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Neutron Door Specs & Drawing

NEUTRON DOOR SPECIFICATION

General:

The door and frame assembly is designed to support the high weight resulting from the shielding materials located in the center of the door. Power operation is recommended due to the high inertia of the door. The size of the door and frame should take into consideration both the overlap needed between the door and frame for good shielding and the clear opening required with the door open at 90°.

Internal Construction:

Frame: ¼" steel angles and bar shall be welded together to support the door weight and to provide the necessary door to frame overlap for shielding purposes. Integral wall concrete anchors, floor anchors and an unlined steel threshold welded between the jambs will aid in securing the frame as it is embedded in support concrete. The frame will be supplied in a prime paint finish. One or more frame mounted door position switches are available if required. Conduit planning should include this switch wiring.

Door:

The door will use a minimum of ¼" A36 steel shell for the front and rear faces, and perimeter frame. ½" x 6' x full height steel hinge reinforcement will be located on the inside of the door at the hinge edge to allow proper fastening of the hinges. The strike side is beveled on the door. Two removable lifting eyes are furnished to aid installation.

Core:

The core material will be determined by the application and room design and shall be approved by the site physicist prior to construction. Both continuous lead sheet and polyethylene materials are commonly used in thicknesses determined by physicist calculation.

Other:

Hardware: The door hardware will include Push/Pull sets and two HD adjustable ball bearing hinges. Each hinge must be rated for the entire door weight. Due to the critical nature of hinge alignment, the hinges shall be factory mounted to the door and frame, and then removed for shipment and reinstallation at the time of door erection.

**Neutron Door Frame
Installation Details &
Drawing**



NUETRUM DOOR FRAME MUST BE LEVEL AND PLUMB IN ALL DIRECTIONS BEFORE ANY CONCRETE IS POURED

TEMPORARY WELDS TO FRAME

REINFORCED LIFTING EYE

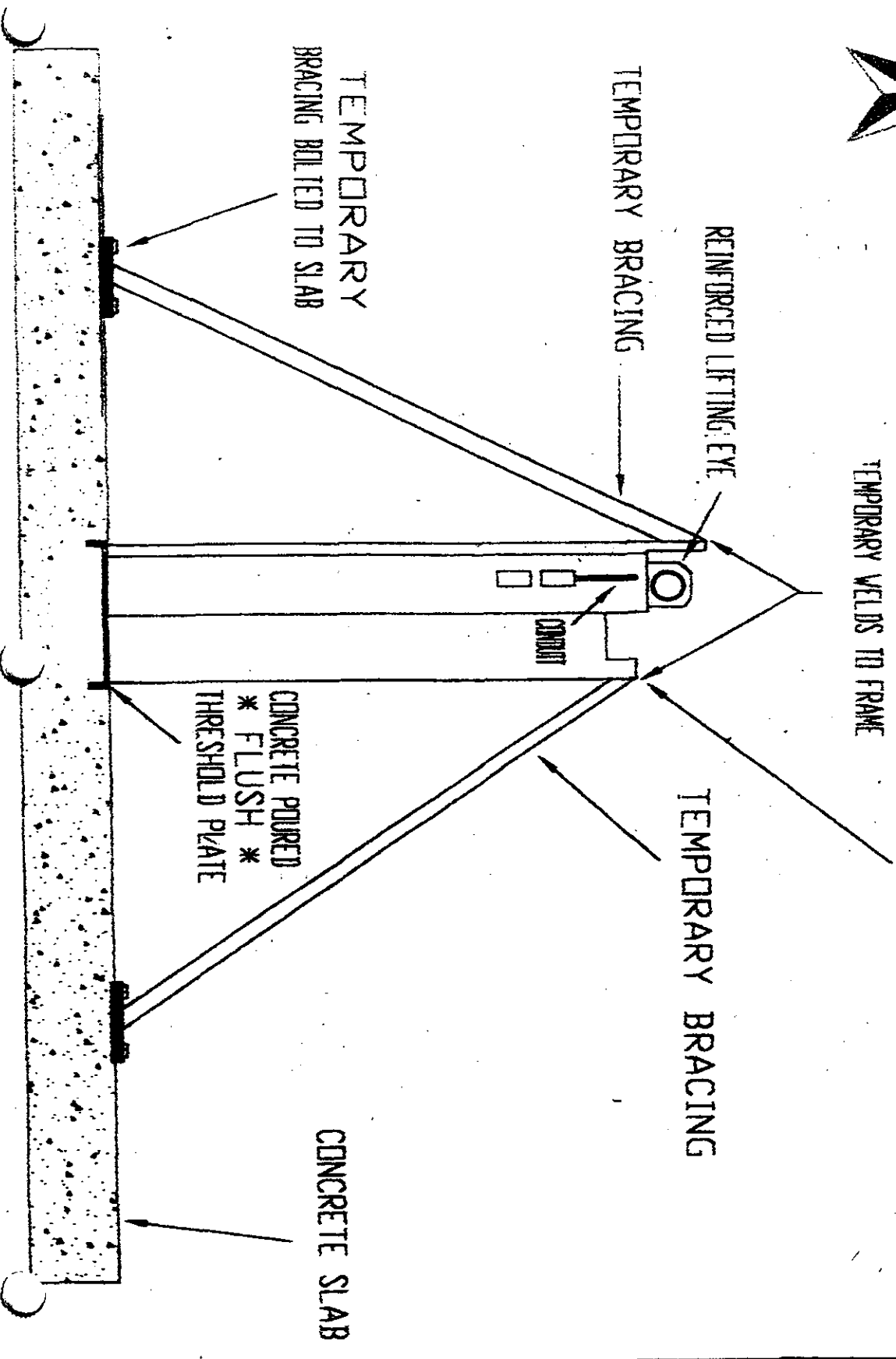
TEMPORARY BRACING

TEMPORARY BRACING

TEMPORARY BRACING BOLTED TO SLAB

CONCRETE POURED * FLUSH * THRESHOLD PLATE

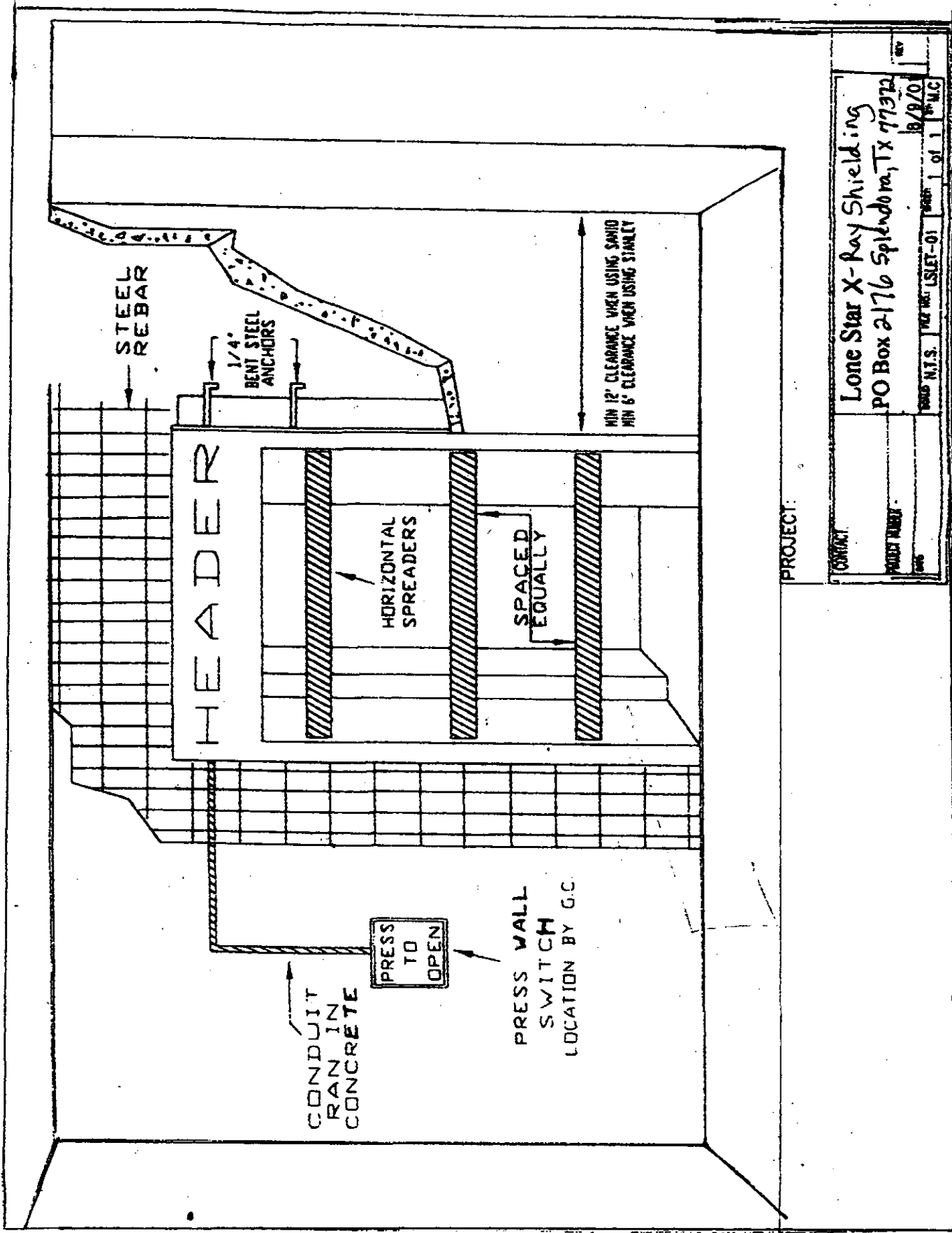
CONCRETE SLAB



C

C

C



PROJECT:

CONTRACT:

PROJECT NUMBER:

DATE:

Lone Star X-Ray Shielding
 PO Box 2176 Splendora, TX 77372

18/9/01
 SHEET NO. LSLET-01 OF 1 SHEETS

NB-500 Brookfield Operator

brookfield industries, inc.

Industrial Door Operator Manual

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LISTED
DOOR HINGE
E 3N16

CE



*For Operator Model Numbers:
NB-500, NB-1000, NB-2000, NB-4000*

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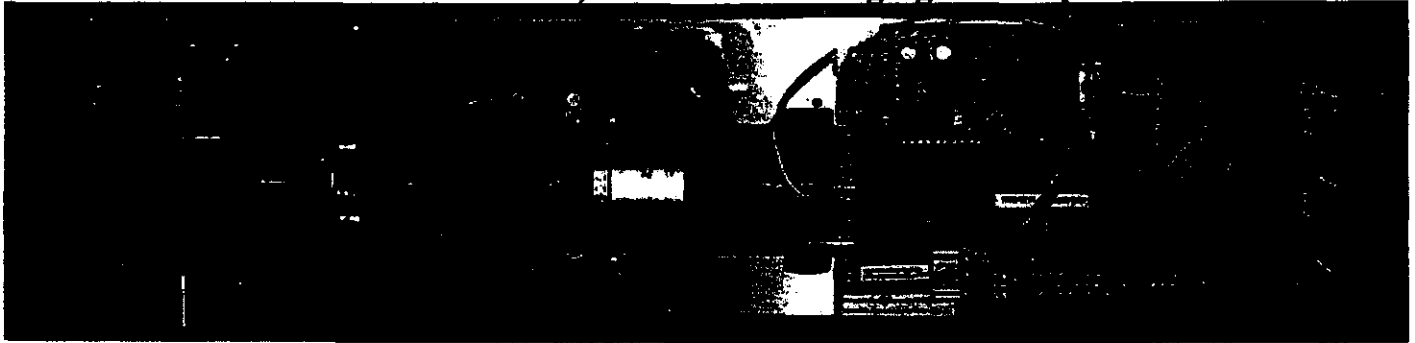
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Limited Warranty

Swing Door Operator Troubleshooting

Series F Series W Door Operators Series III Special Custom Engineering

brookfield industries, inc. NB-500 Swinging Door Operator



Description:


The brookfield NB-500 Swinging Door Operator has been designed, tested and is manufactured by brookfield industries, inc. in accordance with UL 325 and ANSI 156.10 for linear accelerator swing doors weighing up to 4,500 lbs and 66" wide. The NB-500 can be expected to safely operate doors at the maximum weight and width for at least 500,000 cycles, providing the door is set within the ANSI 156.10 speed criteria and the rated operating torque of 1000 lb-in (reflected to the operator) has not been exceeded.

We "list" the NB-500 with Intertek Testing Services (ETL) to assure compliance with UL 325. The "listing" report specifically refers to the heavy commercial/industrial doors associated with linear accelerator rooms.

Since most of the components are constructed from aluminum, this operator is assured to be the lightest and strongest in the industry today. The NB-500 is an electro-mechanical power open/power close operator, which utilizes a state of the art PLC and positioning control components that allow us to offer special patent pending features such as Absolute position feedback and Auto backlash removal to name a few.

PLC (Programmable Logic Control) is programmed by the manufacturer to accept input signals from push paddles, 2 and 3 button station partial open commands. Additional I/O (Input/Output) have been added to the NB-500 to accommodate any number of special customer requirements such as: E-stops, motion detectors, control mats, card readers, reversing edge sensors and battery backup to name a few.

Interface with the PLC is provided with a hand held user-friendly operator panel to adjust door position presets (purchased separately).

Full Specifications in PDF => 

Full Product Manual in PDF => 





Conforms to UL STD 325
Control No. 3011624

brookfield industries, inc. NB-500 Swinging Door Operator

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The brookfield NB-500 Swinging Door Operator has been designed, tested and is manufactured by brookfield industries, inc. in accordance with UL 325 and ANSI 156.10 for linear accelerator swing doors weighing up to 4,500 lbs and 66" wide. The NB-500 can be expected to safely operate doors at the maximum weight and width for at least 500,000 cycles, providing the door is set within the ANSI 156.10 speed criteria and the rated operating torque of 1000 lb-in (reflected to the operator) has not been exceeded.

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Since most of the components are constructed from aluminum, this operator is assured to be the **lightest and strongest** in the industry today. The NB-500 is an electro-mechanical power open/power close operator, which utilizes a state of the art PLC and positioning control components that allow us to offer special patent pending features such as *Absolute position feedback* and *Auto backlash removal* to name a few.

The PLC (Programmable Logic Control) is programmed by the manufacturer to accept input signals from push paddles, 2 and 3 button stations and partial open commands. Additional I/O (Input/Output) have been added to the NB-500 to accommodate any number of special customer requirements such as: E-stops, motion detectors, control mats, card readers, reversing edge sensors and battery backup to name a few.

Interface with the PLC is provided with a hand held user-friendly operator panel to adjust door position presets (purchased separately).

Rating a Door Operator:

The rating of any door operator in a particular application cannot be based solely on the weight and width of the door. Other factors such as an "out-of plum" frame, "hinge bind", hinge friction, acceleration and deceleration rates or pressure differential from one side of the door to the other, may have a substantial affect on the total operating torque it takes to move the door at ANSI speeds. For Example, a 2,500 lb, 56" wide door would be well within the weight and width limitations; however, if any of the other factors are not properly controlled, the total operating torque could exceed the rated values. In the design and testing of the NB-500 door operator, we have factored these variables into the Rated Operating Torque. This assures the customer they are getting the most dependable product at a reasonable cost.

Maximum Rated Operating Torque = 1,000 lb-in
Maximum Rated Door Weight = 4,500 lb
Maximum Rated Door Width = 66 in

The NB-500 can be expected to operate any linear accelerator swing door within the rated values for at least 500,000 cycles, provided the door is operating within the ANSI 156.10 speed criteria and the acceleration rate for a particular door weight has not been exceeded.

Specification:

- 1) **Forward and reverse torque adjustment:** via current limit trimpot settings on the motor control to adjustment the operating torque in order to comply with the entrapment protection requirements of UL 325. This eliminates the need for unreliable and hard to adjust manual clutches or electromagnetic clutches that are not designed for slippage or stall applications.
- 2) **Automatic egress:** or door reversal whenever entrapment protection has been violated in either the opening or closing directions; however, door shall not reverse automatically when in the latchcheck (creep close) or backcheck (creep open) modes. This feature can be adjustable for time delay and stall torque.

- 3) **Auto backlash removal:** automatically closes the door and removes all mechanical backlash in the system when in the latchcheck (creep close) mode. If a small pressure differential exists or if the door wants to float open slightly, the motor will restart and "clamp" the door against the frame; thus, assuring the frame interlocks will not be disengaged and the response time to open will be optimized.
- 4) **Absolute position feedback control:** this assures the CPU always knows the door's position. During installation, a power interruption, or if electrical noise is encountered, the door is not required to be "homed", "reset" nor go through a "learn speed cycle" at any time.
- 5) **Manual operation:** shall be in accordance with UL 325 during a power loss.
- 6) **Supply voltage:** 115VAC +/- 10% 50/60 Hertz. In-Line fuses supplied with PLC and Motor Control.
- 7) **Current Consumption:** maximum 3 amperes.
- 8) **PLC/Logic Control:**
 - a) Shall be a PLC with sufficient I/O and a CPU (Central Processing Unit) with adequate memory, response times and scanning rates in order to properly control the motion and positioning of Linear Accelerator Swing Doors.
 - b) Outputs commands shall be the internal type, integral with the PLC. No external limit switches shall be allowed for control of door positioning.
 - c) A means to interface with the PLC for adjusting preset values for the open, partial open, closed, latchcheck and backcheck positions.
 - d) Diagnostics and troubleshooting of the PLC shall be provided with LED and modular plug-in components.
 - e) The PLC shall be provided with an internal battery to store the door position presets in the CPU memory.
- 9) **Motor:** 1/8 hp permanent magnet 90 volt DC motor 1650 RPM TENV
- 10) **Motor Control:** shall be a full-wave, four quadrant, regenerative, 90 VDC variable speed control with the following functions:

FWD/REV maximum speed	FWD/REV current limit	IR compensation
FWD/REV acceleration/deceleration	1% speed regulation	50:1 speed range.
- 11) **Speed Control:** a means of controlling independent forward and reverse speeds per ANSI 156.10 as well as controlling latchcheck and backcheck "creep" speeds. This can be accomplished externally with speed pots or internally with the PLC.
- 12) **Drive train and linkage mechanism:** shall be designed to allow manual operation of the door per UL 325 in addition to assuring each component from the motor to the door attachment point is properly "sized" in order to transfer all operating torques and forces as defined for Linear Accelerator Swing Doors. Standard linkage shall consist of a pull open design with crank arm, slider block and cam follower assembly.
- 13) **Materials:** Aluminum 6061-T651&T-6, AISI 1018 cold rolled steel, grade 5 bolting or better.
- 14) **Mounting hardware:** the NB-500 shall be mounted with (6) 3/8" grade 5 diameter bolts with compatible washers and lock washers. Hardware must also be properly tightened with adequate thread engagement.
- 15) **Finish:** all exposed carbon steel surfaces shall be prime painted, while all exposed aluminum surfaces shall be brushed.
- 16) **Functionality test:** each NB-500 is cycle tested in position for 24 hrs. prior to shipment. Each unit is checked for leaks and that all I/O are functioning properly.
- 17) **Installation:** the NB-500 shall be installed per drawing NB-500-4 for pull open linkages and NB-500-44 and NB-500-0 for push open applications.

brookfield industries, inc.

**NB-500
DOOR OPERATOR
MANUAL**

(3rd Edition 12/12/01)

Serial No. "D" designates ETL approval



Conforms to UL STD 325
Control No. 3011624

US Patent No. 6,177,771 B1

Warning !

Carefully read these instructions prior to using this product

Industrial swinging door operator for trained traffic* use only. The manufacturer of this product does not include external safety devices as a standard feature.

No person shall install, service or activate this door operator unless they have been properly trained in its safe usage and have read the owner's manual.

Prior to performing any service on this product (including the replacement of any fuses), disconnect the operator from the power supply.

For continued protection against fire, replacement fuses shall be of the same type and ratings as those being replaced.

Before attaching any external safety devices to this operator, consult the owner's manual or call the manufacturer as required.

Before activating this door operator, check the following to avoid serious injury:

1. Assure that all individuals are clear of the path of this operator and the path of the door it is attached to.
2. Assure that all fingers, hands, feet, limbs and articles of clothing are clear of all moving parts and pinch points.

*Defined in ANSI 156.10 as a controlled group of people trained in the safe use and operation of a particular door installation.

Important Safety Instructions!

This door operator should be installed and serviced by a qualified technician, electrician or electrical maintenance person familiar with its operation and the potential hazards involved. We strongly recommend any person performing installation or service on this product, read this manual first. Proper installation includes the mounting and location of the operator, in addition to the wiring and grounding as specified in this manual and as required by any local codes. Proper installation can also reduce the risk of electrical shock, fire or explosion.

Assure activation switches are installed in a location from which operation of the door can be observed by the person operating the switch.

As described in this manual, the Stop command controlled by the motor drive is not intended to be a fail safe or Emergency Stop (E-Stop) since it does not prevent the motor drive from malfunctioning. This can only be accomplished by disconnecting the AC power to the operator (terminals L1 or L2).

Overview

The brookfield **NB-500** Swinging Door Operator has been designed, tested and is manufactured by **brookfield industries, inc.** in accordance with UL 325 and ANSI 156.10 for linear accelerator swing doors weighing up to 4,500 lbs and 66" wide. The **NB-500** can be expected to safely operate doors at the maximum weight and width for at least 500,000 cycles, providing the door is set within the ANSI 156.10 speed criteria and the rated operating torque of 1000 lb-in (reflected to the operator) has not been exceeded.

We "list" the **NB-500** with Intertek Testing Services (ETL) to assure compliance with UL 325. The "listing" report specifically refers to the heavy commercial/industrial doors associated with linear accelerator rooms.

This power open/power close electro-mechanical operator with its state of the art components and mostly all aluminum construction, make it the lightest and strongest in the industry today. Refer to the **Wiring Legend for Terminal Strip Hookup** for all open, partial open, close, stop and safety device inputs, which are all Class (2) 24VDC momentary contact (except terminal 9 which must be a maintained contact). Power supply hookups for both Class (2) 24VDC and 110VAC are also indicated. The PLC then processes all this information, in addition to many other features for proper control of these heavy lead doors, which are patented under **US Patent No. 6,177,771 B1**.

Logic Control:

This Operator offers the latest technology in PLC (Programmable Logic Control). The following (3) modules snap to a DIN rail base:

CPU (Central Processing Unit)- processes and stores data in its internal register such as door position presets, inputs from pushbutton stations and outputs to motor controls. This extremely compact unit houses (8) LED 24 VDC inputs and (6) LED outputs with (3) isolated commons.

Analog/Digital Converter- converts the analog signal of the Rotary Position Transducer to a digital value.

Class (2) 24 VDC Power Supply- converts 110-supply voltage to Class (2) 24VDC power to operate the CPU, A/D converter, Rotary Position Transducer and any presence sensors.

These plug-in modules with LED make diagnostics and replacement of parts easy and quick to perform.

Interface with the PLC is necessary to adjust door-positioning presets in the field. This is accomplished via a 15-pin rectangular cable end attached to the back of the **Data Access Unit** (purchased separately). and a 5 pin round cable end attached to the tool port of the CPU.

The CPU has been uniquely programmed for adjusting such door positioning characteristics as **Open Inhibit** (end of fast opening speed), **Close Inhibit** (end of fast

closing speed) and **Creep Inhibit** (back-check and latch-check speeds). In addition, the CPU provides a door reversal function (a term we like to call *Automatic egress*) when **UL 325 section 29.4 Entrapment** criteria has been violated. The **NB-500** has also been programmed to automatically clamp the door against the frame after each cycle. The motor will shut off after being in contact with the frame for about 5 seconds. This feature will maximize repeatability of the door-closed position, which minimizes the chance of the frame interlocks from being disengaged. If an external force acts on the door, such as a small pressure differential or if the door is simply pushed open slightly, the **Auto Close Enable** preset will be activated and the motor will restart and "clamp" the door against the frame once again.

Input commands for normal operation can be processed in (2) basic formats by making the appropriate connections on the **Terminal Strip Hookup**. By connecting a separate SPST switch between terminals 14 (open) and (com), 13 (partial open) and (com), 12 (close) and (com) and 10 (stop) with (com), will give the customer discrete control of each input by momentarily pressing a single switch to activate that particular command. These commands can also be activated by presence sensors, or control mats. With the 2nd format, the customer is provided with the following (and most basic) mode of operation: by making a connection between terminals 19 and (com) with a single wall switch (push plates), the customer can push it once to open the door and push it again to close the door. Reversing the direction of the door while it's moving (dynamic) can be accomplished with either format of operation by simply pressing the appropriate switch or when hooked up to terminal 19, by pushing the same switch a second time.

Safety Device Inputs that can be mounted on the door, such as reversing edge pressure switches or presence sensors (such as the BEA SuperScan) will open the door (reverse while closing) when momentarily activated by connecting terminal 11 with terminal (common). To close the door with these devices (reverse while opening), they can be hooked up to terminal 12 or they can be connected to terminal 10 to stop the door. Assure the safety devices are attached to the door in such a manner that will provide the best safety performance, as well as allowing sufficient clearances under normal operation to prevent inadvertent activation. Presence sensors that are frame mounted, such as the BEA DK-12, can be used to lockout or disable any door movement when the door is in the open or closed position, through a maintained connection between terminal 9 and terminal (common). This feature will not prevent the door from being activated when in any position outside of the latch-check or back-check ranges. Any presence sensor that runs on 24 VDC, can be powered up by connecting to terminal 3 and terminal (common) of the **Terminal Strip Hookup**.

The **Stop** command (terminal 10) will stop the door in any position when activated but it will not prevent a motor drive from malfunctioning nor is it a true emergency stop. **Emergency Stop (E-Stop)** can only be accomplished by disconnecting AC power to the operator (**Terminal L1 or Terminal L2**).

A **Rotary Position Transducer** attached to the worm gear output shaft provides the position of the door. As the door changes position, the output signal from the transducer

varies in value. This signal, once converted to a digital value, is stored in the CPU for further processing. This device does not need to be "homed" or reset if there is a power loss or electrical noise nor does it need to go through "learn speed" after power up or after adjustments have been made. This is what is called *Absolute position feedback control*.

Motor Control:

The NB-500 uses a state of the art **Regenerative (4-Quadrant) 90 VDC Motor Control**. This provides the best assurance that the door's high inertia characteristics will not "overhaul" (or "freewheel") the motor; thus, resulting in controlled door motion. The motor control features many adjustable trimpots that are necessary to properly control the motion profile of such heavy doors. The **ACC-DEC** trimpot adjusts the acceleration and deceleration times in the forward and reverse directions as a function of maximum rated motor speed. The **MAX SPD** trimpot adjusts the voltage or speed of the motor in the forward and reverse directions. The **IR COMP** trimpot determines the amount in which the motor speed is held constant as the motor load changes. For example, if set too low, the motor may not obtain the desired speed fast enough or not at all. If set too high, the motor will oscillate or over compensate. The **Reverse Torque** and **Forward Torque** trimpots adjust the armature current limit. When properly set, the operator will have sufficient torque to operate in both directions, while at the same time limiting the current to the motor in order to stall and reverse the door's direction so that **Entrapment Protection** requirements will be met (*this eliminates the need for unreliable and hard to adjust devices such as a manual or electromagnetic clutch*).

Overload Protection for the DC motor is provided by using the appropriate line fuse to the 110VAC power supply of the motor control (see wiring diagram) and by the proper setting of the **Reverse Torque** and **Forward Torque** trimpots, which controls the amount of DC current to the motor in both directions.

External Open, Close and Creep Speed "Pots" are provided for the installer to independently set the door's fast open and close speeds and for setting the creep speed for latch-check and back-check.

Drive Train:

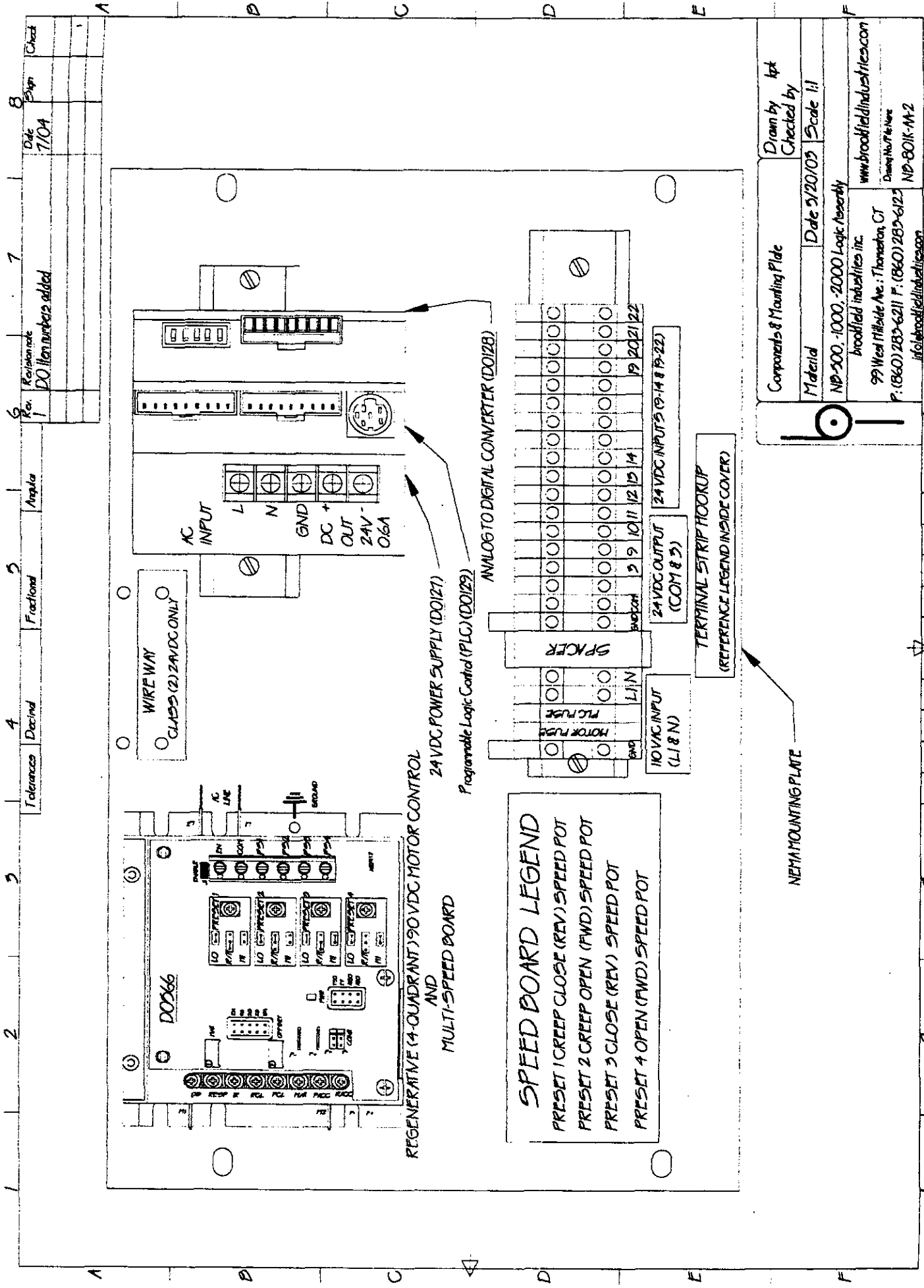
A **5:1 Right Angle Worm Gear Reducer** (with a center distance of 2.06") provides the high output torque necessary to operate these heavy doors. A heavy-duty flexible coupling joins the worm gear to the **102:1 In-Line Helical Gear Reducer**; thus, substantially reducing torque before being coupled to a **1/8 HP 90VDC Permanent Magnet Motor, 1750 RPM TENF**.

Battery Backup (option):

When power is interrupted, and if the door is in any position other than fully open, the battery backup will be activated and provide low voltage DC power directly to the motor. The system is designed to open the door once for each power interruption at a constant speed. This system is not designed to open and close the door repeatedly. A float charger is included to provide a constant charge on the battery. These components are installed in a NEMA 1 box with a test switch that will interrupt power and allow for testing the system. Also included is an end of travel limit switch, which must be installed so that it disconnects power to the motor when the door is fully open. (this limit switch is only for use in battery backup mode and not for normal operation). This is a redundant system and does not replace or substitute any requirements of UL 325 section 29.3 Interruption of Power for manual operation.

Manual Operation:

Shall not be more than 50 lbs to open, when applied at the widest point on the door with the power removed (ref. UL325 29.3).



1	2	3	4	5	6	7	8
Tolerances	Decid	Fractional	Angular	Revision	Check	Date	By
				1		7/04	
				DO Item numbers added			

Components & Mounting Plate	Drawn by	ktk
	Checked by	
Material	Date	3/20/09
Scale	1:1	
NP-200 - 1000 - 2000 Logic Assembly		
broodfield industries inc.		
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