Conforms to UL STD 325
Control No. 3011624

US Patent
6,177,771,B1

brookfield industries, inc. NB-4000 Sliding Door Operator

Description:

The brookfield **NB-4000** Sliding Door Operator has been designed, tested and is manufactured by **brookfield industries, inc.** for linear accelerator sliding doors weighing up to 30,000 lbs with a maximum travel of 60" and horizontal forces up to 700 lbs. The **NB-4000** can be expected to safely operate doors at the maximum weight for at least 500,000 cycles, providing none of the rated values are exceeded.

We are Authorized to Mark the **NB-4000** with the **ETL** and **CE** markings from Intertek Testing Services to assure compliance with UL 325, FCC Part 15 (Emissions) and the following International Standards: EN 60335-1 and -2 (Safety), EN 61000-6-2 (Immunity) and EN 61000-6-4 (Emissions). The "listing" reports specifically refer to the heavy commercial/industrial doors associated with linear accelerator rooms.

The **NB-4000** is designed to be mounted directly to the top or front of the same horizontal beam that supports a linear motion system. The **NB-4000** can also be modified for wall mounted applications, such as those used in bottom roller supported doors.

The **NB-4000** is an electro-mechanical, power open/power close operator, which converts rotary motion from a DC gearmotor to linear motion via a ball screw/nut assembly. The ball screw shaft is supported by a unique *Rigid End Block +Tensioning System.* These blocks support the ball screw shaft in the most rigid configuration of end fixity or what is referred to in engineering terms as the fixed end-fixed end mode. The (2) precision bearings used in each support block are designed specifically for ball screws and are positioned in such a manner that places the ball screw shaft in tension only, no matter what direction the load is applied in. This design allows the ball screw to operate at the highest possible speeds and forces without exceeding what is known as the critical column strength or the critical rotational speed.

Advantages of our ball screw design over other drive methods is that the required driving torque is much lower than the torque associated with gear belts or chain drives designs for any given linear operating force. This means smaller gearboxes and smaller motors are required and much higher operating forces are obtainable with this type of ball screw design. Also, there is no need to worry about adjusting sloppy chains or belts that may stretch over time. The ball nut assembly features a grease fitting for periodic maintenance and is equipped with end wipers to keep grease in and dirt out of the nut assembly.

The PLC (Programmable Logic Control) is programmed by the manufacturer to accept input signals from an external (4) button station (including open, partial open, close and stop commands). Additional I/O (input/output) are featured with the **NB-4000** to accommodate inputs from infrared presence sensors and pressure sensitive tape switches that will either stop or reverse the door to the open position, when activated in the closing cycle. A battery backup system with a float charger has been programmed to automatically open the door if power is interrupted. This has been included as standard safety equipment.

The **NB-4000** features the same *Absolute Position Feedback* control system (US Patent No. 6,177,771,B1) and copyrighted software as other **brookfield industries, inc**. door operators. There are no limit or proximity switches to adjust or install. Simply adjust the door's positioning presets as required by interfacing with the PLC via a hand held Data Access Unit (purchased separately).

Rating a Sliding Door Operator:

The rating of a sliding door operator in any particular installation cannot be based solely on the weight of the door. Other factors such as linear bearing alignment, coefficient of friction, and acceleration/deceleration rates may have a substantial affect on the total axial force acting on the door operator components. We have factored these variables into the **Rated Maximum Operating Forces**. This assures the customer they are getting the most dependable product at a reasonable cost over the life expectancy of the operator.

Maximum Peak Operating Force* =	700 lbs (3115 kg)
Maximum Continuous Operating Force** =	500 lbs (2225 kg)
Maximum Travel =	60" (152.4 cm)(one direction)
Maximum Rated Linear Speed =	4.5 in/sec (11.43 cm/sec)
Maximum Door Weight =	30,000 lbs (13,620 kg)

Minimum Rated Cycles = 500,000 openings and closings

**The maximum horizontal force acting on the ball screw assembly in order to accelerate the mass of the door to the maximum operating speed and to overcome friction and any misalignment.*

** The maximum horizontal force acting on the ball screw assembly to overcome friction and any misalignment once the operating speed has been obtained.

Specification:

1) ***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. Also, limit or proximity switches are not required for controlling the door's position.
2) ***Supply voltage:*** 115VAC +/- 10% (230VAC for European service) 50/60 Hertz single phase. In-Line circuit breakers supplied with motor control and PLC. Surge protection, line filters, and EMI ferrites shall be included.
3) ***Battery Backup (standard):*** Opens the door during power interruption only. (2) 12VDC, 7.0 Ah battery with float chargers and test switch shall be included along with an end of travel limit switch to disconnect the motor. .
4) ***Current Consumption:*** maximum 12 amperes
5) ***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 Sliding Doors.
   b) Outputs commands shall be the internal type, integral with the PLC. No external limit or proximity 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, creep closed and creep open 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.
6) ***Motor:*** 3/4 hp permanent magnet 90 volt DC motor 1750 RPM TEFC with rear shaft extension.
7) ***Motor Control:*** shall be a full-wave, four quadrant, regenerative, 90 VDC variable speed control with the following functions:

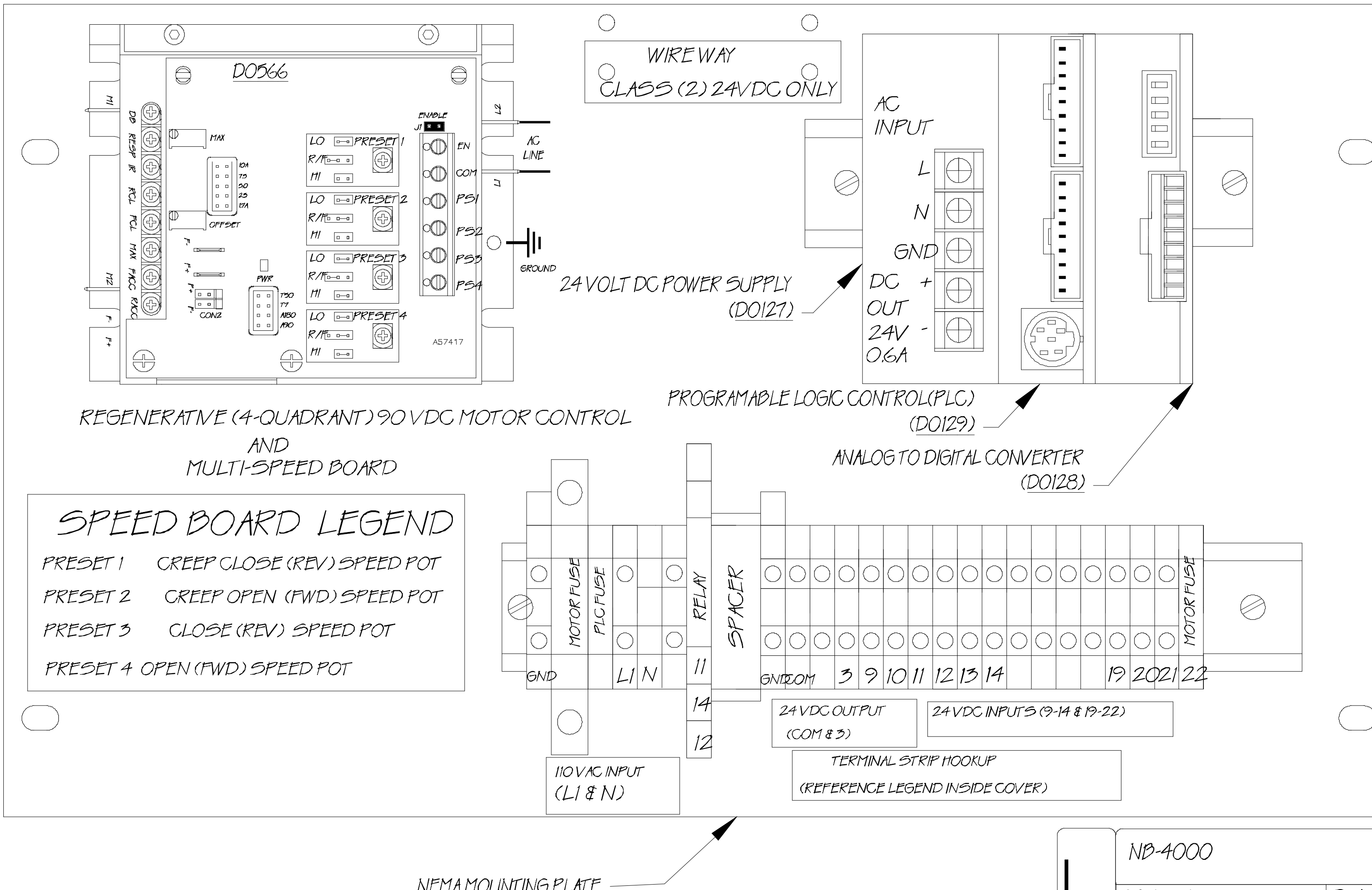
FWD/REV maximum speed	FWD/REV current limit	IR compensation
FWD/REV acceleration/deceleration	1% speed regulation	50:1 speed range.

8) ***Speed Control:*** a means of controlling independent forward and reverse speeds as well as controlling end of travel or "creep" speed. This can be accomplished externally with speed pots or internally with the PLC.
9) ***Drive train:*** shall be designed to assure each component (including gear reducers, ball screw and structural parts) 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 Sliding Doors.
10) ***Enclosure:*** NEMA 1 vented enclosure of sufficient size (24" x 20 x 6-5/8") to house the PLC, motor control, speed pots, battery backup system and terminal strip hookups. Enclosure shall have separate penetrations for supply voltage, safety sensors, push buttons, motor and positioning transducer hookups. All penetrations shall be drilled for ¾" conduits or the equivalent metric size for European installations.
11) ***Raw Materials:*** ASTM A36, AISI 1018 cold rolled steel, Aluminum 6061-T6511, Structural tubing ASTM A- 500, grade 5 bolting or better.
12) ***Mounting hardware:*** the NB-4000 shall be mounted with (8) 3/8" grade 5 diameter bolts with compatible washers and lock washers. Hardware must also be properly tightened with adequate thread engagement.
13) ***Finish:*** all exposed metal surfaces shall be prime painted.
14) ***Functionality test:*** each NB-4000 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.
15) **Manual Operation:**
    A flexible shaft, which is provided for manual operation, engages and disengages the into the rear shaft of the motor via a remote control cable. A lever arm, which activates the remote control cable, and a 7" diameter hand wheel, which is connected to the flexible shaft, are contained in a NEMA 1 box. Approximate opening time, while manually operating the hand wheel, is about 2.5 minutes. Opening force at the hand wheel is not more than 50 lbs with power removed (ref. UL 325 29.3) Important**: the flexible shaft <u>shall not</u> be engaged to the motor unless power to the operator has been interrupted**.

16) ***Installation:*** Support beam shall be drilled per the mounting hole layout. Shim packs are included to assist in the proper alignment of the ball screw shaft, in addition to a complete installation and maintenance manual. Install per drawings NB-4000-AA, NB-4000-BB, NB-4000-CC

Tolerances	Decimal	Fractional	Angular

Rev.	Revision note	Date	Sign	Check
1	DO item numbers	01/04		



NB-4000		Drawn by kpk Checked by
Material	Date 5/20/03	Scale 1:1
Logic Assembly		

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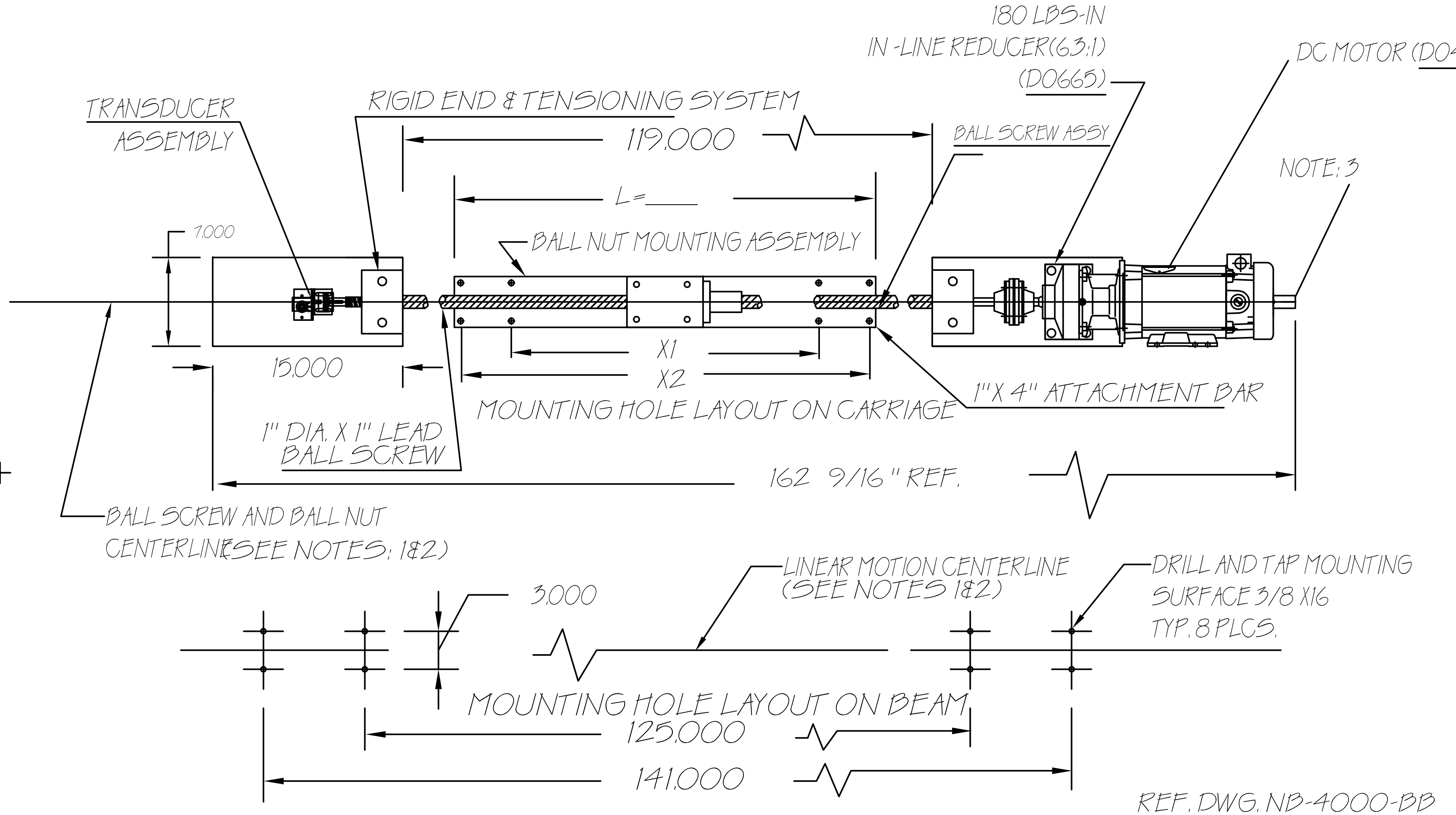
Drawing No./File Name
NB-1061K-AA-2

Rev.	Revision note	Date	Sign	Check
5	Title block revision	5/19/03	cmsk	
6	Item numbers added	07/04	cmsk	
7	REVISE TRANSDUCER END	6/22/22		



Notes:

L=D+6.5=____

D=Spacing between Carrage plates.

X1=L - 5.5"

X2 =L - 1.00"

Tolerances	
Decimal	+/- 0.015
Fractional	+/- xx
Angular	+/- xx

REF. DWG. NB-4000-BB

ADD TO NOTES;

1) BALL SCREW CENTERLINE SHALL BE WITHIN 1/8" OF LINEAR MOTION CENTERLINE OVER 116.625"

2) BALL NUT ATTACHMENT BAR TO BE WITHIN 1/16" OF LINEAR MOTION CENTERLINE FOR BARS 28" LONG OR LESS.

3) SEE NB-4000-21 FOR MANUAL OPERATION

Sliding Door Operator NB-4000

Drawn by kk
Checked by

Material | Date 5/19/03 | Scale 1:1

Installation Drawing

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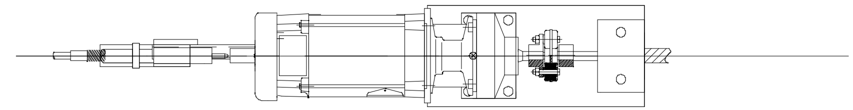
Drawing No/File Name
NB-4000-AA

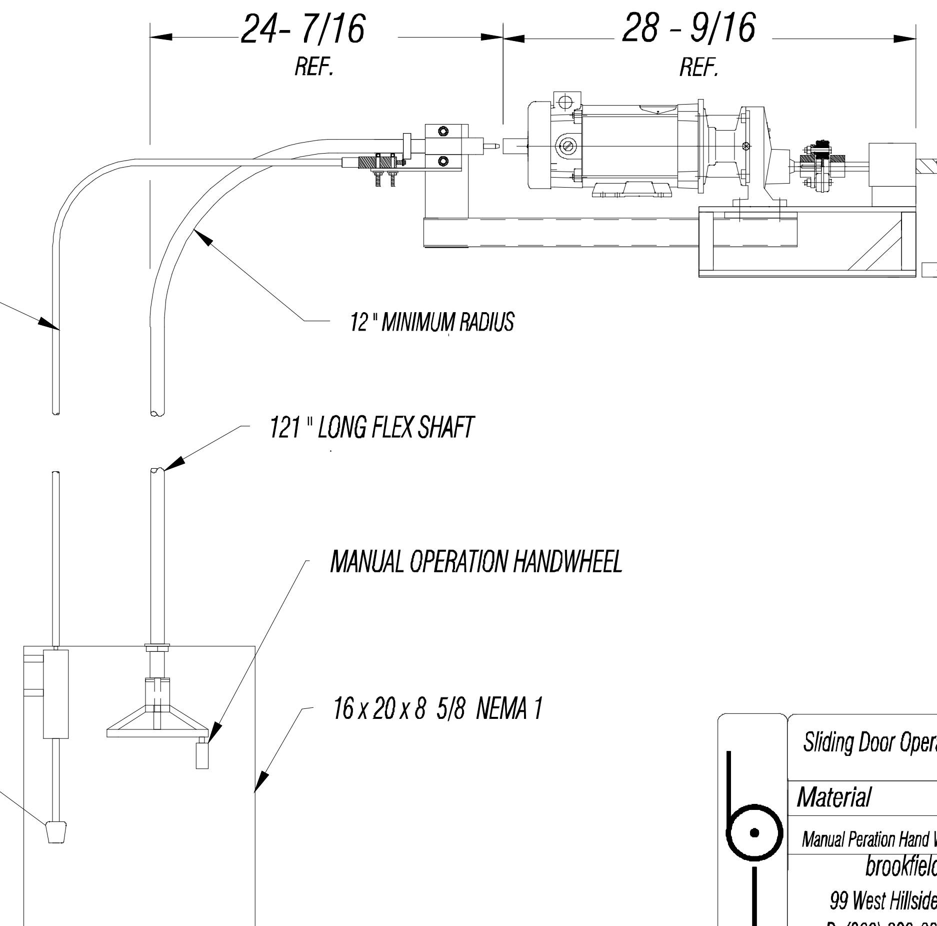
Rev.	Revision note	Date	Sign	Check

WARNING!

ENGAGE ONLY DURING POWER INTERRUPTION
FOR EMERGENCY OPERATION.

DISENGAGE FOR ALL OTHER USE.





TO ENGAGE:

WHILE TURNING HANDWHEEL,
PULL OUT LEVER UNTIL
HANDLE LOCKS.

TO DISENGAGE:
PUSH IN UNTIL HANDLE
LOCKS.

NOTE:
TO UNLOCK HANDLE, PUSH IN
HANDLE RELEASE.

Notes:

Tolerances	
Decimal	+/- 0.005
Fractional	+/-xxx
Angular	+/-xxx

Sliding Door Operator NB-4000

Drawn by kpk
Checked by

Material | Date 5/20/03 | Scale 1:1

Manual Peration Hand Wheel Mounting

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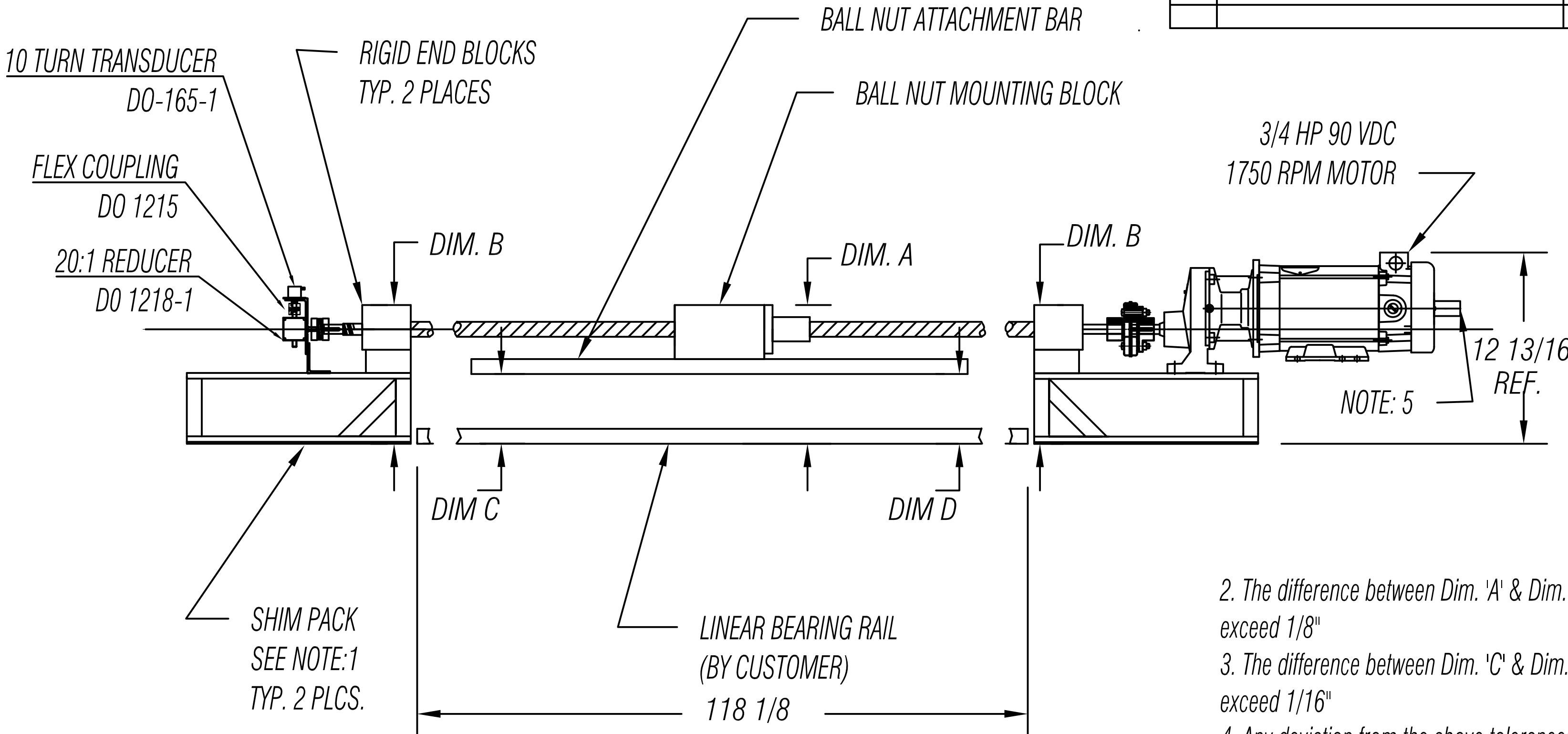
Drawing No./File Name
NB-4000-21

Tolerances	Decimal +/- 0.015	Fractional	Angular

Rev.	Revision note	Date	Sign	Check
5	Update TB	5/19/03	cmsk	
6	REVISE TRANSDUCER END	6/22/22		



2. The difference between Dim. 'A' & Dim. 'B' shall not exceed 1/8"
3. The difference between Dim. 'C' & Dim. 'D' shall not exceed 1/16"
4. Any deviation from the above tolerances must be shimmed to assure proper installation
5. See NB-4000-21 for manual operation

NOTE: 1

PROVIDE (8) SHIM PACKS(SLOTTED & TABBED

(1)--------------------- .125

(2)--------------------- .050

(2)--------------------- .010

(1)--------------------- .005

TOTAL THICKNESS PER SHIM PACK = .250

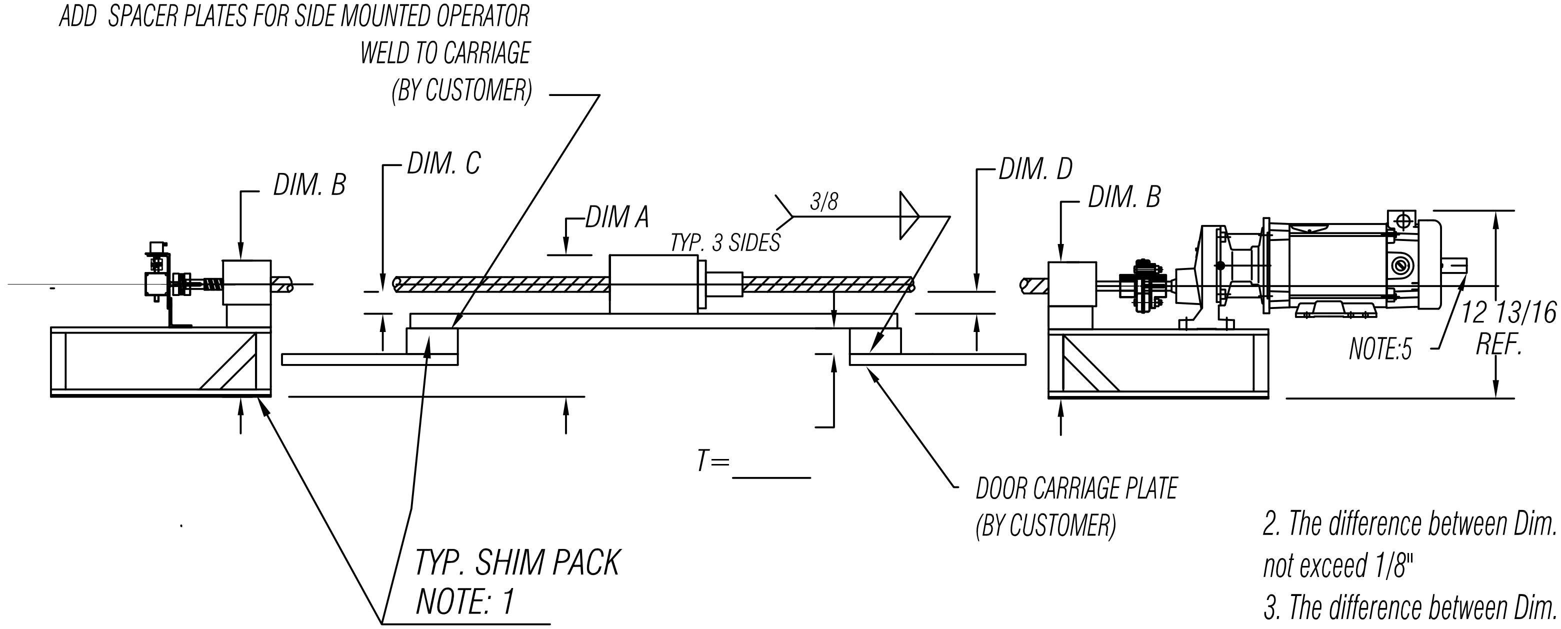
REF. DWG. NB-4000-AA

Sliding Door Operator NB-4000			Drawn by kpk Checked by
Material	Date 5/20/03		Scale 1:1
Installation Information			
brookfield industries inc. 99 West Hillside Ave. : Thomaston, CT P: (860) 283-6211 F: (860) 283-6123 info1@brookfieldindustries.com		www.brookfieldindustries.com Drawing No./File Name NB-4000-BB	

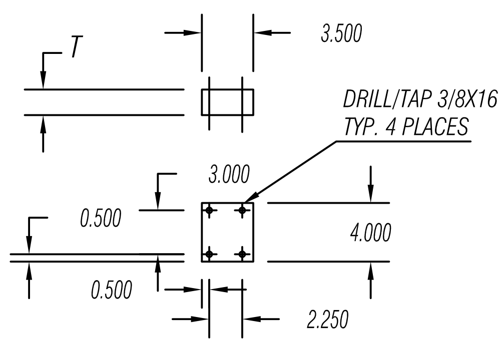
Tolerances	Decimal +/- 0.015	Fractional	Angular

Rev.	Revision note	Date	Sign	Check
6	New TB	5/19/03	cmsk	
7	REVISE TRANSDUCER END	6/22/22		

INSTALLATION INFORMATION FOR SIDE MOUNTED OPERATOR.



2. The difference between Dim. 'A' & Dim. 'B' shall not exceed 1/8"
3. The difference between Dim. 'C' & Dim. 'D' shall not exceed 1/16"
4. Any deviation from the above tolerances must be shimmed to assure proper installation
5. See NB-4000-21 for manual operation



SPACER BLOCK 2 REQ.
MAT. CRS 1018

NOTE: 1
PROVIDE (16) SHIM PACKS (SLOTTED & TABBED)

(1)--------------------- .125
(2)--------------------- .050
(2)--------------------- .010
(1)--------------------- .005
TOTAL THICKNESS PER SHIM PACK = .250

REF. DWG. NB-4000-AA

Sliding Door Operator NB-4000		Drawn by kpk Checked by	
Material	Date 5/20/03	Scale 1:1	
Installation Information			

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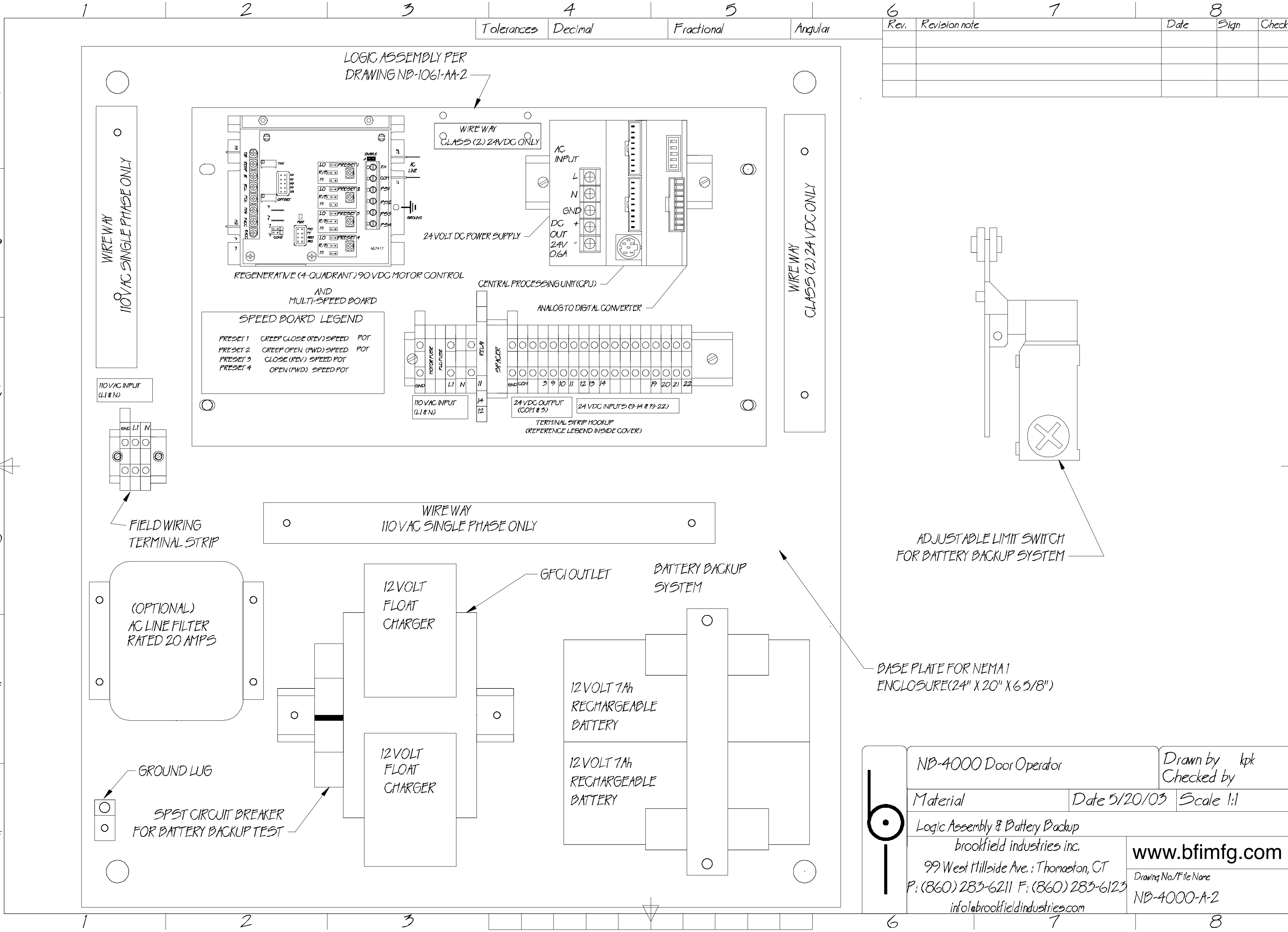
Drawing No./File Name
NB-4000-CC


Tolerances
Decimal
Fractional
Angular
Rev.
Revision note
Date
Sign
Check
LOGIC ASSEMBLY PER DRAWING NB-1061-AA-2
WIREWAY CLASS (2) 24VDC ONLY
AC INPUT
L
N
GND
DC OUT 24V 0.6A
24 VOLT DC POWER SUPPLY
REGENERATIVE (4-QUADRANT) 90 VDC MOTOR CONTROL AND MULTI-SPEED BOARD
CENTRAL PROCESSING UNIT (CPU)
ANALOG TO DIGITAL CONVERTER
WIREWAY 110 VAC SINGLE PHASE ONLY
WIREWAY CLASS (2) 24 VDC ONLY
SPEED BOARD LEGEND
PRESET 1 CREEP CLOSE (REV) SPEED POT
PRESET 2 CREEP OPEN (FWD) SPEED POT
PRESET 3 CLOSE (REV) SPEED POT
PRESET 4 OPEN (FWD) SPEED POT
MOTOR FUSE
PLC FUSE
RELAY
SPACER
110 VAC INPUT (L1 & N)
24 VDC OUTPUT (COM & 5)
24 VDC INPUTS (9-14 & 19-22)
TERMINAL STRIP HOOKUP (REFERENCE LEGEND INSIDE COVER)
FIELD WIRING TERMINAL STRIP
WIREWAY 110 VAC SINGLE PHASE ONLY
(OPTIONAL) AC LINE FILTER RATED 20 AMPS
12 VOLT FLOAT CHARGER
12 VOLT FLOAT CHARGER
GFCI OUTLET
BATTERY BACKUP SYSTEM
12 VOLT 7Ah RECHARGEABLE BATTERY
12 VOLT 7Ah RECHARGEABLE BATTERY
GROUND LUG
SPST CIRCUIT BREAKER FOR BATTERY BACKUP TEST
BASE PLATE FOR NEMA 1 ENCLOSURE (24" X 20" X 6 5/8")
ADJUSTABLE LIMIT SWITCH FOR BATTERY BACKUP SYSTEM
NB-4000 Door Operator
Drawn by kpk
Checked by
Material
Date 5/20/03
Scale 1:1
Logic Assembly & Battery Backup
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Drawing No./File Name
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