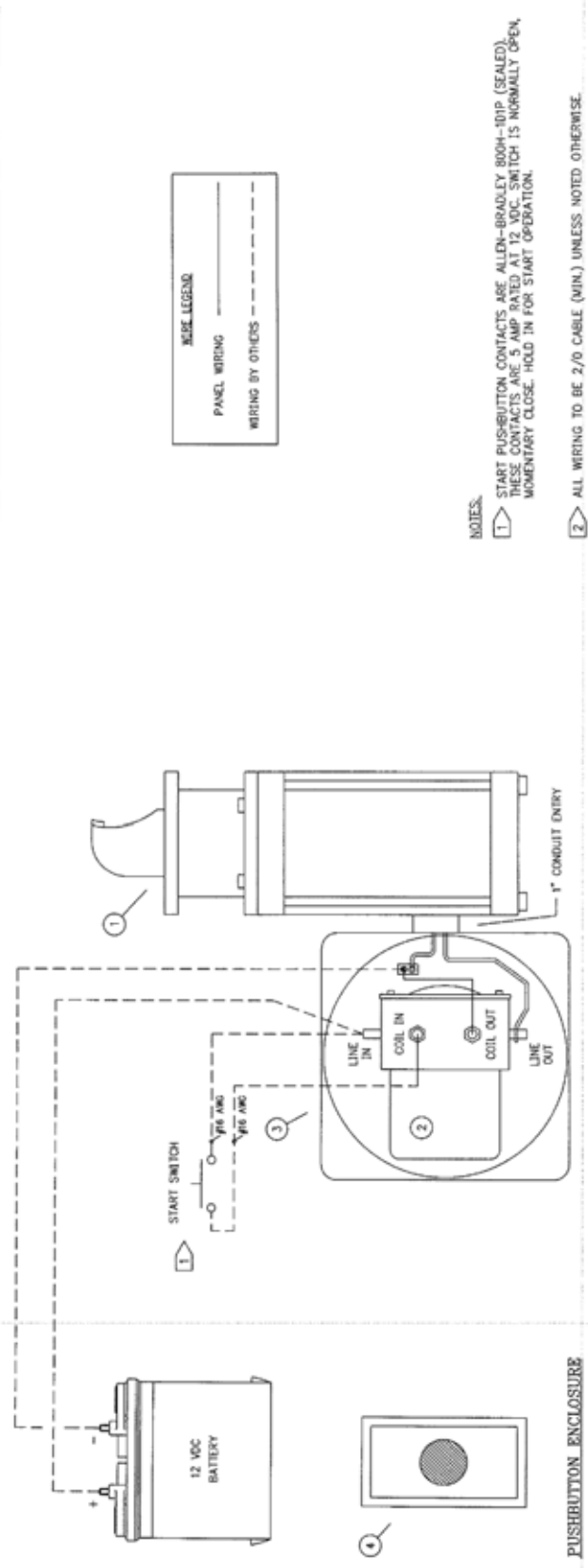
Use an adequate size of junction box at starter.
See attached wire sizing chart.

Use proper size of wire between solenoid and starter.
See attached wire sizing chart.

Use of a "Push Button" start button

Hazardous rated Push-Button / contact assemblies in an approved box are available. Specify: Class 1, Div. 1 or Div.2 rating required. Small wiring from the Solenoid to Push-Button must also meet wiring approvals for conduit etc.

| BILL OF MATERIALS | | | INSTRUCTIONS |
|-------------------|------|--|---|
| ITEM | QTY. | PART NUMBER | DESCRIPTION |
| 1 | 1 | - | STARTER (501 OR 505 SERIES) |
| 2 | 1 | 12618 | SOLENOID |
| 3 | 1 | GRM | KILLARK EXPLOSION PROOF ENCLOSURE (CL 1, GROUP B.C.D./CL II, GROUP E.F.G) |
| 4 | 1 | ST-500-P/B-KIT OR ST-500-1-P/B-KIT | CLASS 1 DIV 2, PUSH BUTTON KIT CLASS 1 DIV 1, PUSH BUTTON KIT |



WIRE LEGEND

PANEL WIRING _____

WIRING BY OTHERS - - - - -

NOTES:

1 START PUSHBUTTON CONTACTS ARE ALLEN-BRADLEY 800H-101P (SEALED). THESE CONTACTS ARE 5 AMP RATED AT 12 VDC. SWITCH IS NORMALLY OPEN, MOMENTARY CLOSE. HOLD IN FOR START OPERATION.

2 ALL WIRING TO BE 2/0 CABLE (MIN.) UNLESS NOTED OTHERWISE.

PUSHBUTTON ENCLOSURE
(SHIPPED LOOSE)

STARTER/SOLENOID AND X.P. ENCLOSURE LAYOUT

Power Ignition and Controls
a Division of Spacron Controls

| | | | | | |
|-------------------------|------|-----------|-----|-----|-----|
| DESCRIPTION | REV. | DATE | BY | CHK | APP |
| ISSUED FOR CONSTRUCTION | 1 | 27 OCT 04 | PKM | LF | LF |
| ISSUED FOR APPROVAL | 1 | 24 MAY 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 5 | 26 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 6 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 7 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 8 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 9 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 10 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 11 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 12 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 13 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 14 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 15 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 16 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 17 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 18 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 19 | 20 APR 04 | PKM | LF | LF |
| ISSUED FOR REVIEW | 20 | 20 APR 04 | PKM | LF | LF |

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPACRON CONTROLS AND MUST BE KEPT IN STRICT CONFIDENCE AND PROPERLY SECURED BY THE RECIPIENT AT ALL TIMES.

EXPLOSION PROOF STARTER CONTACTOR AND PUSHBUTTON ASSEMBLY

REV. 2

METHODS OF STARTING – 12 VOLT OR 24 VOLT

Power from a Vehicle: 12 V starter systems

Recommended two-battery type 12 volt system in vehicle. Wiring between the two batteries should be upgraded to larger current carrying size. e.g. 1/0 cable

Only a “**JUMPER CABLE**” of **NO LESS THAN 2/0 Welder Cable** should be used from vehicle to the starter. Minimum length of 25 feet due to hazardous area ratings.

Power from “Cranking Battery” 12V or 24V system

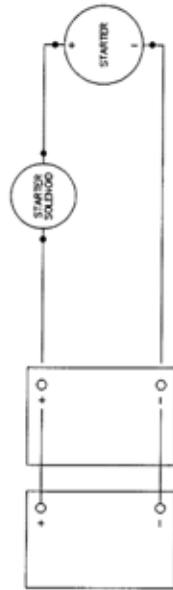
Distance between the starter and the “cranking battery” should be short as possible. This is due to increased wire sizes required for extended lengths.

Ensure batteries are maintained to full charge and are in good operating condition. Regular maintenance required.

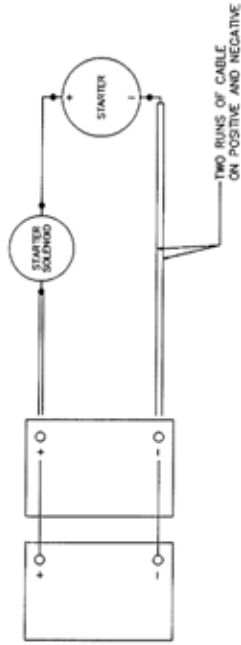
Duty Cycle:

15 seconds on, 1 minute off, 3 attempts, 30 minutes rest.

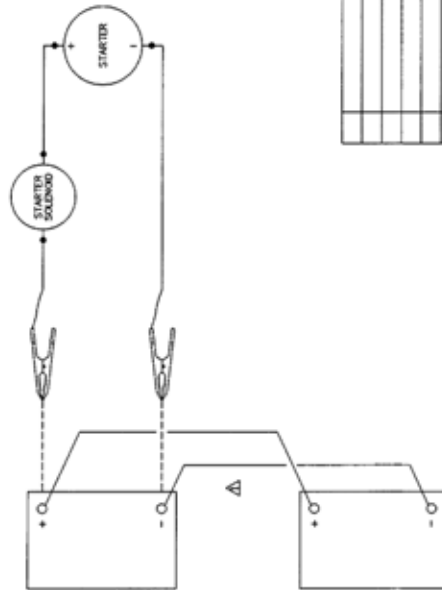
SINGLE CABLE WIRING



DUAL CABLE WIRING
(OPTION 1)

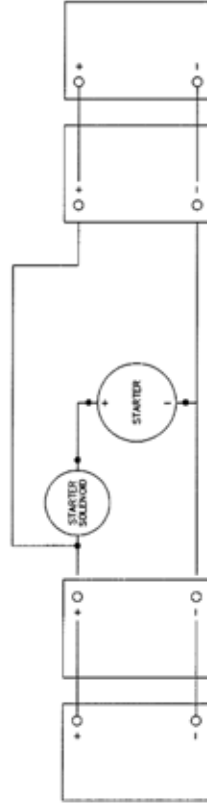


SINGLE CABLE STARTING FROM TRUCKS WITH DUAL BATTERIES
USING BOOSTER CABLES (WELDING CABLE RECOMMENDED)



NOTE:
1. ENSURE WIRE SIZE IN TRUCK CAN HANDLE CURRENT TO ENSURE ADEQUATE SIZING USE SPECIFIED WIRE SIZE BETWEEN BATTERIES.

(OPTION 2)



| | | |
|----------------|-----|------------------------------|
| DATE: | | POWER IGNITION CONTROLS LTD. |
| SHEET NO. OF 1 | | FOR SALES DRAWING |
| SCALE: | N/T | |
| DRAWN BY: | | YOUR ORDER NO. |
| CHECKED BY: | | YOUR ORDER NO. |
| APPROVED BY: | | DRAWING NO. |
| | | STARTER WIRING-50 |
| REV: | 0 | REV |
| | | 0 |

WIRE SIZING

For US Energy Electric Starters

Minimum wire size to be used on any US Energy, electric starter is 2/0 cable.

LONGER THE DISTANCE <-> LARGER THE WIRE

See attached charts for proper sizing of wire runs to starter.

Wires can be run single or in pairs dependant upon current requirements and wire size needed

Always calculate on overall lengths. i.e. length 10 feet to starter = overall length of 20 feet of wire.

This is due to 10 feet positive + 10 feet of return –

Proper Installation must be met to ensure correct operation of this equipment

DO NOT UNDERSIZE THE WIRING.

Damage to or Failure of the starter may result.

Electric Starter Wire Sizing

To use Chart, locate starter model and combined length of cable run and type of wiring single or dual cable run. Look up Maximum Resistivity of cable. Then proceed to wire Characteristics Chart, choose next lowest Resistivity wire size. i.e. for a ST505EP-1, and 40 foot cable length (Single cable run) AWG #00 is required

| Starter Model | Supply Voltage (Vdc) | Current Draw (Amps) | Combined length of positive and negative cable (ft) [Single Cable run wiring; see drawing Starter Wiring] | | | | | | | | | | |
|---------------|----------------------|---------------------|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | | | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 |
| | | | Maximum Resistivity of cable (ohms/1000 ft) | | | | | | | | | | |
| ST-505EP-1 | 12 | 275 | 0.18333 | 0.14667 | 0.12222 | 0.10476 | 0.09167 | 0.08148 | 0.07333 | 0.06667 | 0.06111 | 0.05641 | 0.05238 |
| ST-464EP-1 | 12 | 275 | 0.18333 | 0.14667 | 0.12222 | 0.10476 | 0.09167 | 0.08148 | 0.07333 | 0.06667 | 0.06111 | 0.05641 | 0.05238 |
| ST-585EP-1 | 12 | 275 | 0.18333 | 0.14667 | 0.12222 | 0.10476 | 0.09167 | 0.08148 | 0.07333 | 0.06667 | 0.06111 | 0.05641 | 0.05238 |
| ST-505EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-481EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-585EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-561EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| | | | Combined length of positive and negative cable (ft) [Dual Cable run wiring; see drawing Starter Wiring] | | | | | | | | | | |
| ST-505EP-1 | 12 | 275 | 0.36667 | 0.29333 | 0.24444 | 0.20952 | 0.18333 | 0.16296 | 0.14667 | 0.13333 | 0.12222 | 0.11282 | 0.10476 |
| ST-464EP-1 | 12 | 275 | 0.36667 | 0.29333 | 0.24444 | 0.20952 | 0.18333 | 0.16296 | 0.14667 | 0.13333 | 0.12222 | 0.11282 | 0.10476 |
| ST-585EP-1 | 12 | 275 | 0.36667 | 0.29333 | 0.24444 | 0.20952 | 0.18333 | 0.16296 | 0.14667 | 0.13333 | 0.12222 | 0.11282 | 0.10476 |
| ST-505EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-481EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-585EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |
| ST-561EP-2 | 24 | 375 | 0.27500 | 0.22000 | 0.18333 | 0.15714 | 0.13750 | 0.12222 | 0.11000 | 0.10000 | 0.09167 | 0.08462 | 0.07857 |

This calculation is to determine the allowable voltage drop based on US Energy starter experience.
 Experience shows 50ft of #00 cable will function correctly.

50 ft combined cable length

| Cable Voltage Drop | Current | Cable resistivity |
|--------------------|---------|-------------------|
| 0.1 | 275 | 0.00727 |
| 0.2 | 275 | 0.01455 |
| 0.3 | 275 | 0.02182 |
| 0.4 | 275 | 0.02909 |
| 0.5 | 275 | 0.03636 |
| 0.6 | 275 | 0.04364 |
| 0.7 | 275 | 0.05091 |
| 0.8 | 275 | 0.05818 |
| 0.9 | 275 | 0.06545 |
| 1.0 | 275 | 0.07273 |
| 1.1 | 275 | 0.08000 |
| 1.2 | 275 | 0.08727 |

| Wire Characteristics | |
|----------------------|--------------------------|
| AWG | Resistivity (ohm/1000ft) |
| 0000 | 0.04901 |
| 000 | 0.06180 |
| 00 | 0.07793 |
| 0 | 0.09827 |
| 1 | 0.12390 |
| 2 | 0.15630 |
| 3 | 0.19700 |
| 4 | 0.24850 |
| 5 | 0.31330 |
| 6 | 0.39510 |
| 7 | 0.49820 |

CARE AND MAINTENANCE

All US Energy starters are lubricated at the factory for long life.

These starters are constructed with bushings and bearings in the motor and roller bearings in the pinion housing.

No additional lubrication is required.

Keep all electrical connections tight. Routine inspection suggested.

Keep “Cranking” batteries in good condition and serviced on a regular basis. Most are “wet acid” which require water from time to time.

FOLLOW RECOMMENDED STARTING PROCEDURES.

1. Determine safe conditions at engine, no gas present.
2. Make sure load is removed. OPEN COMPRESSOR BY-PASS FULLY.
3. Observe the Duty Cycle recommendations of the manufacturer.
4. Crank the engine.

U.S. Energy

**EXPLOSION PROOF MOTORS
FOR HAZARDOUS LOCATIONS
CLASS I, DIV. 1+2, GROUP D**

| | | | |
|-------------------|--|----------------|-----|
| MODEL | | | |
| FRAME | USD | H.P. | |
| VOLTS | | AMPS | |
| RPM | VAR. | | |
| DUTY CYCLE | 15 SEC ON 1 MIN. OFF FOR 3 CYCLES THEN 30 MIN. REST | | |
| CYCLE | DC | CLASS | B |
| SER. F | 1.0 | T. CODE | T4A |
| RATING | 60°C AMB. INT. | | |
| SERIAL | | | |



**UNITED STATES ENERGY CORP.
ANAHEIM, CA 92801 U.S.A.**

TROUBLESHOOTING TIPS

Starter will not energize:

- Check for proper power.

Starter energizes but will not crank the engine or is cranking “too slow”

- Loose electrical connections
- Weak batteries – not fully charged
- Undersized wires to starter
- Possibly excess load on engine at crank
- Open Compressor By-Pass fully

Starter turns engine and starts, but will not disengage.

- Shutdown immediately and remove starter
- Possibly pinion drive has failed
- Return starter for repairs

If the starter appears to be faulty, please return to Power Ignition and Controls Ltd for evaluation and repair.

Only authorized facilities qualified for repairing hazardous rated motors should attempt repairs. No field serviceable parts other than pinion drive.