BORN INC.

WORLD-WIDE MANUFACTURERS OF
DIRECT FIRED HEATERS

API FIRED HEATER DATA SHEET

Owner	MEG Energy Corp.	Unit	
Location	Bruderheim, Alberta, Canada	Item Number	5H-1203
BORN REF	Job #3076	Service	Reactor Feed Heater
PURCHASER	MEG Energy Corp.	REF NO :	PO: 13002-0M06M Rev.1

REVISION RECORD

No.	Revision Description	Date	By	Checked	Rev	No. Of Pages
4	Issued w/ clarifications	15-May-14	JAY	VIJAY	3	8
3	Issued w/ GA Package Rev-1	10-Feb-14	JAY	VIJAY	2	8
2	Issued w/ PO Rev-1	18-Dec-13	JAY	VIJAY	1	8
1	First Issue	24-Jun-13	JAY	VIJAY	0	8

TOYO ENGINEERING CANADA LTD.

VENDOR DATA APPROVAL STAMP

- [X] 1. PROCEED
- [ ] 2. PROCEED, CHANGE AS NOTED AND RESUBMIT
- [ ] 3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
- [ ] 4. DATA ACCEPTED FOR INFORMATION ONLY

AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.

TAG NO. 5H-12.3

PKG LEAD AL A | DATE Jun. 4/14

DOC NO. 13002-0-0M06M-D01-002-R3

CLIENT DOC NO.

DATE: MAY 20 2014

TV - 8618

PO: 0M06M

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Corp.			**ITEM NO.**	5H-1203						
	SERVICE	Reactor Feed Heater			**LOCATION**	Bruderheim, Alberta, Canada						
1	Unit :	....			Number Req'd :	One						REV
2	Manufacturer :	BORN INC.			Reference :	Job #3076						
3	Type of heater :	VC - Forced Draft										
4	• Total absorbed duty :	8.19	MM BTU/hr									
5	**PROCESS DESIGN CONDITIONS**											
6	• Operating case			DESIGN		DESIGN		TURNDOWN		TURNDOWN		
7	Heater section			Radiant		Convection		Radiant		Convection		3
8	• Service			Reactor Feed		Reactor Feed		Reactor Feed		Reactor Feed		3
9	Heat absorption,		MM BTU/hr	5.51		2.68		3.014		1.08		3
10	• Fluid			Bitumen		Bitumen		Bitumen		Bitumen		3
11	• Flow rate,		lb/hr	43,919		43,919		21,960		21,960		3
12	• Flow rate,		B.P.D									
13	• Pressure drop, allowable (clean/fouled),		psi									
14	Pressure drop, calculated (clean/fouled),		psi	104.00		76.00		33.00		22.00		3
15	• Average radiant section flux density, allowable,		BTU/hr-ft2									3
16	Average radiant section flux density, calculated,		BTU/hr-ft2	10,009				5,510				3
17	Maximum radiant section flux density, calculated,		BTU/hr-ft2	14,513				7,990				3
18	Convection section flux density (bare tube),		BTU/hr-ft2			11,141				4,341		3
19	• Velocity ~~limitation~~	calculated	ft/s	10.24		10.24		5.12		5.12		3
20	Process fluid mass velocity		lb/s-ft2	524		524		262		262		3
21	• Maximum allowable/calc inside film temperature,		°F		811		760		809		727	3
22	• Fouling factor		hr-ft2-°F/Btu									
23	• Coking Allowance		inch									
24	**INLET CONDITIONS:**											
25	• Temperature,		°F	625.0		536.0		605.0		536.0		3
26	• Pressure,		psig	271.00		347.00		325.00		347.00		3
27	• Liquid flow,		lb/hr			43,919				21,960		3
28	• Vapor flow,		lb/hr									
29	• Liquid Gravity					0.87				0.87		3
30	• Vapor MW											
31	• Viscosity, (liquid/vapor),		cP			2.71				2.71		3
32	• Specific heat, (liquid/vapor),		BTU/lb-°F			0.612				0.612		3
33	• Thermal conductivity, (liquid/vapor),		BTU/hr-ft-°F			0.045				0.045		3
34	**OUTLET CONDITIONS:**											
35	• Temperature,		°F	755.0		625.0		755.0		605.0		3
36	• Pressure,		psig	167.00		271.00		292.00		325.00		3
37	• Liquid flow,		lb/hr	43,785				43,785				3
38	• Vapor flow,		lb/hr	134				134				3
39	• Liquid Gravity			0.78				0.78				3
40	• Vapor MW			130.20				130.20				3
41	• Viscosity, (liquid/vapor),		cP	0.600	0.013			0.600	0.013			3
42	• Specific heat, (liquid/vapor),		BTU/lb-°F	0.695	0.651			0.695	0.651			3
43	• Thermal conductivity, (liquid/vapor),		BTU/hr-ft-°F	0.037	0.033			0.037	0.033			3
44	**REMARKS AND SPECIAL REQUIREMENTS:**											
45	• Distillation data or feed composition:											
46	Short term conditions:											
47												
48												
49	Notes:											
50												
51												
52												
53												
54												
55												
56												
57												
58												
59												
60												
61												
62												

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy C	**ITEM NO.**	5H-1203			
	SERVICE	Reactor Feed Heater	**LOCATION**	Bruderheim, Alberta, Canada			

COMBUSTION DESIGN CONDITIONS

1	Operating Case			Design	Turndown		REV
2	● Type of fuel			Natural Gas	Natural Gas		
3	● Excess air, percent			20%	20%		1
4	Calculated heat release (LHV),		MM BTU/hr	9.94	4.85		1
5	Fuel efficiency calculated, percent (LHV)			82.40%	84.50%		3
6	Fuel efficiency guaranteed, percent (LHV)			81.40%			3
7	Radiation loss, percent of heat release (LHV)			1.5	1.5		1
8	Flue gas temperature leaving:	Radiant section,	°F	1491	1263		1
9		Convection section,	°F	652	578		3
10		Air preheater,	°F				
11	Flue gas quantity,		lb/hr	10,013	4,882		3
12	Flue gas mass velocity through convection section,		lb/s-ft2	0.297	0.145		3
13	Draft at arch,		inch H2O	-0.1	-0.1		2
14	Draft at burners,		inch H2O	-0.25	-0.25		2
15	● Ambient air temperature, efficiency calculation,		°F	60	60		1
16	Ambient air temperature, stack design,		°F	75 (Max.)	75 (Max.)		2
17	● Altitude above sea level,		ft	2120	2120		1
18	● Volumetric Heat Release,		BTU/hr-ft3	9,450	4,608		3
19	● Required emissions:	ppmv (d) (corrected to 3% O2)		NOx:	CO:	SOx:	
20			NOTE-1	UHC:	Particulates:		

21	**FUEL CHARACTERISTICS:**						
22	● Gas Type		Natural Gas	Start-Up			1
23	● LHV,	BTU/SCF	915	1,022			1
24	● HHV,	BTU/SCF					1
25	● Pressure @ burner,	PSIG	2.5	2.5			1
26	● Temperature @ burner,	°F	75	100			1
27	● Molecular weight / Viscosity	-/ °F, SSU	16.66 /	21.48 /			1
28	● Atomizing steam temperature,	°F	N / A	N / A			1
29	● Atomizing steam pressure,	psig	N / A	N / A			1
30	● Composition	Composition	mole%	mole%			1
31		N2	0.65	8.90			1
32		H2S	0.00	0.003			1
33		C1	95.50	69.76			1
34		C2	1.50	7.01			1
35		C3	0.35	4.86			1
36		iC4	0.00	2.49			1
37		nC4	0.15				1
38		iC5	0.00	0.82			1
39		nC5	0.05				1
40		C6+	0.15	0.96			1
41		H2	0.00	3.25			1
42		H2O	1.60	Saturated.			2
43		CO		1.48			1
44		CO2		0.44			1
45		TOTAL	100.0	100.0			1

46	**BURNER DATA:**						
47	● Manufacturer :	Maxon Combustions	Size/Model Number :	8"/ Kinedizer LE	Number Req'd :	1	
48	Type :	Low Nox	Location :	FLOOR	Orientation :	Up-Fired	
49	● Heat release per burner, MMBTU/HR	Design:	11.927	Normal : 9.939		Minimum : 2.982	3
50	Pressure drop across burner @ design heat release, in. WC :			-0.25			
51	Distance burner center line to tube center line, horizontal, Ft. :			4.46	Vertical, Ft. :	16.83	1
52	Distance burner center line to unshielded refractory, horizontal, Ft. :			N/A	Vertical, Ft. :	N/A	
53	● Pilot type :	Interrupted	Capacity, BTU/HR :	500,000	Fuel :	Natural Gas	2
54	● Ignition method :	Electric					
55	● Flame detection, type :	UV scanners - (1) Burner + (1) Pilot			Number :	(2) - 1/2" NPT	1

56	NOTES:	
57	1. NOx and CO emissions will be 47 ppmv(d) and 200 ppmv(d) corrected to 3% O2 from the burner at design conditions.	2
58	2. Please refer to burner datasheet for additional notes on emission guarantees.	2
59		
60		
61		
62		

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Corp.	**ITEM NO.**	5H-1203				
	SERVICE	Reactor Feed Heater	**LOCATION**	Bruderheim, Alberta, Canada				
	MECHANICAL DESIGN CONDITIONS							
1	● Plot limitations :	NONE		Stack limitations :		NONE		REV
2	● Tube limitations :	NONE		Noise limitations		85 dBA @ 3'		
3	● Structural design data,	Wind Velocity, mph : 100		Wind Exposure		NBC 2005		
4		Snow load :		Seismic zone		NBC 2005		
5	● Minimum / normal / maximum ambient air temperature, F :		-40/45/75	Relative humidity, %		57%		
6	Heater section		Radiant	Convection				
7	Service		Process	Process				
8	**COIL DESIGN:**							
9	● Design basis, tube wall thickness (code or specification)		API RP 530	API RP 530				
10	rupture strength (minimum or average)		minimum	minimum				
11	● Stress-to-rupture basis,	hr	100,000	100,000				
12	● Design pressure, Elastic/Ruptue,	psig	400	400				
13	● Design fluid temperature,	°F	800.0	800.0				
14	● Temperature allowance,	°F	25	25				
15	Corrosion allowance, tubes / fittings,	inch	0.0400	0.0400				1
16	Hydrostatic test pressure,	psig	770	770				2
17	● Postweld heat treatment (Yes or No)		NO	NO				
18	● Percent of welds fully radiographed		100%	100%				
19	Maximum (clean) tube metal temperature,	°F	826	774				3
20	Design tube metal temperature,	°F	851	799				3
21	Inside film coefficient,	BTU/hr-ft2-°F	292	213				
22	**COIL ARRANGEMENT:**							
23	Tube orientation : vertical or horizontal		VERTICAL	HORIZONTAL				
24	● Tube material (ASTM specification and grade)		A 312 TP 316	A 312 TP 316				
25	Tube outside diameter,		2.375	2.375				
26	Tube wall thickness, (average),	inch	0.154	0.154				
27	Number of parallel flow streams		1	1				
28	Number of tubes		56	60				
29	Number of tubes per row (convection section)			6				
30	Overall tube length,	Ft.	15.21	7.58				1
31	Effective tube length,	Ft.	16.00	6.00				
32	Bare tubes : Number		56	18				
33	: Total exposed surface, sq. Ft.		557	66				
34	Extended surface tubes : Number			42				
35	: Total exposed surface, sq. Ft.			1846				3
36	Tube layout (in line or staggered)		IN-LINE	STAGGERED				
37	Tube spacing, center to center : Horizontal x Vertical, inch		6.00	6.00				
38	Spacing tube center to furnace wall (minimum),	inch	6.00	2.00				
39	Corbels (Yes or No)	NOTE-1	N/A	Yes				
40	Corbel width (distance from wall)	inch	N/A	2				
41	**DESCRIPTION OF EXTENDED SURFACE:**			NOTE-2				
42	Type : (studs)(serrated fins)(solid fins)			Serrated				2
43	Material			SSTL Typ. 409 & CS				1
44	Dimensions (height x ~~diameter~~ / thickness),	inch		0.5, 1.0 x 0.05				2
45	Spacing (fins / in), ~~(studs per plane)~~			5				2
46	Maximum tip temperature (calculated),	°F		991				3
47	Extension ratio (total area / bare area)			6.805, 12.609				3
48	**PLUG TYPE HEADERS:** NONE							
49	Type							
50	Tube material (ASTM specification and grade)							
51	Nominal rating							
52	Location (one or both ends)							
53	Welded or rolled joint							
54	Notes:							
55	1. Corbels are provided for all the tube rows in the convection section expect the first shield row.							
56	2. Fin density of extended surface tubes in convection provided on pg 8of8.							1
57								
58								
59								
60								
61								

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Co	**ITEM NO.**	5H-1203			
	SERVICE	Reactor Feed Heater	**LOCATION**	Bruderheim, Alberta, Canada			
	MECHANICAL DESIGN CONDITIONS (Continued)						**REV**
1	Heater section		Radiant	Convection			
2	Service		Process	Process			
3	**RETURN BENDS:**						
4	Type		180 LR Bends	180 LR Bends			
5	Material (ASTM spec. and grade)		A 403 WP316	A 403 WP316			
6	Nominal rating or schedule		Sch 40 AW	Sch 40 AW			
7	Location (F.B. = firebox, H.B. = header box)		F.B.	H.B.			
8	**TERMINALS AND/OR MANIFOLDS:**						
9	● Type (BEV = beveled, MANIF = manifold, FLG = flanged)		FLG	FLG			
10	Inlet : Material (ASTM spec. and grade)			A 312 TP316			
11	Size / schedule or thickness			2" / Sch 40			
12	Number of terminals			1			
13	Flange material (ASTM specification and grade)			A 182 F316			
14	Flange size and rating			300# RFWN			
15	Outlet : Material (ASTM spec. and grade)		A 312 TP316				
16	Size / schedule or thickness		2" / Sch 40				
17	Number of terminals		1				
18	Flange material (ASTM specification and grade)		A 182 F316				
19	Flange size and rating		300# RFWN				
20	● Manifold to tube connection (welded, extruded etc.)						
21	Manifold location (inside or outside header box)						
22	**CROSSOVERS:**						
23	● Welded or flanged		Welded				
24	● Pipe material (ASTM specification and grade)		A 312 TP316				
25	Pipe size / schedule or thickness		2" / Sch 40				
26	● Flange material						
27	Flange size / rating						
28	● Location (internal / external)		External				
29	Fluid temperature,	°F	625				
30	**TUBE SUPPORTS:**						
31	Location (ends, top, bottom)		TOP	ENDS			1
32	Material (ASTM specification and grade)		A 351 HK40	CS			1
33	Design metal temperature,	°F	1671				1
34	Thickness,	inch		0.5"			
35	Type and thickness of insulation,	inch	None	3", LHV Castable	NOTE-1		
36	Anchor (material and type)		None	SSTL Bullhorn			
37	**INTERMEDIATE TUBE SUPPORTS: NONE**						
38	Material (ASTM specification and grade)						
39	Design metal temperature,	°F					
40	Thickness,	inch					
41	Spacing	ft					
42	**TUBE GUIDES:**						
43	Location (ends, top, bottom)		BOTTOM				1
44	Material (ASTM specification and grade)		SS 310				1
45	Type / spacing	Ft.					
46	**HEADER BOXES:**						
47	Location :	Convection Ends		Hinged door / bolted panel :	Bolted		
48	Casing material :	CS		Thickness, inch	0.1875" Min		
49	Lining material :	6 PCF CFB	Thermal Ceramics Cerablanket	Thickness, inch	2		1
50	Anchor (material and type) :	SS 304 Pin & Clips					1
51	Notes:						
52	1. LHV Castable will be Sparlite LHV 124.						1
53							
54							
55							
56							
57							
58							
59							
60							

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Corp.		ITEM NO.	5H-1203			
	SERVICE	Reactor Feed Heater		LOCATION	Bruderheim, Alberta, Canada			

MECHANICAL DESIGN CONDITIONS (Continued)

								REV
1	**REFRACTORY DESIGN BASIS:**							
2	Ambient, °F: 80	Wind velocity, mph:		0	Casing temperature, °F :		180	
3	**SHIELDED VERTICAL WALLS:**							
4	Lining thickness, inch :	4			Hot face temperature, design / calculated, °F :		2300 / 1000	1
5	Wall construction :	Ceramics Fiber Blanket (CFB) - Thermal Ceramics Cerablanket						1
6		1" 8PCF CFB + 3" 6PCF CFB						1
7	Anchor (material and type) :	SS 310 Pin & Clips						1
8	Casing material :	CS	Thickness, inch :	0.25		Temperature, °F :	180	
9	**ARCH:**			.				
10	Lining thickness, inch :	6			Hot face temperature, design / calculated, °F :		2000 / 1491	2
11	Wall construction :	Castable - Sparlite LHV 124						1
12		6" LHV Castable						1
13	Anchor (material and type) :	SS 310 V-Anchors	NOTE-2					1
14	Casing material :	CS	Thickness, inch :	0.25		Temperature, °F :	180	
15	**FLOOR:**							
16	Lining thickness, inch :	7.5			Hot face temperature, design / calculated, °F :		2000 / 1250	
17	Wall construction :	Castable - Sparlite LHV 124 & High Quality Fire Brick (HQFB)				NOTE-1		1
18		5" LHV Castable + 2.5" Fire Brick						
19	Anchor (material and type) :	CS Bullhorns						
20	Casing material :	CS	Thickness, inch :	0.25		Temperature, °F :	195	
21	**EXPOSED VERTICAL WALLS: NONE**							
22	Lining thickness, inch :				Hot face temperature, design / calculated, °F :			
23	Wall construction :							
24								
25	Anchor (material and type) :							
26	Casing material :		Thickness, inch :			Temperature, °F :		
27	**CONVECTION SECTION:**							
28	Lining thickness, inch :	6			Hot face temperature, design / calculated, °F :		2000 / 1000	1
29	Wall construction :	Castable - Sparlite LHV 124						1
30		6" LHV Castable						1
31	Anchor (material and type) :	SS 310 V-Anchors	NOTE-2					1
32	Casing material :	CS	Thickness, inch :	0.1875		Temperature, °F :	180	
33	**INTERNAL WALL: NONE**							
34	Type	: None	Material	:				
35	Dimensions, height/width, mm	:						

36	**DUCTS:**						
37	Location		FD fan to burner	Air Intake Stack			2
38	Size or net free area,	Ft. or Sq. Ft.	10" Dia	12" Dia			2
39	Casing material		CS	CS			1
40	Casing thickness,	inch	0.1875	0.1875			1
41	Lining : Internal/external		--	--			1
42	Thickness,	inch	--	--			1
43	Material		--	--			1
44	Anchor (material and type)		--	--			1
45	Casing temperature,	°F	Ambient	Ambient			1

46	**PLENUM CHAMBER: NONE**			
47	Casing material :	Thickness, inch :	Size, Ft. :	
48	Lining material :			
49	Anchor (type and material) :			
50	Notes:			
51	1. HQFB will be supplied loose and should be installed at site by customer.			1
52	2. Please refer to Born Drawing, D-3076-1203-2B for anchor layout.			1
53	3. Convection Section & Stack Castable refractory shop dried at 500F.			1
54				
55				
56				
57				
58				
59				
60				

	OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Corp.	**ITEM NO.**	5H-1203			
	SERVICE	Reactor Feed Heater	**LOCATION**	Bruderheim, Alberta, Canada			
1	**STACK OR STACK STUB:**						REV
2	Number :	ONE	Self-supported or guyed :	Self Supported	Location :	Top of Conv.	
3	Casing material :	CS	Corrosion allowance, inch :	0.125	Min. Thick., in :	0.25"	
4	Inside metal diameter, Ft.	2.50	Height above grade, Ft. :	81.96	Stack len., Ft. :	47	1
5	Lining Material :	LHV Castable			Thickness, in :	2	
6	Anchor (material and type) :	CS Chainlink Fence					
7	Extent of lining :	Full Length	Internal or external :	Internal			
8	Design flue gas velocity, Ft./s :	21.1	Flue gas temperature, °F :	652			3
9	**DAMPERS:**						
10	Location		FD Fan Duct	NOTE-1			2
11	Type (control, tight shut-off, etc.)		Control				2
12	Shaft Material :		MAXON STD				2
13	Blade material :		MAXON STD				2
14	Multiple / single leaf		Single				
15	Provision for operation (manual or automatic)		Automatic				2
16	Type of operator (cable or pneumatic)		Electric				2
17	**MISCELLANEOUS: Per API Std 560**						
18	Platforms	Location	Number	Width	Length / Arc	Stairs / Ladder	Access From
19		Radiant Hearth	1	3'-0"	6'-0" / --	-- / 1	Grade
20		Transition	1	3'-0"	4'-0" / --	-- / 1	Radiant 1
21		Stack Sample / EPA	1	3'-0"	-- / 360 deg	-- / 1	Transition 1
22							
23							
24							
25	Type of flooring	Grating					
26	Doors		Number	Location	Size	Bolted/Hinged	
27	Access		1	RAD FLOOR	18" X 18"	Bolted	
28			1	BREECHING	24" X 24"	Bolted	
29	Observation		1	RAD WALL	6" X 8"	Hinged	
30	Peep		3	RAD FLOOR	8" Dia.	Hinged	3
31	Tube Removal Door		1	RAD ROOF	18" X 24"	Bolted	
32							
33	Instrument connections			Number	Size	Type	
34	Flue gas / combustion air temperature	2-Arch/1-Conv/1-Stack		4	1.5"	3000# NPT CLPG	2
35	Flue gas / combustion pressure	2-Floor/2-Arch/1-Conv/2-FD Fan		7	1.5"	3000# NPT CLPG	2
36	Flue gas sample	Stack		4	4.0"	150# RF	2
37	Snuffing steam / purge	Floor		2	2.0"	3000# NPT CLPG	2
38	O2 Analyzer	Stack		1	3.0"	300# RF	2
39	CO Analyzer	Stack		1	3.0"	300# RF	2
40	Vents / drains	Conv. Header Boxes		2	1.5"	3000# NPT CLPG	2
41	Process Fluid Temperature	2 per pass (@ Crossover & Rad. Outlet)		2	2.0"	300# RF	2
42	Tubeskin thermocouples	1 per pass		1	1.5"	3000# NPT CLPG	2
43	Flue gas temperature	Stack		1	3.0"	150# RF	2
44							
45	Painting requirements :	Surface Prep: SSPC SP6 + Inorganic Zinc Primer (SW Zinc Clad II HS or Equal)					1
46	Internal coating :	NONE					
47	Galvanizing requirements :	Ladders and Platforms					
48	Are painters trolley and rail included :	NONE					
49	Special equipment:	Sootblowers :	NONE				
50		Air preheater :	NONE				
51		Fan(s) :	(1) FD Fan (30HP) w/ space heater & thermistor				2
52		Other :	20' tall air intake stack w/ flame arrestor, rain cap & bird screen				2
53	Notes:						
54	1. Maxon smartlink MRV butterfly valve provided on air duct for air/fuel ratio control.						2
55	2. Enardo Flame Arrestor provided on combustion air intake stack.						2
56							
57							
58							
59							
60							
61							
62							

OWNER / PURCHASER	MEG Energy Corp. / MEG Energy Corp.	ITEM NO.	5H-1203
SERVICE	Reactor Feed Heater	LOCATION	Bruderheim, Alberta, Canada

NOTES

1 Burner testing is not included.
2 Heater Fabrication per Born standard
3 External insulation material and labor by others at site.
4 Fire proofing if any is by others at site.
5
6
7
8 EXTENDED SURFACE TUBES IN CONVECTION:

Row	Height, inch	Thickness, inch	Density(fins/inch)	Material of Fins
1st finned row after bare tubes	0.50	0.05	5	SSTL Typ. 409
2 & 3 finned rows	1.00	0.05	5	SSTL Typ. 410
4 - 7 finned rows	1.00	0.05	5	CS

REV
8 1
9 1
10 1
11 1
12 1

BORN INC.

WORLD-WIDE MANUFACTURERS OF
DIRECT FIRED HEATERS

BURNER DATA SHEET

RFQ No.: 3076
Date: 12/18/13
By: Jay
Sheet: 1 OF 3

				REV
	Purchaser / Owner : Born, Inc. / MEG Energy		**Item No. :** 5H-1203	
	Service : Reactor Feed Heater		**Location :** Bruderheim, AB, Canada	
1	**GENERAL DATA :**			
2	Type of Heater:		Vertical Cylindrical	
3	2. Altitude above sea level, ft.		2,120.0	
4	3. Air Supply:			
5	Ambient / Preheater Air / Gas Turbine Exhaust		Ambient Air	
6	Temperature, F. (Min./Max./Design)		-40 / 75 / 75	
7	Relative Humidity		40-95%	
8	Draft Type: Forced / Natural / Induced		Forced Draft (FD Fan) - 40HP	2
9	Draft Available:	Across Burner, in. W.C.	20" WC	1
10		Across Plenum, in. W.C.	--	
11	Required Turndown		4:1 (16:1 turndown possible from the burner)	2
12	Burner Wall Lining Thicknesss, in.		7.5	
13	Heater Casing Thickness, in		0.25	
14	Firebox Height, Ft.		16.8	1
15	Tube Circle Diameter, Ft.		8.91	
16	**BURNER DATA:**			
17	Manufacturer		Maxon Combustions	
18	Type of Burner (*)		Low Nox	
19	Model / Size (*)		8" Kinedizer LE	
20	Direction of Firing		Vertical Up Fire	
21	Location (Roof / Floor / Sidewall)		Floor	
22	Number Required		1	
23	Minimum Distance Burner Centerline, Ft.:			
24	To Tube Centerline (Horizontal/Vertical)		4.45	
25	To Adjacent Burner Centerline (Horizontal/Vertical)		N/A	
26	To Unshielded Refractory		16.8	2
27	Burner Circle Diameter, Ft.		--	
28	Pilots:			
29	Number Required		1	
30	Pilot type		Interrupted	1
31	Ignition Method		Electric	
32	Fuel		Natural Gas	
33	Fuel Pressure, PSIG		1" WC	1
34	Capacity, Btu/Hr		500,000	1
35	**OPERATING DATA :**			
36	Fuel		Natural Gas / Fuel Gas (Start-Up)	1
37	Heat Release per Burner, MMBtu/Hr			
38	Design		11.927	
39	Normal		9.939	2
40	Minimum		2.982	2
41	Excess Air at Design Heat Release, %		20.00	2
42	Air Temperature, F		Ambient	
43	Draft (Air Pressure) Loss, in W.C.			
44	Design		20" WC	1
45	Normal			
46	Minimum			
47	Fuel Pressure Required,		25" WC	1
48	Flame Length at Design Heat Release, Ft.		6	
49	Flame Shape (Round, Flat, Etc.)		Round	
50	Atomizing Medium / Oil Ratio, Lb/Lb		N/A	
51	NOTES :			
52				
53				
54				
55				
56				
57				
58				
59				
60				
61				

TOYO ENGINEERING CANADA LTD.

VENDOR DATA APPROVAL STAMP

X 1. PROCEED (As Noted)
☐ 2. PROCEED, CHANGE AS NOTED AND RESUBMIT
☐ 3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
☐ 4. DATA ACCEPTED FOR INFORMATION ONLY

AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.

TAG NO. 5H-1203

PKG LEAD NLA | DATE May 21/14

DOC NO. 13002-0-0M06M-D01-004-R2

CLIENT DOC NO.

DATE: APR 30 2014

TV - 8445

PO: 0M06M

BORN INC.
WORLD-WIDE MANUFACTURERS OF
DIRECT FIRED HEATERS

BURNER DATA SHEET

RFQ No.: 3076
Date: 12/18/13
By: Jay
Sheet: 2 OF 3

						REV
	GAS FUEL CHARACTERISTICS					
1	Fuel Type		Natural gas	Start-Up		1
2	Heating Value, LHV, BTU / SCF		915	1,022		1
3	Heating Value, HHV, BTU / SCF					1
4	Molecular Weight		16.67	21.48		1
5	Fuel Tempearture @ Burner, F		75	75		1
6	Fuel Pressure available @ Burner, psig		2.5	2.5		1
7	Fuel Gas Composition (Mole %)					1
8		N2	0.650	8.900		1
9		H2S	0.000	0.003		1
10		C1	95.500	69.760		1
11		C2	1.500	7.010		1
12		C3	0.350	4.860		1
13		iC4	0.000	2.490		1
14		nC4	0.150			1
15		iC5	0.000	0.820		1
16		nC5	0.050			1
17		C6+	0.150	0.960		1
18		H2	0.00	3.25		1
19		H2O	1.60	Saturated		1
20			0.00	1.48		1
21			0.00	0.44		1
22		Total	100.0	100.0		1
23	**LIQUID FUEL CHARACTERISTICS**					
24	Fuel Type		None			
25	Heating Value, LHV, BTU / Lb					
26	Specific Gravity / Deg.API					
27	C / H Ratio (By Weight)					
28	Viscosity @ F (cP)					
29	@ F (cP)					
30	Vanadium, ppm					
31	Sodium, ppm					
32	Potassium, ppm					
33	Nickel, ppm					
34	Fixed Notrogen, ppm					
35	Sulfur, % WT					
36	Ash, % WT					
37	Water, % WT					
38	Distillation : ASTM Initial Boiling Point, F					
39	ASTM mid point, F					
40	ASTM end point, F					
41	Fuel Temperture @ Burner, F					
42	Fuel Pressure available @ Burner, psig					
43	Atomizing medium : Air / Steam / mechanical					
44	Temperature, F					
45	Pressure, psig					
46	NOTES :					
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						

BORN INC.
WORLD-WIDE MANUFACTURERS OF
DIRECT FIRED HEATERS

BURNER DATA SHEET

RFQ No.: 3076
Date: 12/18/13
By: Jay
Sheet: 3 OF 3

				REV
1	Burner Plenum :	Common / Integral	Integral	
2		Material	Carbon Steel	2
3		Plate Thickness, in	1/4"	2
4		Internal Insulation	None	
5	Inlet Air Control :	Damper or Registers	Damper (Butterfly Valve)	1
6		Mode of Operation	Maxon MRV System Air Fuel Ratio Control System	1
7		Leakage	--	1
8	Burner Tile :	Composition	Burner Block: Low Alumina / Silica Refractory	
9		Maximum Service Temperature, F	2,000	2
10	Noise Specification		85 dBA at 3 ft from Burner	
11	Attenuation method		--	
12	Painting Requirements		Surface prepared to SSPC-SP-2 with 1 coat of primer	2
13	Ignition Port :		1	
14	Sight Port :		1	
15	Flame Detection :		UV Scanner	
16				
17	Scanner Connection :		2 - (Burner -1 + Pilot - 1)	1
18	Safety Interlock system for atomizing medium & Oil		N/A	
19	Performance test required		N/A	
20	**EMMISION REQUIREMENTS :**			
21	**Firebox Bridgewall Temperature, F**		1,491	
22	Nox	*	47 ppmv (d)	
23	CO	*	200 ppmv (d)	1
24	UHC	*		
25	Particulates	*		
26	Sox	*	Will directly depend on sulphur content in fuel gas	
27				
28	* Corrected to 3% O2 (Dry basis @ Design Heat Release)			
29	NOTES :			
30	1. Emmision guarantees valid at design and normal operating conditions only and with firebox temperature above 1250F.			

NOx guarantee must be at design BWT 1491°F and meet CCME guideline.

BORN INC.

WORLD-WIDE MANUFACTURERS OF
DIRECT FIRED HEATERS

FAN DATA SHEETS

Owner	MEG Energy Corp.	Unit	....
Location	Bruderheim, Alberta, Canada	Item Number	5B-1201 & 5B-1203
BORN REF	Job #3076	Service	Diluent Stripper & Reactor Feed Heaters
PURCHASER	MEG Energy Corp.	REF NO :	PO: 13002-0M06M Rev.1

REVISION RECORD

No.	Revision Description	Date	By	Checked	Rev	No. Of Pages
2	Issued w/ clarifications	2-Apr-14	JAY	VIJAY	1	8
1	Issued w/ PO Rev-1	18-Dec-13	JAY	VIJAY	0	8

TOYO ENGINEERING CANADA LTD.

VENDOR DATA APPROVAL STAMP

- [x] 1. PROCEED
- [ ] 2. PROCEED, CHANGE AS NOTED AND RESUBMIT
- [ ] 3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
- [ ] 4. DATA ACCEPTED FOR INFORMATION ONLY

AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.

TAG NO.

PKG LEAD AL A DATE May 21/14

DOC NO. 13002-0-0M06M-D01-005-R1

CLIENT DOC NO.

DATE: APR 30 2014

TV - 8445

PO: 0M06M

BORN INC.
WORLD-WIDE MANUFACTURERS OF DIRECT FIRED HEATERS

FAN DATA SHEET

BORN REF : 3076
EQUIP NO : 5B-1203
PAGE : 1 OF 1
Rev: 1

Purchaser / owner : MEG Energy Corp. | Item No. : 5B-1203
Service : FORCED DRAFT FAN | Location : Bruderheim, Alberta, Canada

		DESIGN		NORMAL		TURNDOWN		Rev.
		120%	20%	100%	20%	50%	20%	
1	ITEM							
2	Case (Operating/ Req'd, Fan Design)							
3	(Heater Design % , Air %)							1
4								
5	GAS CHARACHTERISTICS SERVICES							
6	Gas	Air		Air		Air		1
7	Flow, lb/h	11455		9546		4773		1
8	Specific Gravity (Air=1.0)	1		1		1		1
9	SCFM (60F, 14.7 psia)	2498		2082		1041		1
10								
11	OPERATIONS							
12	Flow Temperature, F	75		75		75		1
13	Elevation above S.L., ft	2120		2120		2120		1
14	Flow Desnity, lb/ft3	0.0682		0.0682		0.0682		1
15	ACFM @ Flow temp., Suction or Elevation	2801		2334		1167		1
16	Differential, Inches WC	37.00		26		6.4		1
17	RPM of Fan	3550		3550		3550		1
18	BHP at rating	26.24		22		10		1
19								
20	CONSTRUCTION OF MATERIALS							
21	Manufacturer	Chicago Blower Corp.						
22	Design	Design 53						
23	Size	Size I3						
24	Arrangement (Fans)	4						
25	Class (Fans)	Pressure Blower						
26	Max. Temp. at RPM, F	150						
27	Inlet Facing and Location	8" Flanged / Centre - Horizontal						
28	Discharge Facing and Location	10" Flanged / Top - Horizontal						
29	Variable Inlet Vanes required	N/A						
30	Inlet Screen	Note 1						
31	Clean out required	NONE						1
32	Bearings	N/A						1
33	Fan Rotation from Driver End (CW/CCW) :	CW						
34	Access Door	NONE						1
35	Drains	YES (1.5" NPT)						
36								
37	MISCELLANEOUS							
38	Coupled, V-Belt, Geared	Direct Drive						1
39	Type of Driver: Mtr or Turbine	Motor (TEFC), Baldor Super E Artic Duty						1
40	Driver HP and RPM	40 / 3600						
41	Voltz/Ph/Hz or psig-Temp/Exhaust	575 V / 60 Hz / 3 Ph						
42	Electrical Area Classification	Class I, Group IIA, Zone 2 T3						
43	Driver Mtg	YES (324TS frame)						
44	Driver Weight, lb	500						
45	Fan Weight, lb	960						1
46	Fan Control (VFD/Damper)	Maxon MRV Butterfly Valve						
47	Max. Noise Level	85 dBA @ 3ft						1
48	NOTES:							
49	1) Blower provided with Inlet stack (12" ID x 20' tall) with rain hood, inlet screen and flame arrestor.							
50	2) Fan motor provided with 120V space heater.							1
51								
52								
53								
54								
55								
56								
57	1	4/2/14	Jay					
58	Rev.	Date	By	Remarks				

CHICAGO BLOWER CORPORATION • 1675 Glen Ellyn Road • Glendale Heights, IL • 60139

an ISO 9001 Company

Curve

Job Description:	**Born 3076**
Reference:	**Fan 1203 at Motor Speed**
Fan Type:	**Pressure Blower Centrifugal Fans**
Fan Model:	**Design 53 Pressure Blower**
Fan Size:	**I3**
Fan Width:	**100%**
Design Speed:	**3550 RPM**
Temperature:	**75 °F**
Control Type	**N/A**

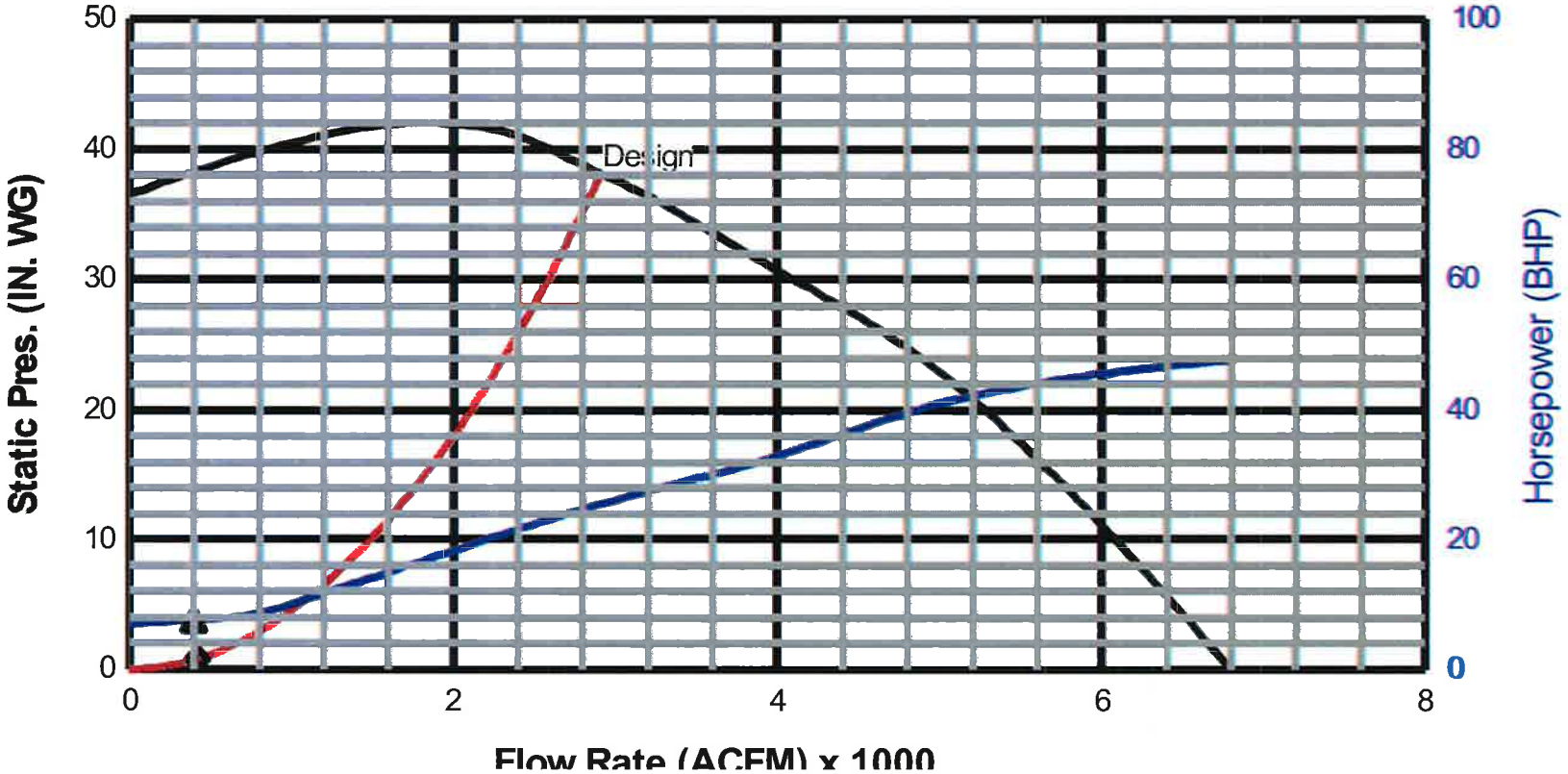
Performance Data

	Volume (ACFM)	SP (IN. WG)	Power (BHP)	Damper (% Open)	Density (LB/FT³)
Design	2918	38.1	25.56	N/A	0.069

DATE: JUNE 16 2014
TV - 8860
PO: 0M06M

TOYO ENGINEERING CANADA LTD.
May 20, 2014
VENDOR DATA APPROVAL STAMP
1. PROCEED
2. PROCEED, CHANGE AS NOTED AND RESUBMIT
3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
4. DATA ACCEPTED FOR INFORMATION ONLY
AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.
TAG NO.
PKG LEAD ALA DATE July 9/14
DOC NO. 13002-0-0M06M-J06-002-R0
CLIENT DOC NO.

- Design Point ◆ - System Curve ▲ - Power vs. Vol



Chicago Blower Corp.

Data Sheet Fan Sound

Customer: Born, Inc. Date May 20, 2014
Cust. Job Reference: 3076 CBC Ref # S/N 323755
Fan Description: Fan 1203, Model I-3, Design 53
Operating Condition: CFM 2,918 SP 38.1" WC Density 0.069 lb./cu.ft.

Sound Pressure Levels (Lp) at 3.0' (1 Meter) from side of 20 ft. stack and 5 ft. above grade, based on Free Field Hemispherical Radiation, per Figure 2B, AMCA 300, "A" weighted.

Octave Band	63	125	250	500	1000	2000	4000	8000
	55	69	78	75	73	66	62	56

Overall dB(A) 81

The sound pressure levels provided are calculated for a free field condition and comply with AMCA Standard 301, *Method for Publishing Sound Ratings*, and are the results of tests made in accordance with AMCA Standard 200, *Test code for Sound Rating Air Moving Devices*. The data is in no way to be construed as a guarantee in that the industry has not found a practical and accurate method of verifying individual equipment sound levels by field testing.

TOYO ENGINEERING CANADA LTD.
VENDOR DATA APPROVAL STAMP
1. PROCEED
2. PROCEED, CHANGE AS NOTED AND RESUBMIT
3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
4. DATA ACCEPTED FOR INFORMATION ONLY
AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.
TAG NO.
PKG LEAD ALA DATE July 9/14
DOC NO. 13002-0-0M06M-D02-002-R0
CLIENT DOC NO.

DATE: JUNE 16 2014
TV - 8860
PO: 0M06M

AC Induction Motor Perform

Record # 42073

Typical performance - not guaranteed values

BLOWER TAG: 5B-1203
MOTOR TAG: 5HM-1203

Winding: 12WGY682	**Type:** 1256M	**Enclosure:** TEFC

Nameplate Data

Rated Output (HP)	40			
Volts	575			
Full Load Amps	35			
R.P.M.	3530			
Hz	60	Phase	3	
NEMA Design Code	B	KVA Code	F	
Service Factor	1.15			
NEMA Nom. Eff.	92.4	P.F.	91	
Rating - Duty	40C AMB-CONT			
S.F. Amps				

General Characteristics at 575 V, 60 Hz: Single Volt Motor

Full Load Torque	59.4 LB-FT
Start Configuration	DOL
Break Down Torque	173 LB-FT
Pull-Up Torque	60.3 LB-FT
Locked-rotor Torque	78.3 LB-FT
Starting Current	224 Amps
No-load Current	7.75 Amps
Line-line Res. @ 25°C.	0.229 Ohms
Temp. Rise @ Rated Load	64°C
Temp. Rise @ S.F. Load	79°C

Load Characteristics at 575 Volts, 60 Hz

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	72	86	90	91	91	90	91
Efficiency	89.7	92.7	93.1	92.8	92.1	91.1	92.4
Speed	3583	3568	3553	3537	3518	3497	3526
Line Amperes	11.9	18.9	26.7	35.3	44.8	54.7	41

Baldor Electric Company Fort Smith, Arkansas

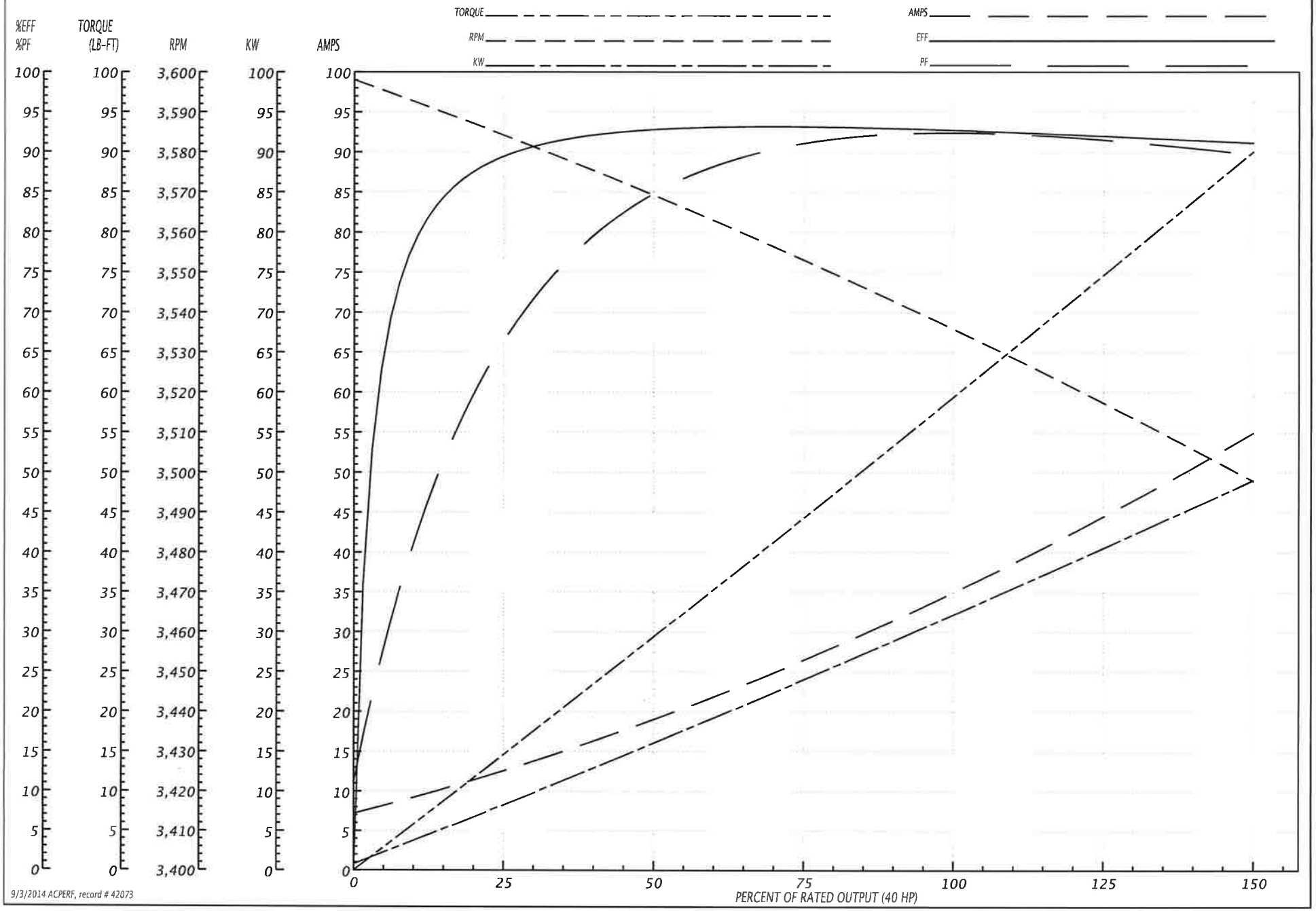
BALDOR ELECTRIC COMPANY

WINDING # 12WGY682

Typical performance - not guaranteed values.

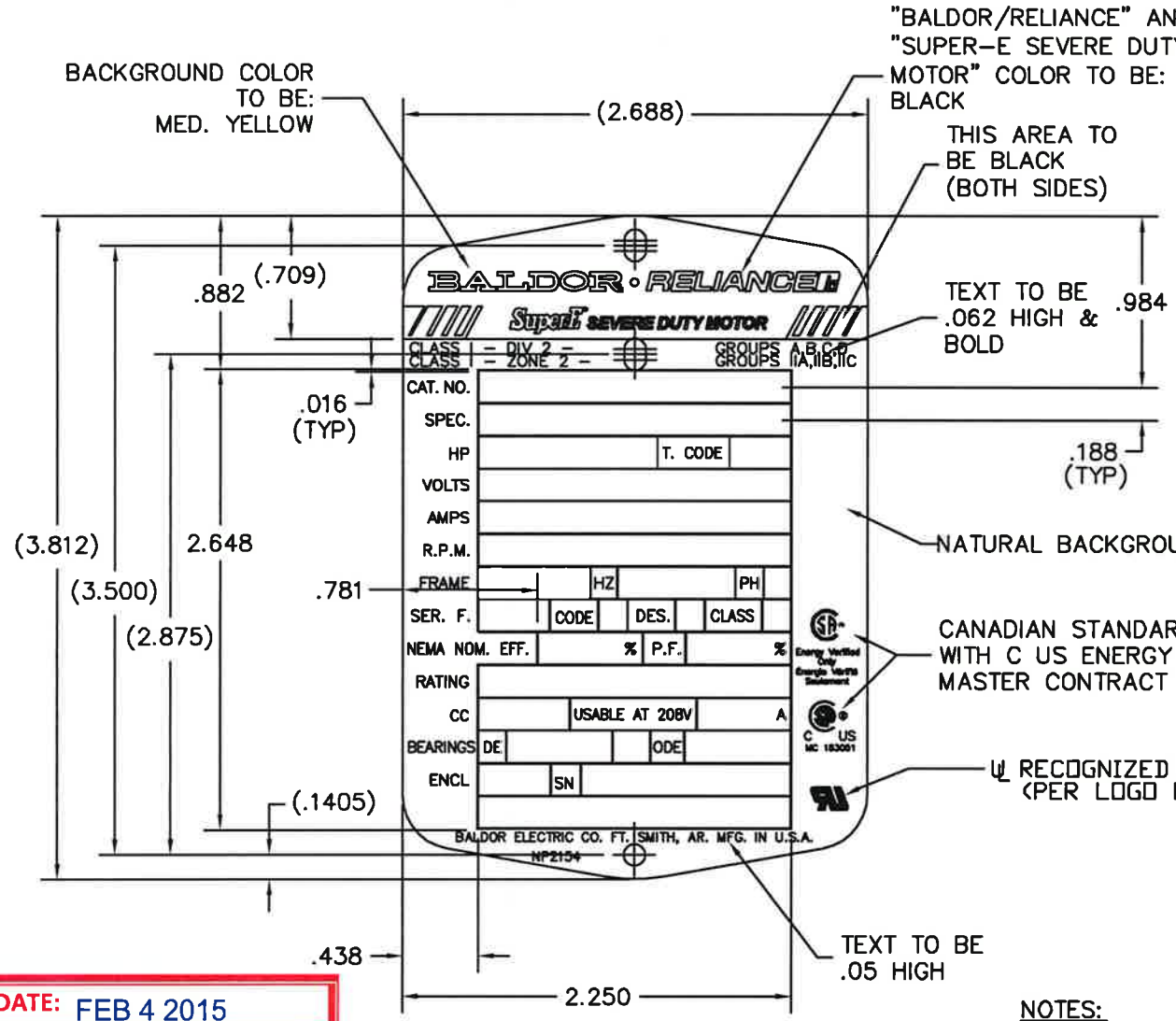
40 HP 3 PH 60 HZ 3530 RPM 575 V 1256M

TORQUES(LB-FT): PO=173 PU=60.3 LR=78.3 LRA=224



9/3/2014 ACPERF, record # 42073

NP2154



LENGTH OF BOX (INSIDE)

LINE NO.	BOX 1	BOX 2	BOX 3	BOX 4
3	1.054	.376		
7	.634	.665	.144	
8	.400	.153	.153	.153
9	.594	.594		
11	.515	.531		
12	.600	.600		
13	.404	1.200		

TOYO ENGINEERING CANADA LTD.
VENDOR DATA APPROVAL STAMP
1. PROCEED
2. PROCEED, CHANGE AS NOTED AND RESUBMIT
3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT
4. DATA ACCEPTED FOR INFORMATION ONLY
APPROVAL OF THIS DOCUMENT DOES NOT RELIEVE CONTRACTOR/VENDOR OF ITS RESPONSIBILITY OF LIABILITY UNDER THE CONTRACT/PURCHASE ORDER.
TAG NO. 5HM-1201 & 1203
PKG LEAD ALA DATE Feb 17/15
DOC NO. 13002-0-0M06M-D06-003-R0
CLIENT DOC NO.

DATE: FEB 4 2015
TV - 011185
PO: 0M06M

MOTOR TAGS: 5HM-1201 & 5HM-1203

NOTES:

1. ALL LETTERING AND BOX BORDERS TO BE BLACK
2. LETTERS NOT DIMENSIONED TO BE .062 HIGH.
3. ALL LETTERS TO BE VERTICAL EXCEPT "SUPER-E SEVERE DUTY MOTOR.
4. NAMEPLATE TO BE PAINTED AND BAKED.
5. USE STANDARD NAMEPLATE SHAPE NP9403A32.

REV. DESC: UPDATE CSA LOGO		
REV. LTR: E	VERSION: 05	TDR: 000000868467
FILE: \AAA\00164\444	REVISED: 07:58:41 08/25/2014	BY: ENTROEO
MTL: .020 #304SS		

BALDOR

SS DIV 2 CP SUPER-E UL CSA-C US EEV CC

SH 1 of 1

NP2154