Electrospeed

Integrated Control System

CENTRILIFT

ICS ELECTROSPEED KEYPAD PARAMETERS

a. Select Parameter to be displayed or changed
b. Use Up/down Arrow Keys to change Parameter
c. Press Enter Key to make change effective
d. Press any other Key to Abort change

DRIVE MODEL/OVERLOAD PARAMETERS
1. VT DRIVE ID
2. AMPS OL SET
3. SEC OL TRIP

VOLTS AT 60 Hz/START FREQUENCY
1. VOLTS @ 60Hz
2. START Hz

SYNCH DELAY/HIGH SPEED CLAMP
1. SYNC DLY
2. Hz MAX SPD

LOW SPEED CLAMP/V BOOST
1. MIN SPD
2. VOLTS @ 0 Hz

I LIMIT/I LIMIT SYNC
1. AMPS I LIM
2. I LIM SYNC

V BOOST SYNC/V CLAMP
1. VOLTS @ 0 Hz SYNC
2. V CLAMP

ACCEL TIME/DECEL TIME
1. SEC ACCEL
2. SEC DECEL

REGULATOR GAIN/SLIP COMP
1. % REG GAIN
2. % SLIP COMP

FAULT RESTART PARAMETERS
1. FLT RESTARTS
2. MIN RESTARTS
3. MIN FLTRESET

UNDERLOAD PARAMETERS
1. AMPS UL SET
2. MIN RESTART
3. UL RESTARTS
4. SEC UL TRIP
5. AUX STOP RESTART OFF >or< ON

SET FREQUENCY
1. Hz SET SPD
2. kpad >or< Ext. POT >or< RTU

CONTROLLER SET POINT/JOG FREQUENCY
1. A SET PT >and or< B SET PT
2. JOG SPD

ANALOG CONTROL SETUP
1. A ANALOG >or< B ANALOG
2. SET PNT >or< FOLLOWER

*** SETPOINT *** **(choice)**

3. DIRECT >or< REVERSE
4. SIGNAL TYPE (4-20 Ma, 0-10 volts etc.)
5. UNITS TYPE (PSI, GPM, BPD etc)
6. ZERO (adjust UNITS for zero signal)
7. SPAN (adjust UNITS for max signal)
8. PORP GAIN (set % gain)
9. INT GAIN (set % gain)
10. DERIV GAIN (set % gain)
11. LOW ALM (set units low alarm)
12. HI ALM (set units high alarm)
13. ALM DELAY (set min delay at start-up)

*** FOLLOWER *** **(choice)**

3. DIRECT >or< REVERSE
4. SIGNAL TYPE (4-20 Ma, 0-10 volts etc.)

CLOCK/DRIVE HISTORY
1. TIME (set time)
2. DATE (set Date)
3. EVENT No & TIME
4. EVENT No & DATE
5. EVENT No & EVENT NAME

FREQUENCY AVOIDANCE/OUTPUT ROTATION
1. OFF >or< ON FREQ AVOID
2. Hz+/- AVOID (set +/- tenths Hz band)
3. FREQ #1 (set Freq #1)
4. FREQ #2 (set Freq #2)
5. FREQ #3 (set Freq #3)
6. FREQ #4 (set Freq #4)
7. FREQ #5 (set Freq #5)
8. FWD >or< REV >or< EXT ROTATION

DISPLAY OUTPUT AMPS/VOLTS
1. AMPS A PH
2. AMPS B PH
3. AMPS C PH
4. VOLTS OUT
5. CODE NUMBER (access code)

DISPLAY ANALOG INPUTS
1. UNITS INPUT A
2. UNITS INPUT B

DISPLAY STATUS
1. (Displays present operating status)

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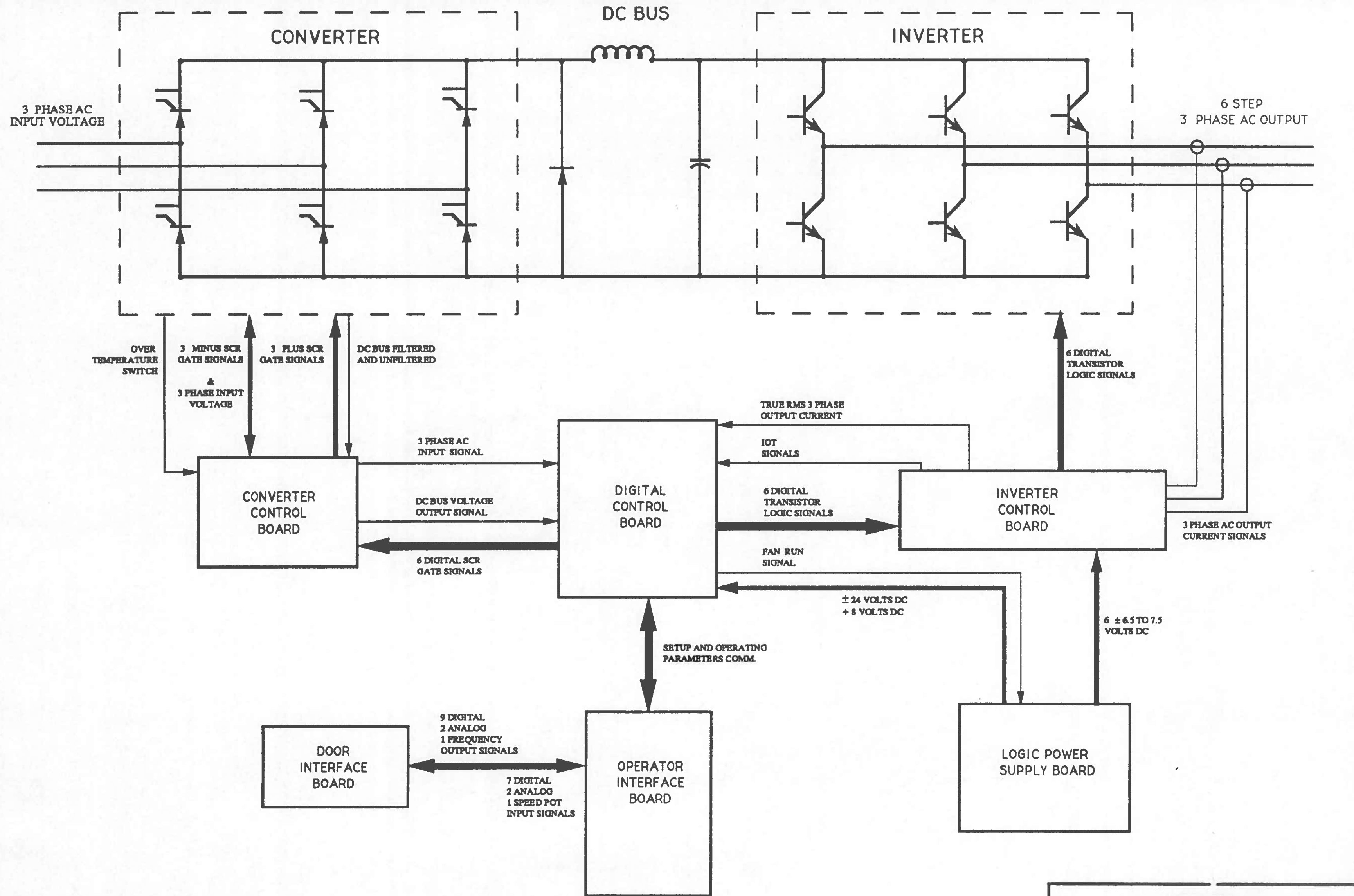
ICS ELECTROSPEED PARAMETER RANGE

OVERLOAD	0	to	100%	of Full Load Rating
OVERLOAD TIME	0	to	60	Sec. (to trip at 150% of OL setting)
VOLTS @ 60 HZ	1	to	640	Volts
START FREQUENCY	3	to	20	Hz.
SYNC DELAY	0	to	60	Sec.
HIGH SPEED CLAMP	40	to	120	Hz.
LOW SPEED CLAMP	5	to	90	Hz.
V BOOST	0	to	200	Volts
I LIMIT	0	to	150%	of Full Load Rating
I LIMIT SYNC	0	to	150%	of Full Load Rating
V BOOST SYNC	0	to	200	Volts
V CLAMP	240	to	550	Volts
ACCEL TIME	3	to	200	Sec. (over a 60 HZ span)
DECEL TIME	3	to	200	Sec. (over a 60 HZ span)
REGULATOR GAIN	0	to	100%	
SLIP COMP	0	to	7.0%	of Speed
FAULT RESTARTS	0	to	5	(starts from faults)
FAULT RESTART TIME	2	to	200	Min.
FAULT RESET TIME	5	to	300	Min. (valid run time, resets fault counter)
UNDERLOAD RESTARTS	0	to	30	OR INF.
UNDERLOAD RESTART TIME	2	to	1000	Min.
UNDERLOAD TRIP DELAY	1	to	300	Sec. (time in underload before trip)
SET FREQUENCY	5	to	120	Hz. (run speed)
JOG FREQUENCY	5	to	60	Hz.
FREQUENCY AVOID BAND	0	to	5	Hz.
ALARMS BYPASS TIMER	0	to	600	Min.



CENTRILIFT

A Baker Hughes company

ICS BASIC BLOCK DRAWING

ELECTROSPEED

INTEGRATED CONTROL SYSTEM

2060 VT DRIVE ID

Analog	A
Cntrl. Type	
Acting	
Signal	
Units	
Zero	
Span	
Porp Gain	
Int Gain	
Deriv Gain	
Low Alrm	
High Alrm	
Alrm Del	

POWER ON | RUN | FAULT | UNDERLOAD | OVERLOAD

START	MODEL OVERLOAD TRIP TIME	VOLTS AT 60 HZ START FREQUENCY	SYNC DELAY HIGH SPEED CLAMP	LOW SPEED CLAMP V BOOST
OFF	I LIMIT I LIMIT SYNC	V BOOST SYNC V CLAMP	ACCEL TIME DECEL TIME	REGULATOR GAIN SLIP COMP
MODE 1	FAULT RESTARTS MIN RESTART MIN RESET	ULNDERLOAD AMPS MIN RESTART RESTARTS SEC UL TRIP	SET FREQUENCY KEYPAD SPEED POT	SET POINT ANALOG A ANALOG B JOG FREQUENCY
MODE 2	ANALOG CONTROL SETUP	CLOCK DRIVE HISTORY	FREQUENCY AVOIDANCE OUTPUT ROTATION	↑
ENTER	DISPLAY OUTPUT AMPS/VOLTS	DISPLAY ANALOG INPUTS	DISPLAY STATUS	↓

Analog	B
Cntrl. Type	
Acting	
Signal	
Units	
Zero	
Span	
Porp Gain	
Int Gain	
Deriv Gain	
Low Alrm	
High Alrm	
Alrm Del	

CENTRILIFT

ICS OPERATOR INTERFACE KEYPAD

CENTRILIFT™

CONTROL RESEARCH

TECHNICAL BRIEF

PARALLEL/12 PULSE/8000 SERIES DRIVES

WITH THE RELEASE OF THE 8000 SERIES DRIVES, WE NOW HAVE THREE PRODUCTS IN THE FIELD THAT USE THE NEW MCC OR MULTI-CONVERTER CONTROLLER AND ASSOCIATED HARDWARE. A PARALLEL SYSTEM IS, OF COURSE, WHEN TWO DRIVES ARE CONNECTED TOGETHER TO OPERATE AS ONE UNIT. A 12 PULSE SYSTEM HAS TWO SEPERATE CONVERTERS AND LINK REACTORS, AND THE POWER FED TO THE TWO CONVERTERS IS SHIFTED IN TIME. THIS MEANS THAT THE GATE SIGNALS TO THE TWO SETS OF SCRS HAS TO OCCUR AT DIFFERENT TIMES. THE 8000 SERIES DRIVE HAS SOME OF THE CHARACTERISTICS OF BOTH. IT HAS TWO CONVERTERS WHICH CAN BE HOOKED UP EITHER IN PARALLEL OR AS A 12 PULSE TO REDUCE HARMONICS. IT ALSO HAS TWO INVERTER CONTROL BOARDS IN THE INVERTER SECTION. BECAUSE THE NEW MCC BOARD IS SOMEWHAT "TRANSPARENT" TO THE OPERATION OF THE DRIVE, IT WILL HELP YOU IN TROUBLESHOOTING TO BE AWARE OF HOW IT WORKS AND WHERE IT FITS INTO THE SYSTEM.

THE ONE COMMON ELEMENT OF ALL THREE SYSTEMS THAT USE THE MCC BOARD IS THAT THEY ALL HAVE TWO SEPARATE SETS OF CONVERTER SCRS TO CONTROL. THIS CAN BE BECAUSE THERE ARE TWO PHYSICAL BOXES AS IN THE CASE OF THE PARALLEL DRIVE, OR BECAUSE OF THE NEED TO FIRE THE SCRS AT DIFFERENT TIMES AS IN THE CASE OF 12 PULSE OPERATION. IN BOTH SITUATIONS, CONVERTER 1 IS STILL DIRECTLY CONTROLLED BY THE DCB. THE SECOND SET OF SCRS IS TREATED AS A TOTALLY INDEPENDENT SECOND CONVERTER, AND IS CONTROLLED BY THE MCC. (WHEN USED, THE INVERTER SIGNALS ARE SIMPLY ROUTED FROM THE DCB THROUGH A SMALL DRIVER IC) THIS MEANS THAT THE DRIVE IS SMART ENOUGH TO HANDLE ANY INPUT WIRING IT MAY SEE IN THE FIELD, AND THUS MAKES IT IMMUNE TO MOST INPUT POWER WIRING MISTAKES THAT MIGHT OCCUR. UNFORTUNATELY, THIS NECESSITATES SEPARATE MONITORING OF INCOMING PHASE ROTATION AND ZERO CROSSING FOR BOTH CONVERTERS. ALSO SINCE THERE IS NO ACTUAL PHYSICAL COMMUNICATION BETWEEN THE MCC AND DCB (OTHER THAN THE FAULT LINE) THE ONLY WAY FOR THE MCC TO KNOW WHAT THE FIRING ANGLE FOR THE SCRS SHOULD BE IS TO MEASURE WHAT THE DCB IS DOING WITH CONVERTER 1.

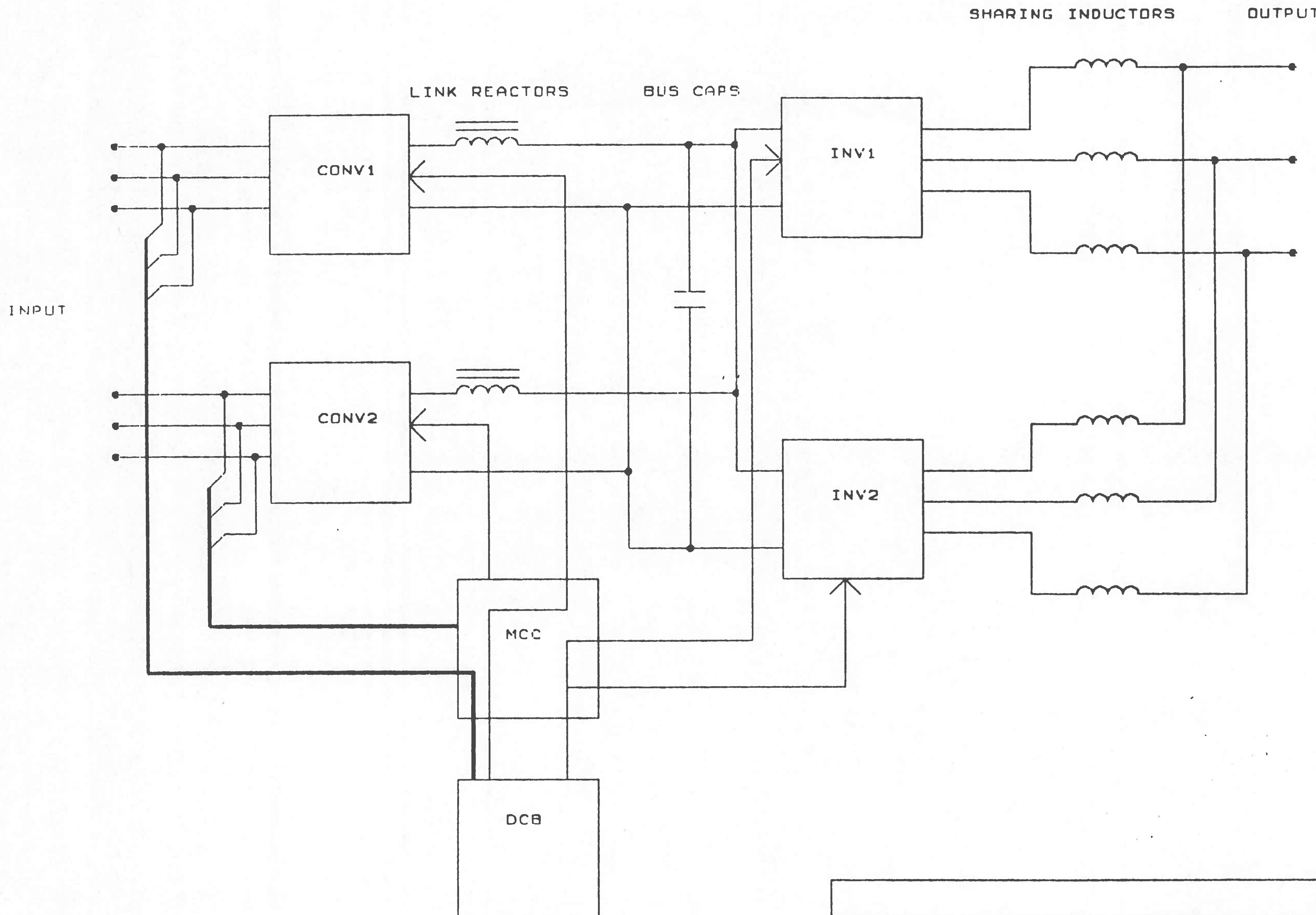
Date 2.23.93
No. 70 Rev. ____

THE OTHER RESPONSIBILITY OF THE MCC IS TO BALANCE THE CURRENT BETWEEN THE TWO CONVERTERS. THIS IS ACCOMPLISHED BY MEASURING THE INPUT CURRENT ON ONE PHASE OF BOTH CONVERTERS AND ADJUSTING THE FIRING ANGLE OF CONVERTER 2 SLIGHTLY TO CONTROL THE CURRENT SHARING. OF COURSE IT IS EXTREMELY IMPORTANT THAT THE INPUT CTS BE ASSOCIATED WITH THE CORRECT CONVERTERS. (THE ONE ON CONVERTER 1 PLUGGED INTO THE MCC CONNECTOR MARKED CNV1 ETC.) ALSO, THE DC BUS VOLTAGE IS ONLY MONITORED FROM CONVERTER 1, SO IN A 12 PULSE OR 8000 SERIES DRIVE YOU WILL ONLY SEE THE DC FEEDBACK CONNECTED TO THE CONVERTER BOARD ON CONVERTER 1.

THERE ARE A FEW OTHER MINOR HARDWARE DIFFERENCES. BOTH THE 12 PULSE AND 8000 SERIES DRIVES HAVE THE LINK REACTORS SPLIT INTO TWO EQUAL INDUCTANCES, ONE FOR EACH CONVERTER. THE OUTPUT OF THESE INDUCTORS THEN TIE INTO A COMMON DC BUS. ON THE 8000 SERIES, YOU WILL NOTICE ONE LARGE POWER SUPPLY BOARD RATHER THAN TWO SMALL ONES. IT'S CIRCUITRY IS EXACTLY LIKE THE NORMAL POWER SUPPLY BOARD. ALSO, TO KEEP FROM PARALLELING 16 TRANSISTOR MODULES DIRECTLY, EACH INVERTER LEG CONSISTS OF TWO GROUPS OF UP TO EIGHT MODULES CONNECTED TOGETHER BY A CURRENT SHARING INDUCTOR. THIS INDUCTOR HELPS TO EVEN OUT THE LOAD ON THE TWO GROUPS OF TRANSISTOR MODULES DURING THE SWITCHING TRANSITIONS. OF COURSE EACH GROUP OF MODULES IS DRIVEN BY A SEPARATE INVERTER BOARD.

WHEN TROUBLESHOOTING THESE DRIVES BE AWARE THAT THE DUPLICATE SET OF HARDWARE CAN HELP TO ZERO IN ON THE FAULTY SECTION VERY QUICKLY. ON A PARALLEL DRIVE, EITHER DRIVE CAN BE OPERATED BY ITSELF (OF COURSE AT A REDUCED LOAD) BY DISCONNECTING THE MCC AND CONNECTING ONE SET OF INVERTER AND CONVERTER CABLES AT A TIME DIRECTLY TO THE DCB. (OF COURSE THE MASTER DRIVE POWER MUST REMAIN ON TO POWER THE DCB) WHEN ATTEMPTING THIS IN A 12 PULSE OR 8000 SERIES, YOU WOULD NEED TO JUMPER THE DC BUS FEEDBACK PIN ON BOTH CONVERTER BOARDS TOGETHER. (J6 PIN1) ALL HARDWARE FAULTS FROM THE SECOND INVERTER AND CONVERTER BOARDS WILL GENERATE THE CORRESPONDING FAULTS ON THE DISPLAY. ADDITIONALLY, IF YOU HAVE THE LATEST OIB SOFTWARE (OIB15) THE DISPLAY WILL FLASH SIGNIFYING A CONVERTER2/INVERTER2 FAULT. ANY OTHER FAULT DETECTED BY THE MCC SOFTWARE WILL BE DISPLAYED AS AN INPUT ZERO-CROSSING ERROR. (INPUT ZC) OF COURSE IF THIS COMES FROM THE MCC, IT WILL FLASH SIGNIFYING A CONVERTER 2 FAULT.

MICKEY LEUTHEN



Title	8ØØØ SERIES B_OCK DIAGRAM	
Size A	Document Number	REV
Date: February 23, 1993	Sheet 1 of 1	

CENTRILIFT

CONTROL RESEARCH

TECHNICAL BRIEF

OPERATOR INTERFACE SOFTWARE REVISION - OIB15

The operator interface software for ICS drives has been revised. This new version (OIB15) adds some new features and also takes care of some operational problems found with version OIB12. Version numbers OIB13 and OIB14 have been skipped because of a few test chips that were produced under these numbers. These test chips do not include all of the changes made in OIB15. A brief description of the changes follows:

1. New ICS Model Numbers

   New model numbers have been added under the drive model selection. These model numbers are for the new 1000 series and 8000 series ICS drives now available for production. These new models are the 1050, 1060, 1075, 1100, 1125, 8600, 8700, 8800 and 8900 models for variable torque ratings. The new constant torque models are the 1050, 1075, 1100, 1125, 8500 8600, 8700 and 8800.

2. Fault Counter Changes

   In the OIB12 version, some faults such as low speed and a few others would not increment the fault counter. Therefore, the drive would always restart after the fault restart counter had expired even if the number of restarts was set to zero. The OIB15 revision fixes this problem.

3. Underload Timer Change

   Another potential problem could occur when a very slow acceleration time was set in the drive parameters. The underload timer was active as soon as the drive was started. If the time necessary to load the motor during the acceleration period exceeded the underload trip time, the drive would go down on underload. In the OIB15 revision the underload timer does not start until the drive output frequency reaches the low speed clamp value.

4. <u>Setpoint Controller Changes</u>

There have been two changes made to the setpoint controller software. The first is a bypass timer for the setpoint alarms. This timer is adjustable and is set under the analog set up key. This timer causes the setpoint control routine to ignore the high and low alarms for a predetermined time. This timer starts whenever the drive is started. This allows, for instance, a high level pressure alarm to be ignored until the drive causes the pressure level to drop. **Please note**: There is only one timer used for both "A" and "B" controllers.

The other change to the setpoint controller allows the analog "B" input to be used as the setpoint for the analog "A" setpoint controller. To use this feature, the procedure below should be followed:

A. Set up the analog "A" input as a setpoint controller. There is no change to this set up.

B. Set up the analog "B" input parameters to match the input units, zero, span, etc. set up in analog "A". Make sure the input 0-5V, etc. is correct for the analog "B" input.

C. Adjust the analog "A" setpoint to the same value as the zero parameter in the analog "A" set up. When these parameters are set to the same value the program uses the analog "B" input for the setpoint.

D. The setpoint value of analog "B" can be monitored on the display by pressing the display analog inputs key on the keypad.

5. <u>Auxiliary Stop Input Changes</u>

The auxiliary stop routine has an added feature in that you now have the option to set whether or not the drive will automatically restart. This option is set under the underload parameters key. If "automatic restarts" is turned **OFF** then the input acts like a normal stop input except that the auxiliary stop condition must be reset before the drive can be restarted. Any stop input will reset the auxiliary stop condition. Also, the drive run output is no longer active when an auxiliary stop condition is present.

6. <u>External Start Input Change</u>

The operation of the external "start input" has been changed. When external controls cause the "start input" to be maintained, the drive can still be stopped with any "<u>stop</u> input". With previous versions, under these circumstances, the drive would automatically restart when the "<u>stop</u> input" was removed. With the OIB15 version the drive will only restart if the "start input" is removed and then reapplied.

7. RTU Speed Control

This feature has been added to the "mode 1" operation of the drive. The set frequency can now be controlled by a remote terminal unit (RTU). This feature can be turned **ON** by selecting the RTU option under the set frequency key. When this option is selected and the drive is operating in "mode 1" the set frequency can be increased by .1 HZ each time the "external jog" input is pulsed. The frequency can be decreased by pulsing the "analog A/B" input.

8. Scientific Units Available for Follower/Setpoint Controller Operation

Due to feedback from the field, the units available for input sealing have been changed. The following is a list of the units now available: BARS, BPD, FT, GPM, K/C2, Kpa, MTRS, %, and PSI. When a scientific unit type is not available for the transducer being used, use either % or whichever unit available makes the most sense.

9. Fault Display Change

With the addition of 12 pulse, parallel and 8000 series drives to our product line, the need to distinguish common type problems that can occur in different sections of the drive has become apparent. All of these new types of drives have multiple converter sections. This is necessary because they can all be run as 12 pulse converters. The parallel drives have two different inverter sections and the 8000 series drives, although they have only one inverter section, have two inverter boards. Each converter board and inverter board can generate faults. Because of this, there needs to be a way to tell which converter or inverter board has generated a fault. OIB15 now does this. Faults generated by the primary inverter or converter board are displayed just as in previous versions of the program. The primary converter and inverter are defined as the boards located in the master drive of a parallel drive or the left board in each pair of control boards in the 8000 series units. Faults generated by secondary control boards are distinguished by a flashing fault message.

CENTRILIFT

A Baker-Hughes company
Claremore, Oklahoma, USA

CONTROL TECHNOLOGIES
TECHNICAL BRIEF

MULTIPLE SET POINT PROGRAM FOR ICS DRIVES

A new program for the ICS drive is now available. This program was developed for application demands for the use of multiple set points when operating in set point control. This new program offers up to four set points which can be selected through the customer interface board. This chip set is named IMW16A. The main features of the program are:

1. Four set points selected with digital inputs.
2. Set points are selected through the customer interface board.
3. A soft fill timer.

Due to the limited program space in the operator interface board, the following features have been changed or modified in this program:

1. All analog B functions have been removed.
2. The auxiliary stop has been deleted.

PROGRAM DESCRIPTION

The set-up of this program is identical to the standard OIB software with the exceptions that all references to analog B are removed and there is a new parameter to set. The new parameter is the soft fill time. This time is set in the analog set-up just after the alarm bypass time parameter. The set points are set up under the controller set point key. These points are identified as A, X, Y and Z. They are set up as in the A and B set points on standard OIB software.

In order to operate this new program, the drive should be set to operate in mode 2 in set point mode. Upon starting the drive, it will start normally and accelerate to the manual set speed. It will continue to run at this speed until the soft fill timer expires. At the end of this timer, the drive will start controlling speed using the set point controller. The drive will maintain the set point selected on the customer interface board. It should be noted that the set point alarm by-pass timer starts at the end of the soft fill time.

The customer interface board inputs used to select the set point (A, X, Y, Z) are external direction, jog and A/B select. These inputs are prioritized with Z set point being the highest, then Y, then X and A. The following table shows the relationship of the CIB inputs to the set point:

Z set point - A/B select active; Y set point - Jog active; X set point - external direction active; A set point - none.

Jerald Rider

Date: 30 March 1995
No: 82

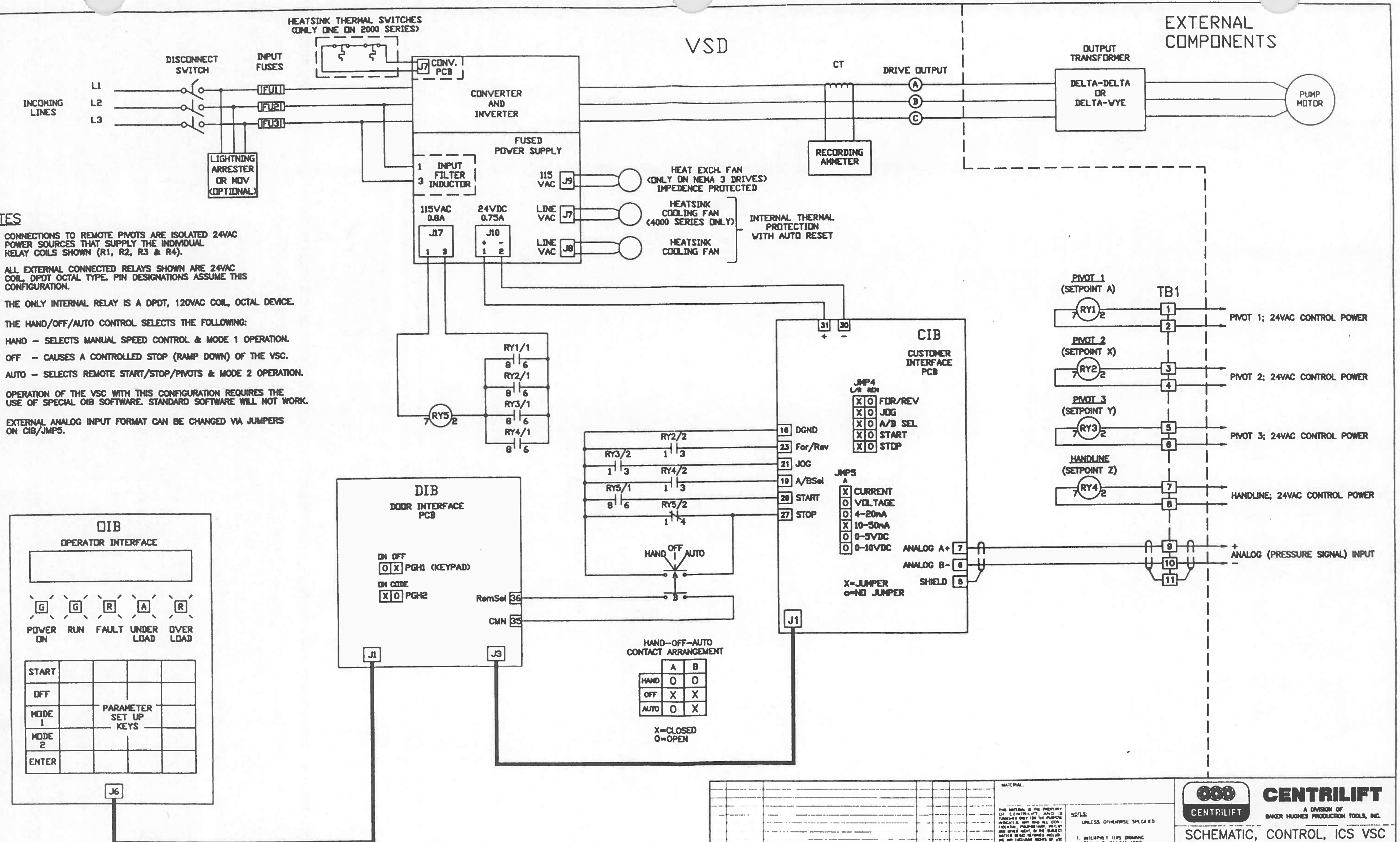
IMW OIB 16A PROGRAM (a special ICS program)

1. This program accepts 1 Analog Input, Analog A.
2. Analog B input function has been removed.
3. Auxiliary stop input function has been removed.
4. Analog A is an input with 4 adjustable setpoints for both Control and Display. The setpoints are selected with external contacts connected to the Door Interface or Customer Interface Board with connections and control priorities as indicated below.

Setpoint	Priority				
A	**4**	Controls when no other setpoints are selected.			
X	**3**	Control precedence over A setpoint.			
		FWD/REV	DIB 29 - 19	or	CIB 23 - 30
Y	**2**	Control precedence over A & X setpoints.			
		JOG	DIB 32 - 19	or	CIB 21 - 30
Z	**1**	Control precedence over A, X & Y setpoints.			
		A/B SEL	DIB 39 - 19	or	CIB 19 - 30

5. **MODE 2**, now has a Soft Fill Function added. When used, allows the drive to run in manual set frequency for an adjustable period of time after which it automatically switches to Analog A Setpoint control.
6. The **Soft Fill Speed** is the manual set frequency speed and is set in **MODE 1** using the **Set Frequency** and arrow Keys.
7. The **soft fill time** is adjustable from 0-900 sec under the **Analog Control Setup** Key and is key press 14 or the next parameter following the Alarm Bypass Timer.
8. The Alarm Bypass Time starts when the Soft Fill Time ends.

Ref: Controls Tech Brief 82.



	A	B
HAND	O	O
OFF	X	X
AUTO	O	X

NOTES

1. CONNECTIONS TO REMOTE PIVOTS ARE ISOLATED 24VAC POWER SOURCES THAT SUPPLY THE INDIVIDUAL RELAY COILS SHOWN (R1, R2, R3 & R4).
2. ALL EXTERNAL CONNECTED RELAYS SHOWN ARE 24VAC COIL, DPDT OCTAL TYPE. PIN DESIGNATIONS ASSUME THIS CONFIGURATION.
3. THE ONLY INTERNAL RELAY IS A DPDT, 120VAC COIL, OCTAL DEVICE.
4. THE HAND/OFF/AUTO CONTROL SELECTS THE FOLLOWING:
   HAND – SELECTS MANUAL SPEED CONTROL & MODE 1 OPERATION.
   OFF – CAUSES A CONTROLLED STOP (RAMP DOWN) OF THE VSC.
   AUTO – SELECTS REMOTE START/STOP/PIVOTS & MODE 2 OPERATION.
5. OPERATION OF THE VSC WITH THIS CONFIGURATION REQUIRES THE USE OF SPECIAL OIB SOFTWARE. STANDARD SOFTWARE WILL NOT WORK.
6. EXTERNAL ANALOG INPUT FORMAT CAN BE CHANGED VIA JUMPERS ON CIB/JMP5.

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEMATIC, CONTROL, ICS VSC GENERIC, FOR IRRIGATION APPS.

SCALE 1 = 1	DATE			
DWN BY MIK	05APR95			
CHKD BY MIK	05APR95	DRAWING NUMBER EDA-2029	REV 1	
APP BY MIK	05APR95			

REV	DATE	REVISION	DWN BY	CHK BY	APP BY	PCN NO
1	05APR95	RELEASE	MIK	MIK	MIK	

CENTRILIFT
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FIELD SERVICE
TECHNICAL MEMO

April	5,	1993
November	5,	1993
June	30,	1994
March	**14,**	**1995**

No. C-1993 1 Rev E

EPROMS - ICS ELECTROSPEED PROGRAMS

DIGITAL CONTROL BOARD EPROMS

	PRGM, DCB 21, FORMER DCB STANDARD
	PRGM, DCB 22, FORMER DCB STANDARD
	PRGM, DCB 23, FORMER DCB STANDARD
	PRGM, DCB 24, FORMER DCB STANDARD
	PRGM, DCB 26, FORMER DCB STANDARD
	PRGM, DCB 28, FORMER DCB STANDARD
49607	PRGM, DCB 29, PRESENT DCB STANDARD

MULTI-CONVERTER CONTROL BOARD EPROMS

SEI2117D01	PRGM, MCC 06, 12 Pulse Special 12 Pulse or Parallel (1/10/92)
	PRGM, MCC 09, FORMER MCC STANDARD 12 Pulse or Parallel (2/10/93)
51276	PRGM, MCC 11, PRESENT MCC STANDARD 12 Pulse or Parallel (11/5/93)

OPERATOR INTERFACE BOARD EPROMS

	PRGM, OIB 12 FORMER OIB STANDARD
	PRGM, OIB 15 FORMER OIB STANDARD
49608	PRGM, OIB 16, PRESENT OIB STANDARD
	PRGM, IMW 16A, SPECIAL OIB for IMW

REGARDS

RUDY HALL

CENTRILIFT
HUGHES

FIELD SERVICE
TECHNICAL MEMO

NO. 212

PHD TEMPERATURE CORRECTION CHART

8 August 1988

The PHD temperature correction chart presently in use to calibrate the PHD system on VSC's originates sometime prior to 1982. It's origin and the method used to develop it are unknown.

Attached is a revised table and information about how it was developed. Careful use of this table should help improve calibration results on VSC PHD systems.

TO USE THE CHART

With the PHD and motor on the surface. Measure the ambient temperature of the PHD unit on it's shaded side. Subtract that temperature from the bottom hole temperature. Look up the resulting temperature. Add this resistance value to the motor resistance as measured while on the surface. Adjust the rheostat to this value. Connect it between the PHD surface inductor pkg high voltage (blue) wire and ground. Calibrate for zero on the interface. (or +0 on the output of the signal conditioner)

Not using temperature adjustments can result in errors up to 300 PSI.

Rudy

Rudy Hall /sf

RH:sal

Attachment

FHD TEMPERATURE COMPENSATION CHART 1988

DELTA F	DELTA R	DELTA F	DELTA R
0	0	150	635
5	20	155	657
10	42	160	678
15	63	165	699
20	84	170	720
25	105	175	742
30	126	180	763
35	148	185	784
40	169	190	805
45	190	195	826
50	211	200	848
55	232	205	869
60	254	210	890
65	275	215	911
70	296	220	932
75	317	225	954
80	339	230	975
85	360	235	996
90	381	240	1017
95	402	245	1038
100	423	250	1060
105	445	255	1081
110	466	260	1102
115	487	265	1123
120	508	270	1145
125	529	275	1166
130	551	280	1187
135	572	285	1208
140	593	290	1229
145	614	295	1251

CABLE VOLTAGE DROP

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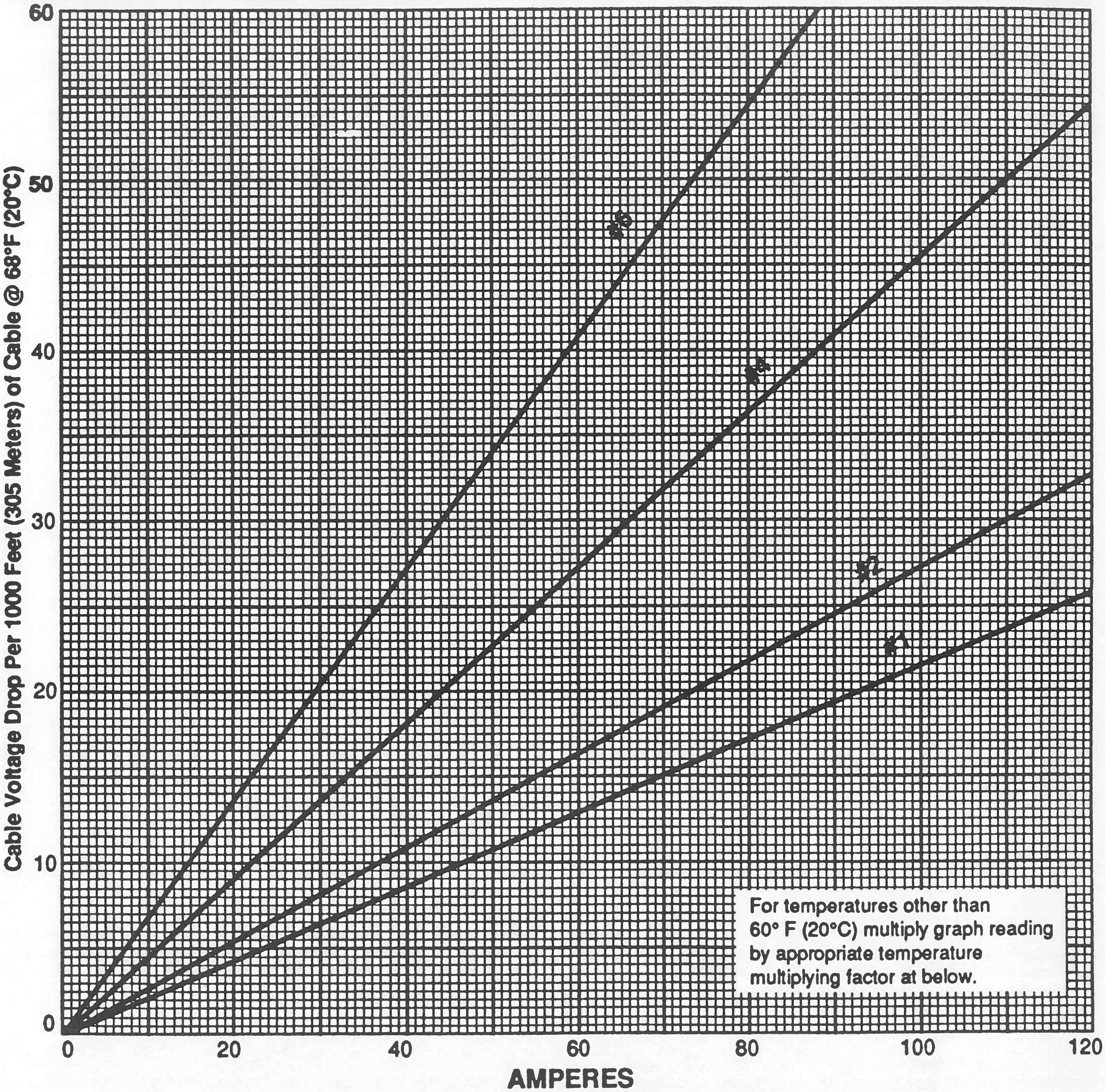
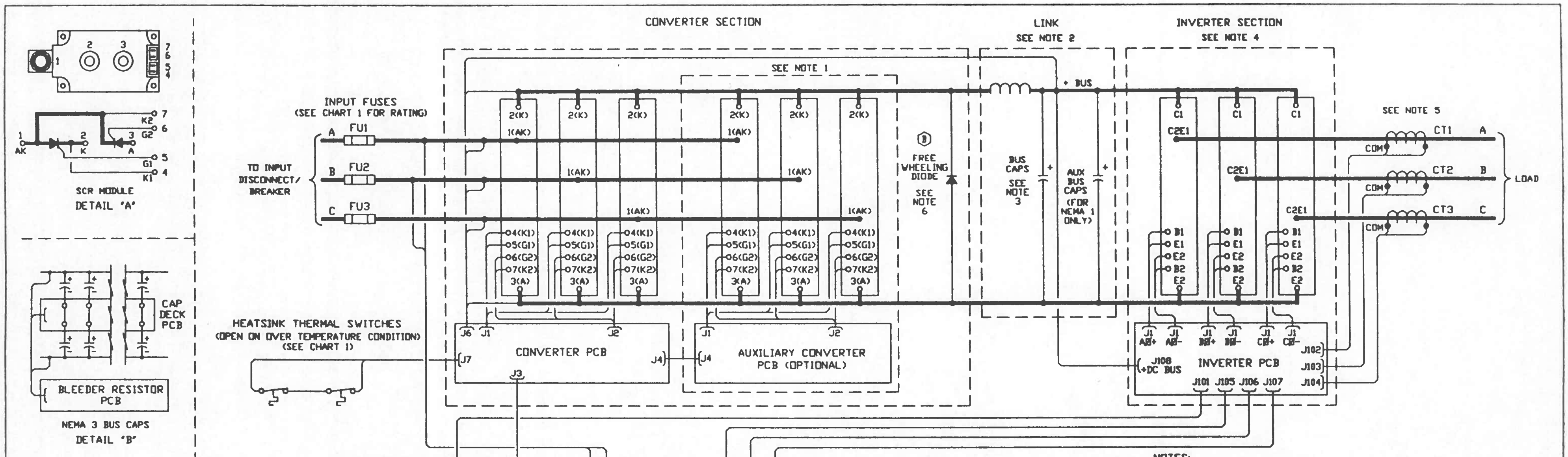
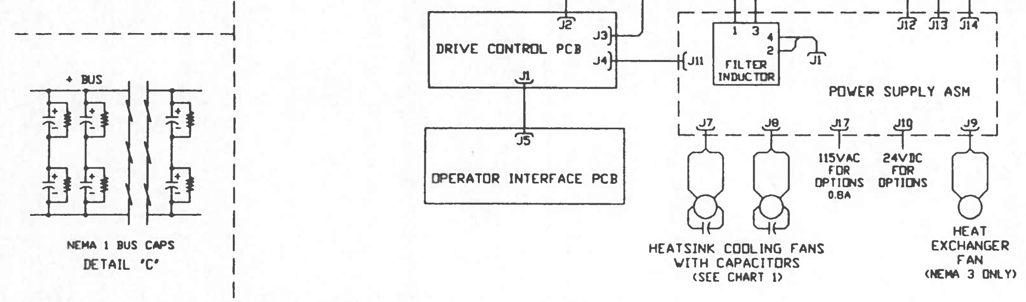
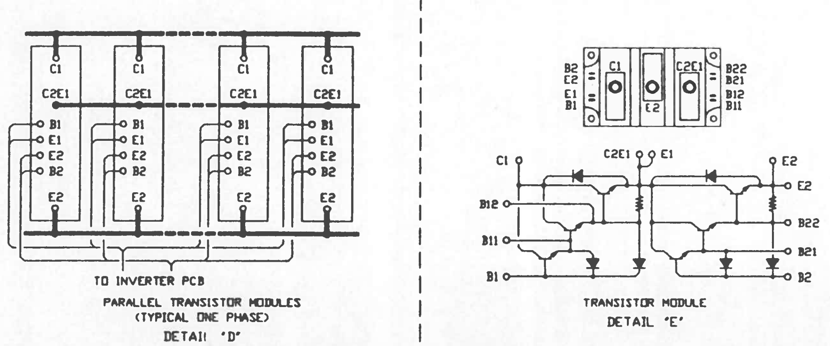
A Baker Hughes company



Conductor Voltage Drop			
Temp. °F(°C)	Mulitiplying Factor	Temp. °F (°C)	Mulitiplying Factor
100(38)	1.070	200(93)	1.288
110(43)	1.092	210(99)	1.310
120(49)	1.114	220(104)	1.332
130(54)	1.136	230(110)	1.354
140(60)	1.157	240(116)	1.376
150(66)	1.179	250(121)	1.398
160(71)	1.201	260(127)	1.420
170(77)	1.223	270(132)	1.441
180(82)	1.245	280(138)	1.463
190(88)	1.267	290(143)	1.485







NOTES:

1. SCR MODULES ARE USED IN PARALLEL IN THE LARGER VSC's. AN AUXILIARY CONVERTER BOARD IS REQUIRED FOR THE ADDITIONAL SET OF THREE MODULES. SEE CHART 1 BELOW. SEE DETAIL 'A' FOR SCR MODULE TERMINAL IDENTIFICATION.
2. THE LINK INDUCTOR MAY CONSIST OF UP TO FOUR SEPARATE INDUCTORS IN PARALLEL. THE NUMBER IS DETERMINED BY THE VSC RATING. SEE CHART 1 BELOW.
3. THE BUS CAPACITANCE CONSISTS OF PAIRS OF CAPACITORS IN SERIES TO ATTAIN THE REQUIRED VOLTAGE RATINGS. BLEEDER RESISTORS ARE PLACED IN PARALLEL WITH EACH CAPACITOR IN THE PAIR. THE RESISTORS INSURE THE VOLTAGE IS EQUALLY DIVIDED ACROSS THE PAIR OF CAPACITORS. MULTIPLE PAIRS OF CAPACITORS AND ASSOCIATED BLEEDER RESISTORS ARE USED IN PARALLEL TO OBTAIN THE OVERALL CAPACITANCE REQUIRED. THIS CAPACITANCE IS DETERMINED BY THE VSC RATING. SEE CHART 1 BELOW FOR THE NUMBER OF PAIRS REQUIRED. THE BLEEDER RESISTORS ARE CONNECTED TO THE CAPACITORS IN TWO WAYS. ON THE NEMA 3 CONTROLLER, THE BLEEDER RESISTORS ARE MOUNTED TO A PRINTED CIRCUIT BOARD WHICH IS CONNECTED, VIA A CABLE ASSEMBLY, TO ANOTHER PRINTED CIRCUIT BOARD MOUNTED TO THE CAPACITOR TERMINALS. SEE SCHEMATIC DETAIL 'B'. ON THE NEMA 1 UNIT THE RESISTORS ARE LUGGED AND MOUNTED DIRECTLY TO THE CAPACITOR TERMINALS. SEE SCHEMATIC DETAIL 'C'.
4. TRANSISTOR MODULES ARE USED IN PARALLEL TO ACHIEVE THE REQUIRED RATINGS. THIS SCHEMATIC SHOWS ONE MODULE PER PHASE. ADDITIONAL MODULES ARE CONNECTED AS SHOWN IN SCHEMATIC DETAIL 'D'. SEE DETAIL 'E' FOR TRANSISTOR MODULE TERMINAL IDENTIFICATION. SEE CHART 1 BELOW.
5. CT1, CT2, AND CT3 HAVE MULTIPLE SECONDARY TAPS. SEE CHART 1 BELOW FOR TERMINAL IDENTIFICATION.
6. (B) MULTIPLE DIODE MODULES ARE USED TO ACHIEVE THE REQUIRED RATINGS. SEE CHART 1 BELOW.

THE QUANTITIES OF SCR's, INDUCTORS, AND CAPACITORS VARY DEPENDING ON THE VSC RATING. THE NUMBER OF TRANSISTOR MODULES DETERMINES THE NUMBER OF OTHER COMPONENTS. SEE CHART 1 BELOW.

CHART 1

TRANSISTOR MODULES PER PHASE	SCR MODULES PER PHASE	AUXILIARY CONVERTER BOARD	DIODE MODULES	INDUCTORS LARGE	INDUCTORS SMALL	CAPACITOR PAIRS	CT TAP	FUSES	FANS	THERMAL SWITCHES
1	1	NO	1	0	1	4	125	100A	1	1
2	1	NO	1	1	0	8	250	200A	1	1
3	1	NO	2	1	1	12	375	300A	1	1
4	1	NO	2	2	0	16	500	400A	1	1
5	2	YES	1	2	1	20	625	500A	2	2
6	2	YES	2	3	0	24	750	600A	2	2
7	2	YES	2	3	1	28	875	700A	2	2
8	2	YES	2	4	0	32	1000	800A	2	2

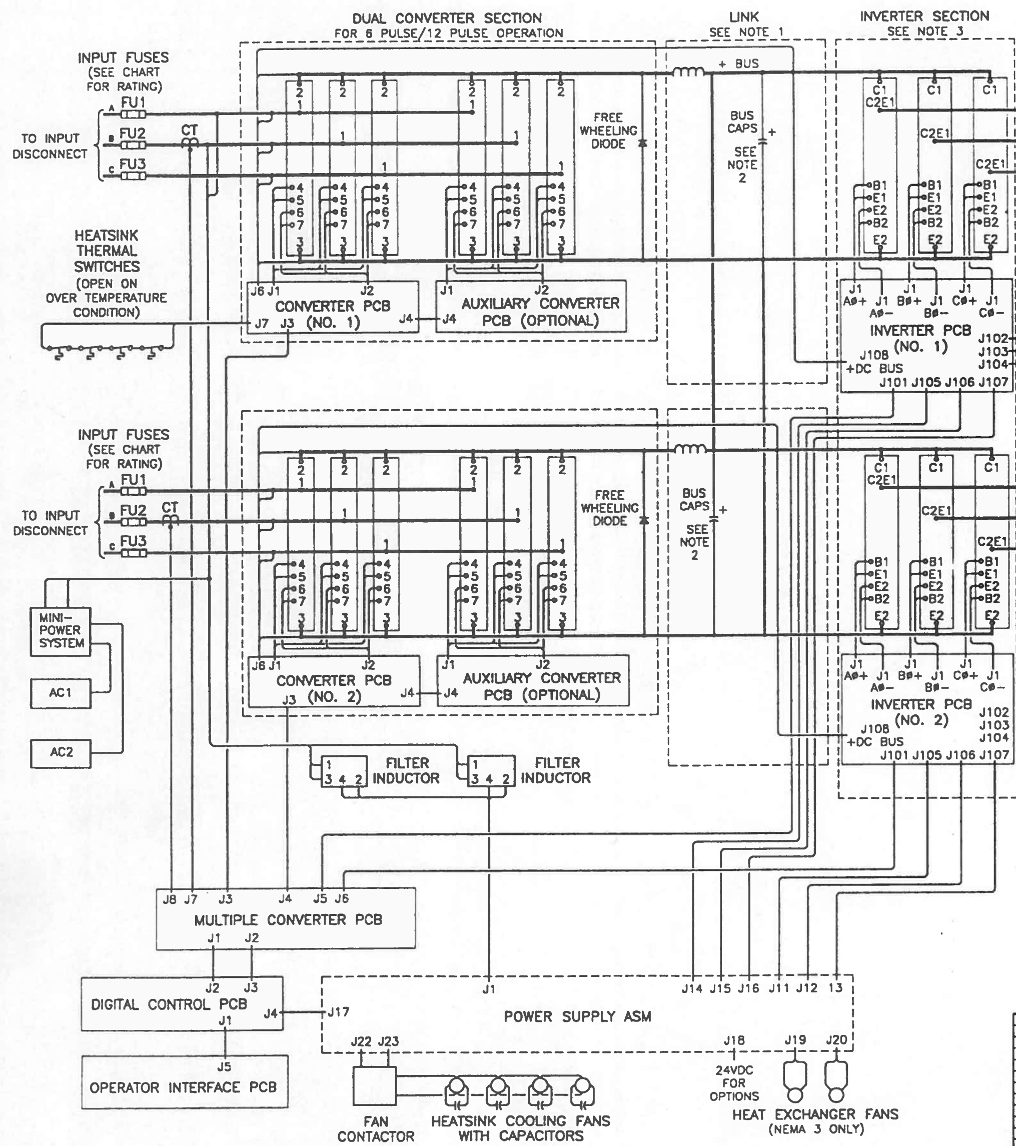
REV	DATE	REVISION				ECN
		SHOW LARGE & SMALL IND IN CHART 1.	DI			13401
C	20SEP90	REV CAP PAIR NOS. IN CHART 1 AND ADD FILTER IND TO PWR SUP ASM & FREE WHEELING DIODE TO SCHEM.	DI	RR	JML	13185
B	29MAY90	ADDED COLUMN 4 TO CHART 1, NOTE 7.				
A	19OCT88	RELEASED	DI	RR		

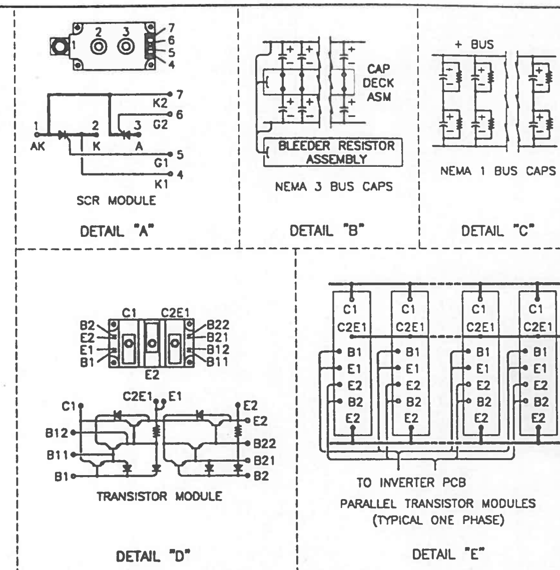
CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEMATIC, BASIC POWER CKT., ELECTROSPEED, ICS

SCALE	NONE	
DWN BY	DON INMAN	19OCT88
CHKD BY	RAY RAYNOR	6-5-90
APP BY	J.M. LEUTHEN	6-5-90

DRAWING NUMBER 48410 REV. C





NOTES:

1. THE LINK INDUCTOR MAY CONSIST OF UP TO EIGHT SEPARATE INDUCTORS IN PARALLEL. THE NUMBER IS DETERMINED BY THE VSC RATING. SEE CHART BELOW.
2. THE BUS CAPACITANCE CONSISTS OF PAIRS OF CAPACITORS IN SERIES TO ATTAIN THE REQUIRED VOLTAGE RATINGS. BLEEDER RESISTORS ARE PLACED IN PARALLEL WITH EACH CAPACITOR IN THE PAIR. THE RESISTORS INSURE THE VOLTAGE IS EQUALLY DIVIDED ACROSS THE PAIR OF CAPACITORS. MULTIPLE PAIRS OF CAPACITORS AND ASSOCIATED BLEEDER RESISTORS ARE USED IN PARALLEL TO OBTAIN THE OVERALL CAPACITANCE REQUIRED. THIS CAPACITANCE IS DETERMINED BY THE VSC RATING. SEE CHART BELOW FOR THE NUMBER OF PAIRS REQUIRED. THE BLEEDER RESISTORS ARE CONNECTED TO THE CAPACITORS IN TWO WAYS. ON THE NEMA 3 CONTROLLER, THE BLEEDER RESISTORS ARE MOUNTED TO A PANEL WHICH IS CONNECTED, VIA A CABLE ASSEMBLY, TO A PLATE MOUNTED TO THE CAPACITOR TERMINALS. SEE SCHEMATIC DETAIL "B". ON THE NEMA 1 UNIT THE RESISTORS ARE LUGGED AND MOUNTED DIRECTLY TO THE CAPACITOR TERMINALS. SEE SCHEMATIC DETAIL "C".
3. TRANSISTOR MODULES ARE USED IN PARALLEL TO ACHIEVE THE REQUIRED RATINGS. THIS SCHEMATIC SHOWS ONE MODULE PER PHASE. ADDITIONAL MODULES ARE CONNECTED AS SHOWN IN SCHEMATIC DETAIL "E". SEE DETAIL "D" FOR TRANSISTOR MODULE TERMINAL IDENTIFICATION. SEE CHART BELOW.
4. CT1, CT2, AND CT3 HAVE MULTIPLE SECONDARY TAPS. SEE CHART BELOW FOR TERMINAL IDENTIFICATION.

THE QUANTITIES OF INDUCTORS AND CAPACITORS VARY DEPENDING ON THE VSC RATING. THE NUMBER OF TRANSISTOR MODULES DETERMINES THE NUMBER OF OTHER COMPONENTS. SEE CHART BELOW.

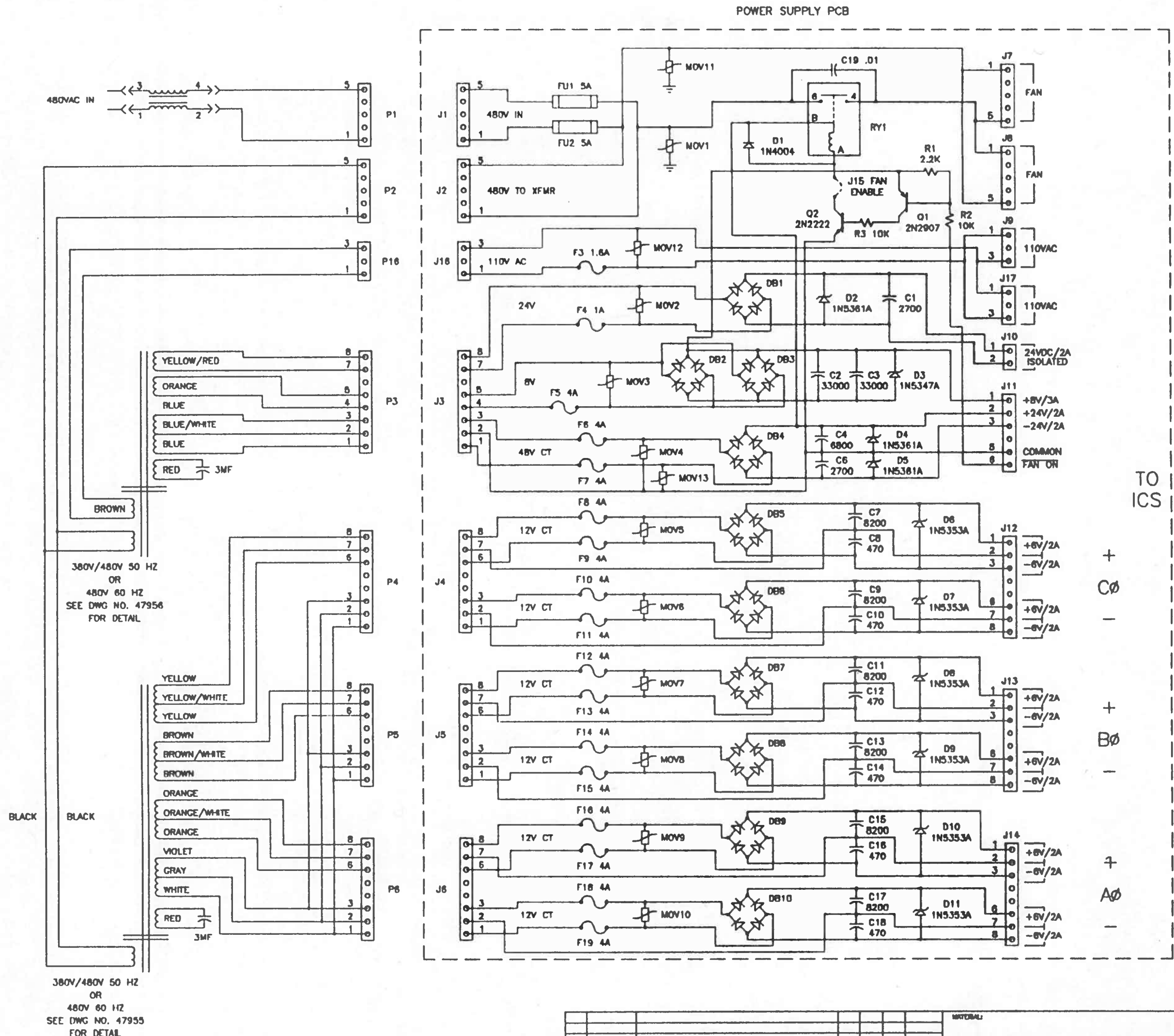
TRANSISTOR MODULES PER PHASE	INDUCTORS LARGE	INDUCTORS SMALL	CAPACITOR PAIRS	CT TAP	FUSES
10	4	2	40	625	500A
12	6	0	48	750	600A
14	6	2	56	875	700A
16	8	0	64	1000	800A

REV.	DATE	REVISION			
B	13JUN95	GENERAL REVISIONS	DI	RR	JR
A	25JAN94	PRODUCTION RELEASE	DI	RR	JR

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEMATIC, BASIC POWER CIRCUIT WITH AIR CONDITIONING, 8000 SERIES, ELECTROSPEED, ICS

SCALE 1 = 2	DATE	ALL OVER EXCEPT AS NOTED
DRN BY: DON INMAN	25JAN94	
CHKD BY: RAY RAYNOR	28JUN95	DRAWING NUMBER 55119
APP BY: JERALD RIDER	28JUN95	REV. B



REV.	DATE	REVISION	DWN BY	CHK BY	APP BY	PCN NO.
C	11·6·91	ADD C19.	DI			13660
		TO BROWN, & YELLOW TO ORANGE.	DI	RR	JML	13206
		XFMR FROM BROWN TO YELLOW, ORANGE				
B	8·1·90	CHG COLOR DESIGNATIONS ON INVERTER				
A	2.7.90	RELEASED	DI	RR	DLK	13206

MATERIAL:

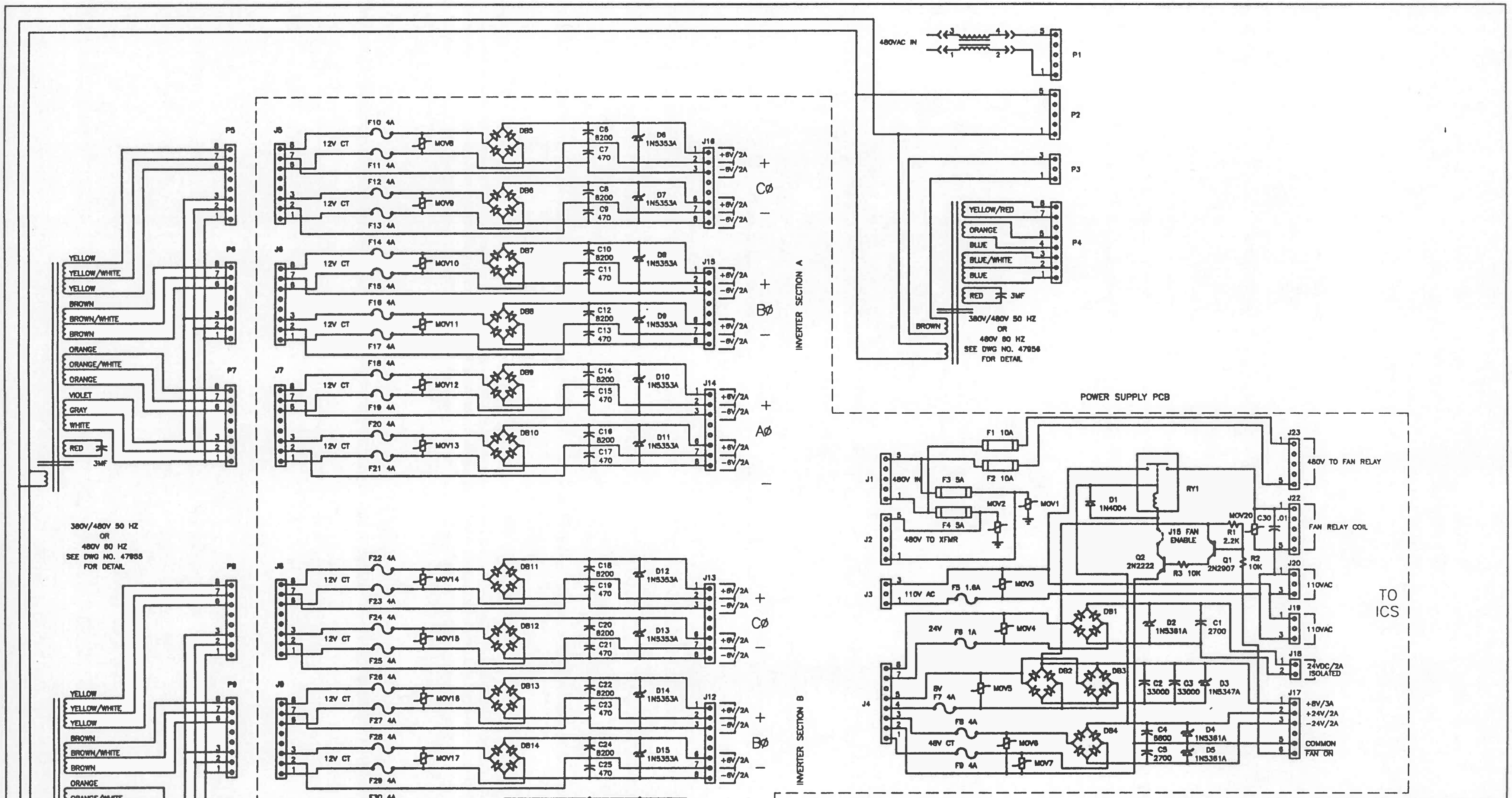
NOTES:
UNLESS OTHERWISE SPECIFIED

1. INTERPRET THIS DRAWING PER ANSI Y14.5M-1982
2. BREAK ALL SHARP CORNERS
3. DO NOT SCALE PRINT
4. ALL DIM'S IN INCHES
5. MACHINING TOLERANCE:
ANGULAR +/- 0.5°
FRACTIONAL +/- 1/64
DECIMAL .XX +/- .015 .XXX +/- .003

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEMATIC,
POWER SUPPLY ASM, ICS

SCALE	NONE	DATE	ALL OVER EXCEPT AS NOTED
DWN BY	DON INMAN	12JUL89	
CHKD BY	RAY RAYNOR	7:15 89	DRAWING NUMBER 47984
APP BY	D.L. KNOX	8:16 89	REV. C



REV	DATE	REVISION	DRWN BY	CHK BY	APP BY	PCN NO.
A	27JAN92	RELEASED	JR	D.I.	JML	13714

MATERIAL:

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NOTES:
UNLESS OTHERWISE SPECIFIED

1. INTERPRET THIS DRAWING PER ANSI Y14.5M-1982
2. BREAK ALL SHARP CORNERS
3. DO NOT SCALE PRINT
4. ALL DIM'S IN INCHES
5. MACHINING TOLERANCE:
   - ANGULAR +/- 0.5°
   - FRACTIONAL +/- 1/64
   - DECIMAL .XX +/- .015
   - .XXX +/- .003

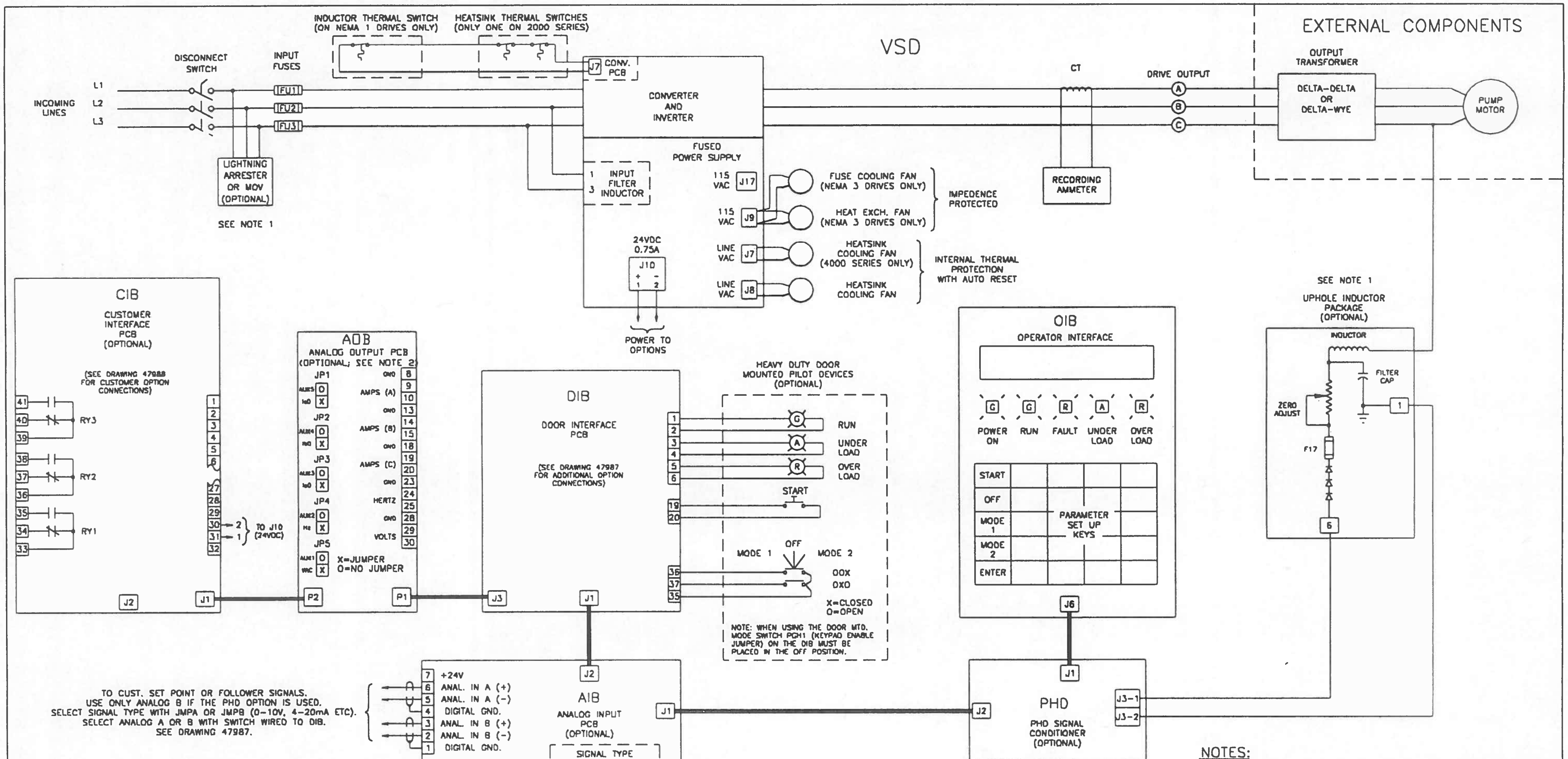
CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEMATIC, PCB, POWER SUPPLY
1000 KVA, ICS .

		DATE
SCALE	NONE	
DRN BY	J. RIDER	8JAN92
CHK'D BY	DON INMAN	27JAN92
APP BY	J.M. LEUTHEN	13NOV92

√ ALL OVER EXCEPT AS NOTED

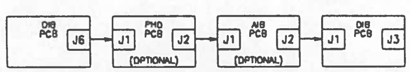
DRAWING NUMBER 50558 REV. A



NOTES:

1. THIS ITEM IS MOUNTED TO THE DRIVE ENCLOSURE ON NEMA 3 DRIVES, BUT SHIPPED SEPARATELY FOR FIELD MOUNTING ON NEMA 1 DRIVES.
2. J3 ON DIB CONNECTS TO J1 ON CIB WHEN AOB IS NOT USED.

OPTION BOARD CABLE CONNECTIONS



IF AN OPTION BOARD IS NOT USED THE CABLE CONNECTIONS ARE MADE TO THE CONNECTOR ON THE NEXT BOARD TO THE RIGHT. I.E. IF THE PHD IS NOT USED THE CONNECTOR WILL GO FROM J6 ON THE OIB TO J1 ON THE AIB PCB.

REV	DATE	REVISION	DWN BY	CHK BY	APP BY	PCN NO.
C	19JUL95	PARALLEL FUSE COOLING FAN TO J9 INSTEAD OF TO J17 ON CONV. PCB	DSG	DJ.	RR	14522
B	5JUL95	ADD AOB & NOTE 2.	DSG	DJ.	RR	14348
A	8DEC94	PRODUCTION RELEASE - WAS ED9840-8.	STU	DI	JML	14372

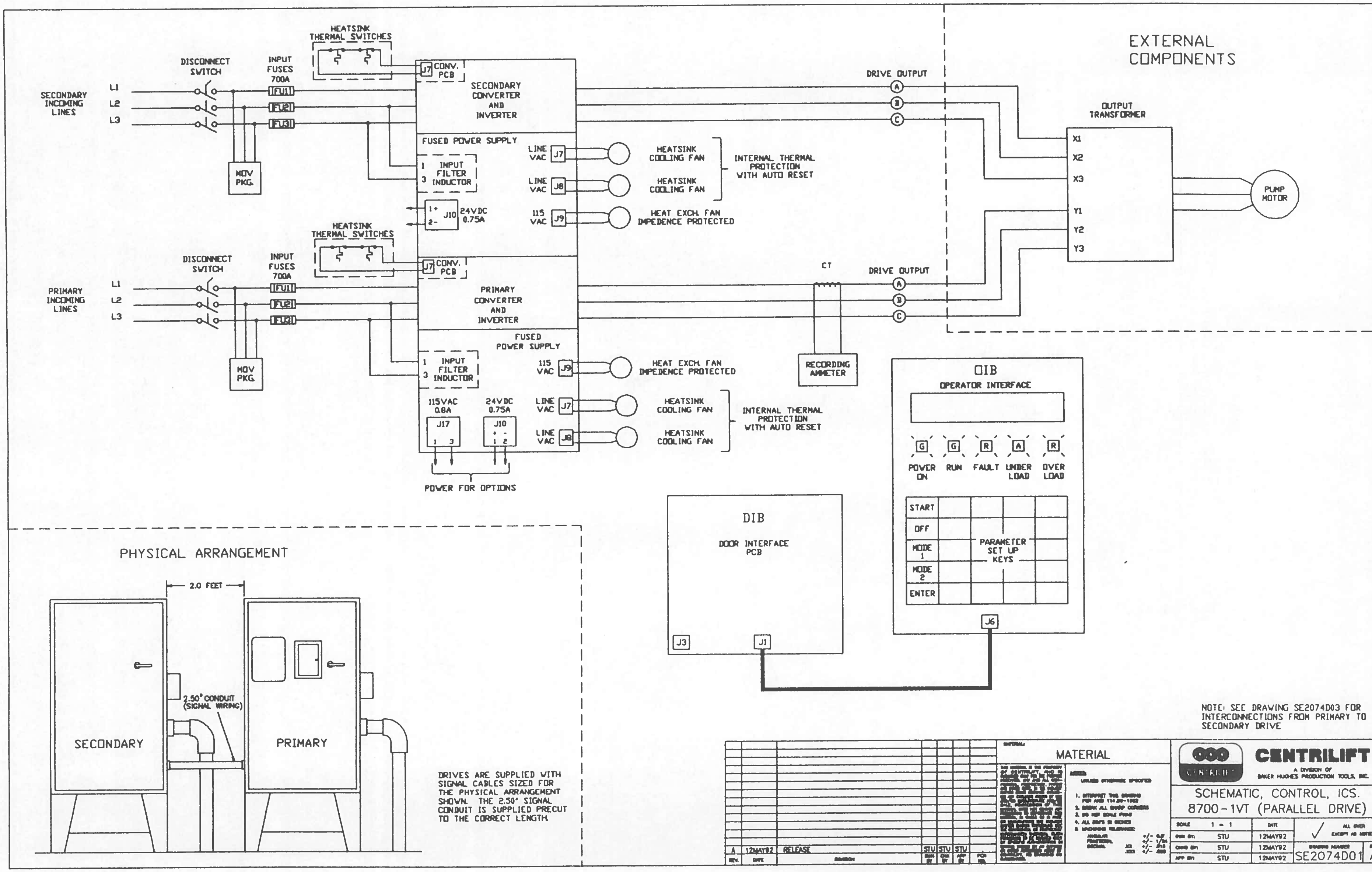
MATERIAL:

NOTES: UNLESS OTHERWISE SPECIFIED

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

SCHEM. CONTROL, VSD
ICS W/ STD. OPTIONS

SCALE	1 = 1	DATE	ALL OVER EXCEPT AS NOTED
DWN BY	STU	30AUG91	
CHK'D BY	DON INMAN	12DEC94	DRAWING NUMBER 56464
APP BY	J.M. LEUTHEN	12DEC94	REV. C



DRIVES ARE SUPPLIED WITH SIGNAL CABLES SIZED FOR THE PHYSICAL ARRANGEMENT SHOWN. THE 2.50" SIGNAL CONDUIT IS SUPPLIED PRECUT TO THE CORRECT LENGTH.

NOTE: SEE DRAWING SE2074D03 FOR INTERCONNECTIONS FROM PRIMARY TO SECONDARY DRIVE

REV.	DATE	REVISION	DWN BY	CHK BY	APP BY	PCN NO.
A	12MAY92	RELEASE	STU	STU	STU	

MATERIAL

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

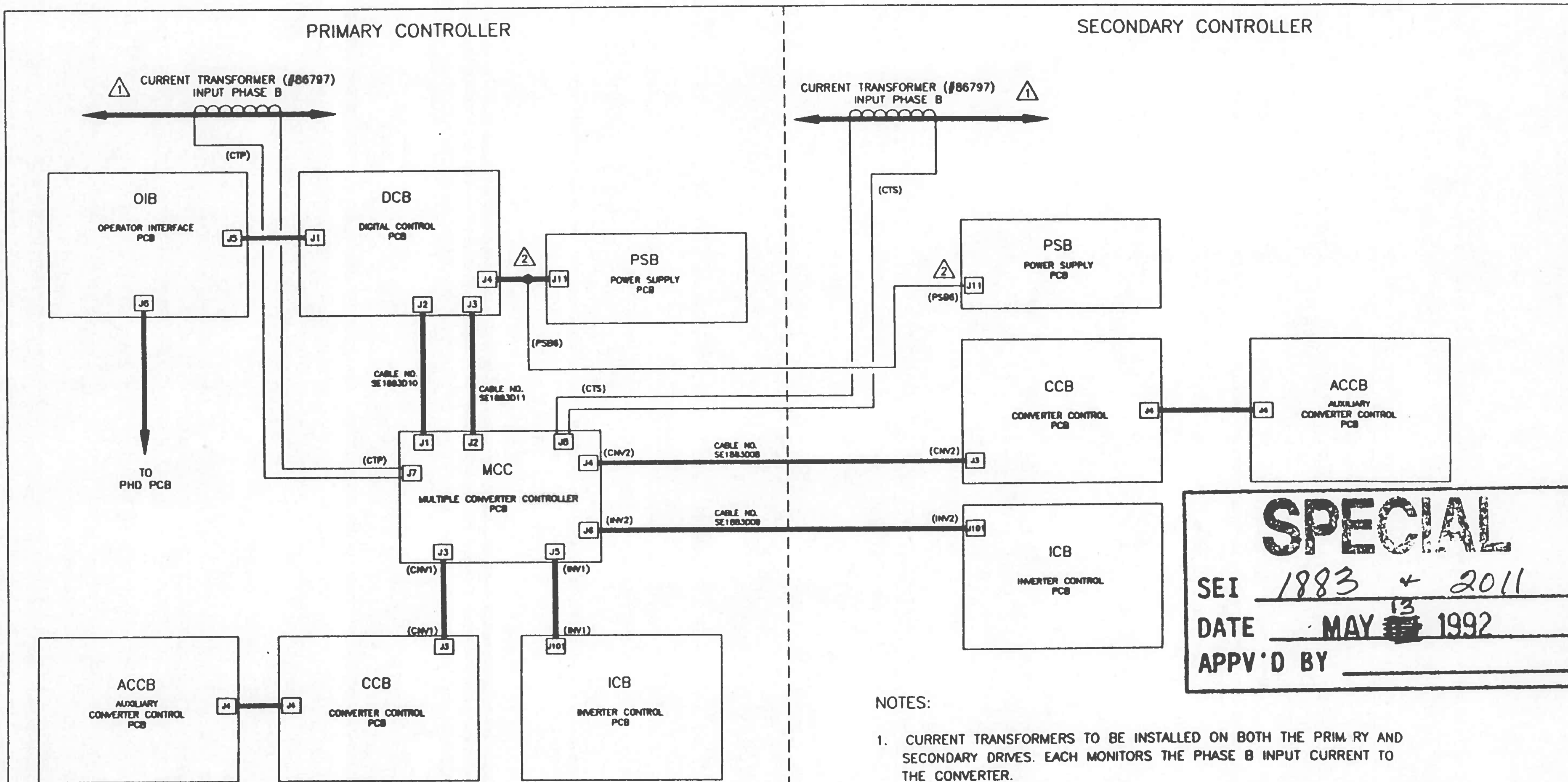
SCHEMATIC, CONTROL, ICS. 8700-1VT (PARALLEL DRIVE)

SCALE	1 = 1	DATE	
DWN BY	STU	12MAY92	ALL OVER EXCEPT AS NOTED
CHKD BY	STU	12MAY92	DRAWING NUMBER
APP BY	STU	12MAY92	SE2074D01 · REV. A

SUPERSEDE

NOTE: TH... SUPERSEDES ALL
OTHE... NUMBER
AND ... ISSUE
DESTROY OUTDATED PRINT.

DATE: MAY 11 1992



SPECIAL

SEI 1883 + 2011

DATE MAY 13 1992

APPV'D BY

NOTES:

1. CURRENT TRANSFORMERS TO BE INSTALLED ON BOTH THE PRIM RY AND SECONDARY DRIVES. EACH MONITORS THE PHASE B INPUT CURRENT TO THE CONVERTER.

2. LINE TO SECONDARY DRIVE'S PSB IS FED FROM THE LINK BETWEEN THE PRIMARY DRIVE'S DCB/J4 AND PSB/J11-PIN 6. ONLY THE PIN 6 FEED IS NEEDED.

D	11MAY92	CHANGED NOTE 1 TO SHOW "PHASE B"	MIK	MIK	MIK	N/A
C	8MAY92	MCC J4 AND J6 INTERCHANGED	STU	STU	STU	N/A
		CONFORM TO STANDARD PRACTICES.	MIK	MIK	MIK	N/A
B	23APR92	CHANGED WIRE LABEL NUMBERS TO				
A	10MAR92	RELEASED.	MIK	MIK	MIK	PDS

CENTRILIFT
A DIVISION OF BAKER HUGHES PRODUCTION TOOLS, INC.

INTERCONNECTIONS, PARALLEL ICS CONTROLLER. SAYYALA FIELD PROJ PETROLEUM DEVELOPMENT OMAN

SCALE 1 = 1

SE1883D05 D

ICS PCB REVISION LEVEL

FEB. 3,1992

47323	OPERATOR INTERFACE BOARD	REV. A
47371	DIGITAL CONTROL BOARD	REV. C
89856	INVERTER CONTROL BOARD	REV. C
47189	CUSTOMER INTERFACE BOARD	REV. A
47206	CONVERTER CONTROL BOARD	REV. B
47370	POWER SUPPLY BOARD	REV. C
47210	AUX CONVERTER BOARD	REV. B
90269	DOOR INTERFACE BOARD	REV. A

Electrospeed ICS Start-Up Work Sheet

Customer: ______________________ **Date:** ______________________

Well Number: ______________________ **Drive S/N:** ______________________

1. Motor Voltage: _______ Amps: ______ Cable Size: _______ Length: __________

2. Desired Operating Frequency Minimum: ________ Maximum: ______________

3. Maximum Volts Available (Input Voltage): ____________

4. Secondary Voltage @ Maximum Hertz: =

$$\frac{\text{Motor Voltage \_\_\_\_\_\_ X Max Hz. \_\_\_\_\_\_}}{\text{60 Hz.}} + \text{Cable Drop \_\_\_\_\_\_} = \underset{\text{Item 4}}{\text{\_\_\_\_\_\_}}$$

5. Secondary Voltage Taps Selected: __________

6. Transformer Ratio: =

$$\frac{\text{Secondary Voltage Taps Selected \_\_\_\_\_\_}}{\text{Tranformer Primary} \quad 480} = \underset{\text{Item 6}}{\text{\_\_\_\_\_\_}}$$

7. Secondary Voltage @ 60 Hertz: =

$$\frac{\text{Secondary Voltage @ Max. Hertz } \underset{\text{Item 4}}{\text{\_\_\_\_\_\_}} \text{ X } 60}{\text{Maximum Hertz. \_\_\_\_\_\_}} = \underset{\text{Item 7}}{\text{\_\_\_\_\_\_}}$$

8. Drive Volts @ 60 Hertz: =

$$\frac{\text{Secondary Voltage @ 60 Hertz } \underset{\text{Item 7}}{\text{\_\_\_\_\_\_}}}{\text{Transformer Ratio } \underset{\text{Item 6}}{\text{\_\_\_\_\_\_}}} = \underset{\text{Item 8}}{\text{\_\_\_\_\_\_}}$$

9. Required KVA @ Max Hertz: =

$$\frac{\text{Surface Voltage \_\_\_\_\_\_ X Motor Nameplate Amps \_\_\_\_\_\_ X } 1.732}{1000} = \text{\_\_\_\_\_\_}$$

10. Controller sizing: = Motor Name Plate Amps X Transformer Ratio = __________

(select a drive Model with a continuous current rating => than this calculation). Refer to table 2.1, page 10).

11. V- Clamp: =

$$\frac{\text{Drive Volts @ 60 Hertz } \underset{\text{Item 8}}{\text{\_\_\_\_\_\_}}}{60} \text{ X Max Hz} = \text{\_\_\_\_\_\_}$$

Figure 5.2 Start-Up Work Sheet ICS Controller

Electrospeed Start-Up Work Sheet

Primary Power 380 Volts 50 Hz
Stepup transformer 480 Volt Primary

480

Customer: ______________________ **Date:** ______________

Well Number: ______________________ **Drive S/N:** ______________

1. Motor Voltage: ______ Amps: ______ Cable Size: ______ Length: ______

2. Desired Operating Frequency Minimum: ______ Maximum: ______

3. Maximum Volts Available (Input Voltage): ______

4. Surface Voltage @ Maximum Hertz **:**

$$\frac{\text{Name Plate Motor Voltage \_\_\_\_\_ X Max Hz. \_\_\_\_\_}}{\text{Name Plate Hz : } \mathbf{60} \text{ or } \mathbf{50}} + \text{Cable Drop \_\_\_\_\_} = \_\_\_\_\_$$

5. Surface Voltage corrected for 480 step-up Volt Transformer **:**

Surface Voltage @ Maximum Hz X 1.263 = ______

Use line 5, Select xfmr tap for voltage = to or higher.

6. Transformer Voltage Selected **:** ______

7. Transformer Ratio **:**

$$\frac{\text{Transformer Voltage Selected \_\_\_\_\_}}{\text{Tranformer Primary Volts } \mathbf{480}} = \_\_\_\_\_$$

8. Secondary Voltage @ 60 Hertz **:**

$$\frac{\textbf{(Line 4)} \text{ Secondary Voltage @ Max. Hertz \_\_\_\_\_ X 60}}{\text{Maximum Hertz. \_\_\_\_\_}} = \_\_\_\_\_$$

9. Required 60 Hertz Voltage **:**

$$\frac{\textbf{(line 8)} \text{ Secondary Voltage @ 60 Hertz \_\_\_\_\_}}{\text{Transformer Ratio \_\_\_\_\_}} = \_\_\_\_\_$$

10. Required KVA @ Max Hertz:

$$\frac{\text{Surface Voltage \_\_\_\_\_ X Motor Nameplate Amps \_\_\_\_\_ X 1.73}}{\textbf{(Line 4)} \quad 1000} = \_\_\_\_\_$$

Start-Up Work Sheet Electrospeed Controller

Electrospeed Start-Up Work Sheet

Primary Power 380 Volts 50 Hz

Stepup transformer 380 Volt Primary

380

Customer: ______________________ **Date:** ______________

Well Number: ______________________ **Drive S/N:** ______________

1. Motor Voltage: ______ Amps: _____ Cable Size: ______ Length: ________
2. Desired Operating Frequency Minimum: ______ Maximum: ________
3. Maximum Volts Available (Input Voltage): __________

4. Surface Voltage @ Maximum Hertz:

$$\frac{\text{Motor Voltage \_\_\_\_\_\_ X Max Hz. \_\_\_\_\_\_}}{\text{50 Hz.}} + \text{Cable Drop \_\_\_\_\_\_} = \text{\_\_\_\_\_\_}$$

Use line 4, Select xfmr tap for voltage = to or higher.

5. Transformer Voltage Selected: ______________

6. Transformer Ratio:

$$\frac{\text{Transformer Voltage Selected \_\_\_\_\_\_}}{\text{Tranformer Primary Volts } \mathbf{380}} = \text{\_\_\_\_\_\_}$$

7. Secondary Voltage @ 50 Hertz:

$$\frac{\text{(Line 4) Secondary Voltage @ Max. Hertz \_\_\_\_\_\_ X 50}}{\text{Maximum Hertz. \_\_\_\_\_\_}} = \text{\_\_\_\_\_\_}$$

8. Required 60 Hertz Voltage:

$$\frac{\text{(line 7) Secondary Voltage @ 50 Hertz \_\_\_\_\_\_}}{\text{Transformer Ratio \_\_\_\_\_\_}} \text{ X 1.2} = \text{\_\_\_\_\_\_}$$

9. Required KVA @ Max Hertz:

$$\frac{\text{Surface Voltage \_\_\_\_\_\_ X Motor Nameplate Amps \_\_\_\_\_\_ X 1.73}}{\text{(Line 4) } \quad 1000} = \text{\_\_\_\_\_\_}$$

Start-Up Work Sheet Electrospeed Controller

CENTRILIFT

A Baker Hughes company

AREA No____________ REPORT DST No____________

STARTUP___ SERVICE___ RESTART___

CUSTOMER______________________ (PROVIDENCE) COUNTY________________ (COUNTRY) STATE__________

Facility/Field____________ Unit/Lease____________ No______ CITY__________

EQUIPMENT

VSC Sn___________ Model___________ Amps_____ KVA_____ Program________

Motor Mfg____________ Volts_________ Amps______ Hp______ Serv fact_____

Cable Size_____ Ft_________ Volts/ft____ Temp Factr_____ Cable Drop______

Pump Mfg___________ Model_________ Series_______ Stages______ Type______

Intake (Rotary. Rev-flow. Std.) Min Hz____ BPD______ Max Hz____ BPD______

Check valve_____JAP Setting Depth________ft Bottom Hole Temp._____F deg.

Xfrm SN _________ Voltage________ Ratio_____ TAPs 1_____.2_____ Conn D Y

Drive **INPUT** volts **UNLOADED**
a/b______ a/c______ b/c______

Drive **INPUT** volts to **GND**
a______ b______ c______

Drive **INPUT** volts **LOADED**
a/b______ a/c______ b/c______

Drive **INPUT** amps
@Hz_____ a)______ b)______ c)______
@Hz_____ a)______ b)______ c)______

MOTOR & CABLE ohms **PHASE** to **PHASE**
a/b______ a/c______ b/c______

Drive **OUTPUT** volts
@Hz_____ a/b_____ a/c_____ b/c_____
@Hz_____ a/b_____ a/c_____ b/c_____

Drive **OUTPUT** amps
@Hz_____ a)______ b)______ c)______
@Hz_____ a)______ b)______ c)______

DOWN HOLE motor **AMPS**
@Hz_____ a)______ b)______ c)______
@Hz_____ a)______ b)______ c)______

Surface **VOLTS** Phase to **GND**
a)________ b)________ c)________

MOTOR & CABLE ohms **PHASE** to **GND**
a________ b________ c________

SETUP OR OPERATING PARAMETERS

____ OVERLOAD AMPS	____ 60 HZ VOLTS	____ **SYNCH DELAY**	____ **LO SPD CLMP**
____ OVERLOAD TIME	____ **START FREQ**	____ **HI SPD CLMP**	____ V BOOST
____ I LIMIT	____ V BOOST SYNC	____ ACCEL TIME	____ REG GAIN %
____ I LIMIT SYNC	____ **V CLAMP**	____ DECEL TIME	____ SLIP COMP %
____ FLT RESTARTS	____ AMPS UL SET	____ CONTRL SET PT	____ PROGRAM REV
____ MIN RESTART FLT	____ **MIN RESTART**	____ JOG FREQUENCY	____ **SF RATE**
____ MIN FLT RESET	____ UL RESTARTS	____ FREQNCY AVOID	____ **SN SEC**
____ **SET SPEED(Hz)**	____ **SEC UL TRIP**	____ ROTATION OUT	____ **I-DC (10)**
____ **RUN SPEED(Hz)**	____ MODE	____ CONTROL SIG	____ **I-LIMIT (7)**

REASON FOR SERVICE CODE (circle one) ->

1 COLD WEATHER	2 CUSTOMER DAMAGED	3 CUSTOMER INEXPE.	4 DOWN HOLE CABLE
5 DOWN HOLE EQUIPMENT	6 DRIVE MOVED	7 ENGINEERING PROBLEM	8 LIGHTNING
9 LINE SLAP	10 MANUFACTURING PROBLEM	11 WRONG COMPONENT	12 CHANGED SETTINGS
13 UNKNOWN REASON	14 OIL CONTAMINATED	15 OVER HEATED	16 POWER GRID BUMP OR SAG
17 POWER OR PHASE LOSS	18 REVERSE ROTATION	19 SAFETY MODIFICATION	20 SERVICEMAN INEXPE.
21 SHIPPING DAMAGE	22 SIZED WRONG	23 TAMPERED WITH	24 WATER IN DRIVE
25 BAD INPUT XFORMER	26 BAD OUTPUT XFORMER	27 NEW STARTUP	28 RESTART
29 SURFACE CABLE BAD	30 COMPONERNT FAILURE	31 FIELD MODIFICATION	32 WORK DELAY/CONTINUE
33 PC BOARD FAILURE	34 ADVERSE WELL COND.	35 OTHER CUSTOMER EQUIP	36 CUST. REQ. CONSUL.
37 LOOSE CONNECTION	38 FAN/PUMP MOTOR FAILED	39 NO PROBLEM FOUND	40 INTERMITTENT

Comments ____

Job START Date____________ **Completed Date**____________ **Serviced by**____________

CEN-1078

v/hz calculations

DATE__________ DST No____________

1) Find: **Secondary volts** @ max Hz
Use: motor volts__________ x max Hz______ / 60 + cable drop________ = ___________volts

2) Avail. Xfmr volts = _________ Taps________ & ________ (if max Hz can't be obtained) use next highest tap

3) Find: **Xfmr Ratio**
Use: (line 2) avail. Xfmr volts___________ / 480 = ___________

4) Find: **Secondary volts *@ 60 Hz***
Use: (line 1) Secondary **volts** @ Max Hz__________ x 60 / max Hz_______ = __________volts

5) Find: **Required vsc output volts *@ 60 Hz***
Use: (line4) Secondary **volts** @ 60 Hz__________ / (line 3) Xfmr ratio________ = __________volts

6 Find: **Available *vsc* Amps**
Use: vsc nameplate output amps________ / (line 3) Xfmr ratio________ = ________Amps

DRIVE HISTORY

COMMENTS and or ANALOG SETTINGS

TIME	DATE	EVENT No	EVENT NAME	

CUSTOMER______________ FIELD____________ WELL___________ SERVICE MAN______________

FUSE KITS

SERIES		321/121	322/122	323/123	324/124	345/145	346/146	347/147	348/148
MODEL		FI-2060	FI-2125	FI-2200	FI-2250	FI-4300	FI-4350	FI-4400	FI-4500
PART NO.		49181	49182	49183	49184	49185	49186	49187	49188
48106	FUSE, 5A	4	4	4	4	4	4	4	4
48107	FUSE, 1A	4	4	4	4	4	4	4	4
48108	FUSE, 1.6A	4	4	4	4	4	4	4	4
48109	FUSE, 4A	14	14	14	14	14	14	14	14
85572	FUSE, 100A	9							
86808	FUSE, 600A						9		
86809	FUSE, 800A								9
88895	FUSE, 200A		9						
88896	FUSE, 300A			9					
88897	FUSE, 400A				9				
88898	FUSE, 500A					9			
88899	FUSE, 700A							9	

ICS SPARE PARTS KITS

POWER KITS

SERIES MODEL PART NO.		321/121 PI-2060 49191	322/122 PI-2125 49192	323/123 PI-2200 49193	324/124 PI-2250 49194	345/145 PI-4300 49195	346/146 PI-4350 49196	347/147 PI-4400 49197	348/148 PI-4500 49198
85332	MDL, TRANSISTOR	1	2	3	4	5	6	7	8
88126	CMPD, THERMAL	1	1	1	1	1	1	1	1
88465	MDL, SCR, 250A				1	2	2	2	2
88565	MDL, SCR, 160A	1	1	1					
89087	MDL, DIODE, 95A	1	1	1	1				
89089	MDL, DIODE, 260A					1	1	1	1
49189	HDWR, PWR	1	1	1	1	1	1	1	1

HARDWARE		EA. KIT
47843	STDF, 8-32X1"	6
85002	WASHER, FLAT, 1/4"	6
85007	WASHER, LOCK, 1/4"	6
85011	WASHER, PLAIN, 5/16"	6
85017	WASHER, STAR, #8	6
85038	WASHER, LOCK, 5/16"	6
85294	SCREW 8-32X3/8"	6
85299	SCREW, 1/4"-20X1/2"	6
86332	SCREW, 8-32X5/8"	6
88469	SCREW, M6-1X20MM	6
88470	SCREW, 6MM-3X12MM	6
88818	SCREW, 8-32-1/4"	6
89116	STDF, 1/4" HEX	6

LOGIC KITS

SERIES MODEL PART NO.		ALL LI-4500 49190
47371	PCB, DCB	1
47323	PCB, OPERATOR INT.	1
89856	PCB, INVERTER	1
47206	PCB, CONVERTER	1

CENTRILIFT
A Baker Hughes company

3/15/95

ICS - ELECTROSPEED CIRCUIT BOARDS

DESCRIPTION		S/A	S/A BOXED	SCHEM	ENGRG SPEC
Customer Interface Board	CIB	47189	49896	47583	239
Converter Control Board	CON	47206	49897	47212	240
Auxiliary Converter Board	ACN	47210	49898	47213	241
Operator Interface Board	OIB	47323	49899	47584	242
PHD Sig. Cond. Board	PHD	47337	49900	47338	243
Power Supply Board	PSB	47370	49901	47984	244
Power Supply Board, 8000	PS8	50560	-----	50558	---
Digital Control Board	DCB	47371	49902	47272	245
Auxiliary Relay Board	ARB	47462	49903	47465	246
Analog Input Board	AIB	48104	49904	48119	249
Analog Output Board	AOB	52140	52143	52142	
Inverter Control Board	INV	89856	49905	89872	247
Door Interface Board	DIB	90269	49906	47320	248
Multi-Converter Control Board	MCC	48868	50897	49092	---
Keypad S/A (replaces 48127)	KPA	55527			
Cable Ribbon, Keypad, 9 Cond.	RC9	55524			
Cable Ribbon, Keypad, 6 Cond.	RC6	55523			
Keypad (Only)	KPO	55522			
Basic Power Dwg. 2000/4000				48410	

ICS - VSC SIMULATOR CIRCUIT BOARDS

DESCRIPTION		S/A	BLANK BOARD	SCHEM	ENGRG SPEC
Test Interface Board	TIB	49127	49126	49460	282
DIB Test Adapter Bd.	DTA	47540	47539	49179	n/a
CIB Test Adapter Bd.	CTA	47542	47541	49180	n/a
Connector Adapter Bd.	CAB	49380	49381	49382	n/a
ICS, VSC SIMULATOR (TEST SET)		49514	-----	-----	283

CIRCUIT BOARD SPECIFICATIONS

FABRICATION OF PRINTED WIRING BOARDS..........CES-118
ENHANCED RELIABILITY INTEGRATED CIRCUITS.......ES-212
APPROVED VENDOR PART NUMBERS..................ES-256