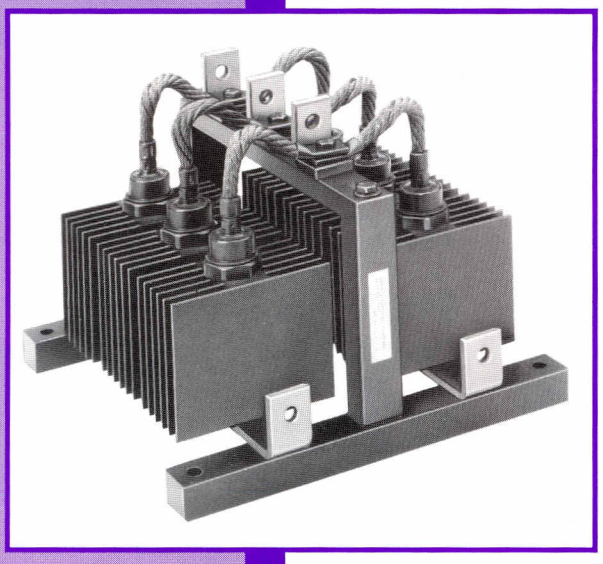
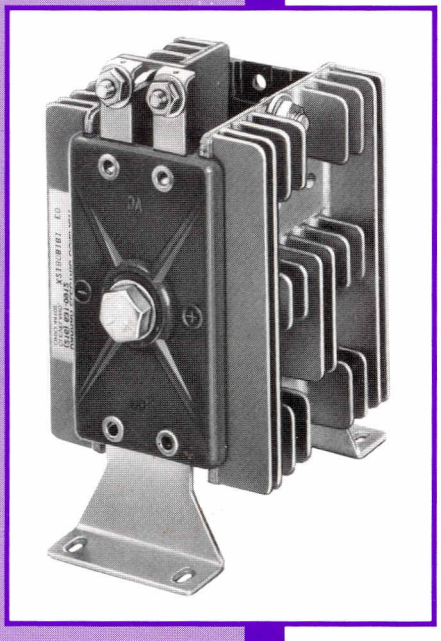
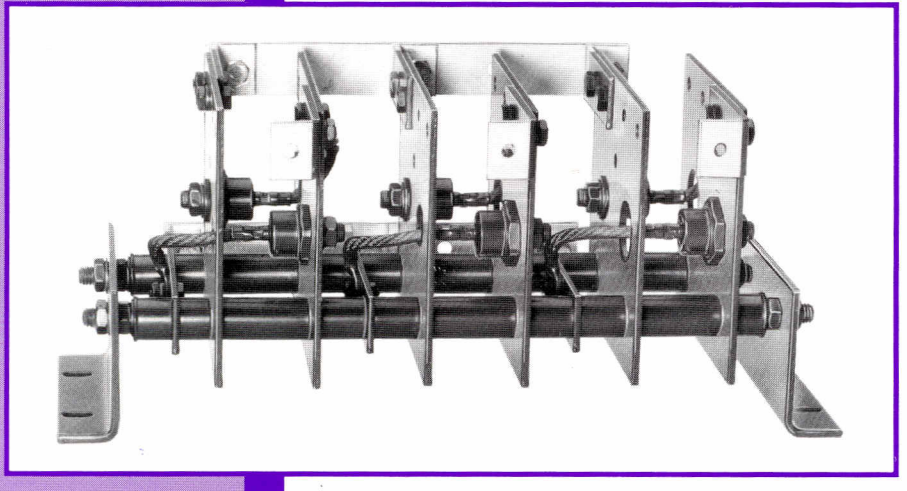
Bulletin 7304



DARRAH



Single and Three Phase Rectifier Circuits



DEC

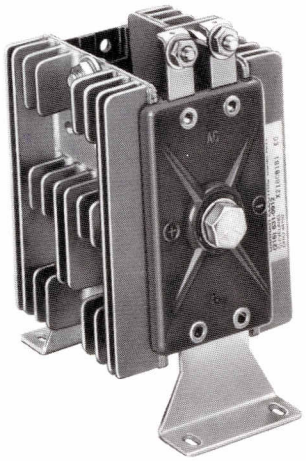
Medium Power Air Cooled Designs

Darrah Electric Company

DARRAH ELECTRIC COMPANY was established in 1960 to serve the power semiconductor market in the U.S. and overseas. From the beginning, customers found that they could depend on DARRAH to have quality products when they need them. They also found fairness in pricing, dedication to service, and an exceptional ability for innovation and design.

Today, we manufacture custom built DC power supplies up to 400 KW output. Cooling methods include air, water and oil. In addition, we are a stocking distributor for worldwide power semiconductor manufacturers. We stock over $3,000,000 in power semiconductors, and are capable of responding to and solving problems overnight.

We have state-of-the-art in-house computer assisted design, engineering, assembly and testing capabilities. Our value added inventory, supplies thousands of finished rectifier and SCR assemblies per year to customers worldwide.



RECTIPOINT SERIES

Single and Three Phase Rectifier Bridges

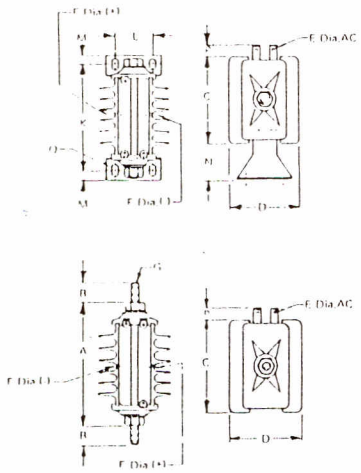
- Complete bridge with heat sinks no assembly required
- Available in single or three phase bridge assemblies
- Available with bracket or bolt mounting
- Can be supplied with either DO-4 or DO-5 rectifiers
- Blocking voltages to 1600V

CODE NUMBER IDENTIFICATION

Y	21	20	B	1	N	1	–S
Size of Heat Sink	Type of Diode	Peak Reverse Voltage	Type of Circuit	No. of Diodes in Series	Type of Mounting	No. of Diodes in Parallel	Special Features
X-3″ × 4″	20	20-200	B-1 Phase Bridge	1	N-Stud	1	S-Surge
Y-2½″ × 2¾″	21	30-300 100-1000	Z-3 Phase Bridge		B-Brackets		Suppressor
	34	40-400 120-1200					Furnished
	37	60-600 160-1600					
		80-800					

CHOOSE YOUR CIRCUIT

This bulletin describes Darrah's standard Stud Type Rectifier Circuits. Choose from either single or three phase in a variety of circuit configurations. Please remember that we custom build stack assemblies to meet your specific needs. If you have a question or concern on any part or application we strongly recommend and welcome your call. We're confident you'll find our in-house engineering staff knowledgeable and helpful. No minimum order required, and no setup charges.



Catalog Number	Type of Circuit	Rated Continuous D-C Amperes at 400°C Maximum Ambient Temperature: Natural Convection	Rated Continuous D-C Amperes at 400°C Maximum Ambient Temperature: Forced Air at 800 LFM
Y20-B1-1	1 Phase	10	20
Y21-B1-1	Bridge	14	28
Y20-Z1-1	3 Phase	12	36
Y21-Z1-1	Bridge	22	66
X20-B1-1	1 Phase	15	30
X21-B1-1	Bridge	25	50
X34-B1-1		35	70
X37-B1-1		43	86
X20-Z1-1	3 Phase	18	54
X21-Z1-1	Bridge	28	84
X34-Z1-1		35	105
X37-Z1-1		43	130

ELECTRICAL SPECIFICATIONS

Current range: 10 to 43 amperes (86 amperes with forced air cooling of 800 LFM) in single phase bridge 12 to 43 amperes (130 amperes with forced air of 800 LFM) in three-phase bridge. Input voltage: up to 460 volts RMS. Ambient temperature range: –65° to +150°C. Operating frequency: up to 10,000 Hz.

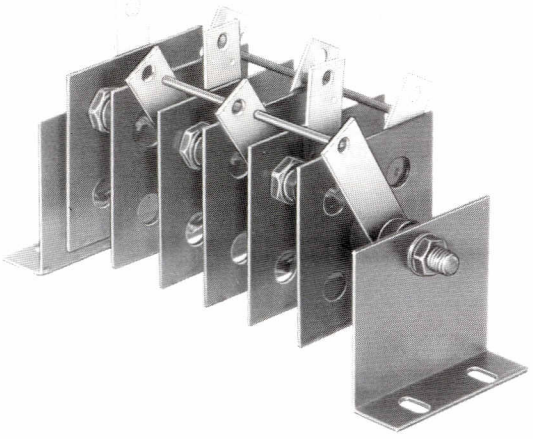
MATERIAL SPECIFICATIONS

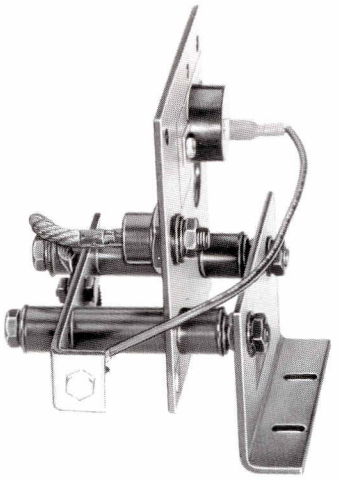
The finned heat sinks are corrosion resistant aluminum alloy. The end plates are molded from glass filled polyester resin. This material is non-flammable and self-extinguishing and shows no heat distortion at 200°C. It has a tensile strength of approximately 8000 lbs. per square inch and a dielectric strength in excess of 300 volts per mil.

X TYPE	
Dimension	Inches
A	4.31
B	0.625
C	4.0
D	3.12
E	0.201
F	0.265
G	3/8-16UNC-3A
K	3.93
L	1.5
M	0.281
N	0.875
P	0.625
Q	3/16 × 5/16

Y TYPE	
Dimension	Inches
A	4.0
B	0.5
C	2.5
D	2.56
E	1.77
F	0.198
G	5/16-18UNC-3A
K	3.75
L	1.25
M	0.281
N	0.937
P	0.625
Q	3/16 × 5/16

PLATE HEAT SINK DESIGNS





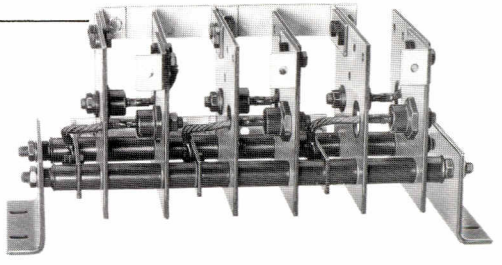
- Complete bridge with heat sinks — no assembly required
- Available in many types of circuit configurations
- Incorporating a variety of heat sink sizes
- Characterized for natural convection or forced air cooling
- Designs include DO-4, DO-5, DO-8 and DO-9 diodes
- Blocking voltages to 1600V

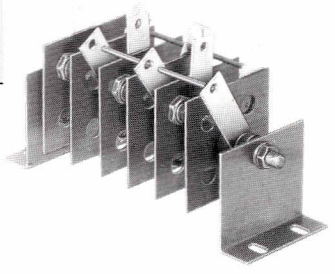
SILICON POWER RECTIFIER ASSEMBLY CODING SYSTEM

K	34	20	B	I	E	B	I	S
Size of Heat Sink	**Type of Diode**	**Peak Reverse Voltage**	**Type of Circuit**	**No. of Diodes in Series**	**Type of Finish**	**Type of Mounting**	**No. of Diodes in Parallel**	**Special Features**
E–2″ x 2″	20 Series	10-100	***Single Phase***	Per leg	E–Commercial	B–Stud with brackets or insulating board with mounting bracket	Per leg	Surge Suppressor
K–3″ x 3″	21 Series	20-200	H-Half Wave		T–High humidity salt spray	N–Stud with no bracket		
G–5″ x 5″	34 Series	30-300	C–Center Tap Positive		F–Fungicide	BC–Bolt mounting with one bracket		
N–7″ x 7″	37 Series	40-400	N–Center Tap Negative					
	43 Series	60-600	D–Doubler					
	504 Series	80-800	B–Bridge					
		100-1000	M–Open Bridge					
		120-1200						
		160-1600	***Three Phase***					
			Z–Bridge					
			X–Center Tap					
			Y–Half Wave DC Positive					
			Q–Half Wave DC Negative					
			W–Double Wye					
			V–Open Bridge					

SPECIFICATIONS FOR SILICON RECTIFIERS USED IN DARRAH'S ASSEMBLIES

Type of Diode	Package Outline	I_F(AV) Amps	I_{FSM} Amps
20 Series	DO-4	16	200
21 Series	DO-4	22	250
34 Series	DO-5	45	700
37 Series	DO-5	85	1500
43 Series	DO-8	150	2500
504 Series	DO-9	300	5000





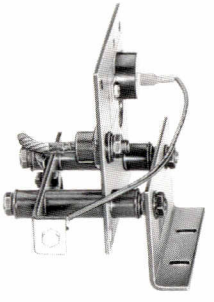


PLATE HEAT SINK DESIGNS

2″ × 2″ E • 3″ × 3″ K
Series 20 & 21 Diodes

DIODE SERIES 20 • HEAT SINK SIZE 2 x 2 x 1/16 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	5.8	11.6	11.6	17.4	17.4	28.4
70	4.5	9.0	9.0	13.5	13.5	22.0
100	3.2	6.4	6.4	9.6	9.6	15.6

DIODE SERIES 20 • HEAT SINK SIZE 3 x 3 x 1/16 INCHES

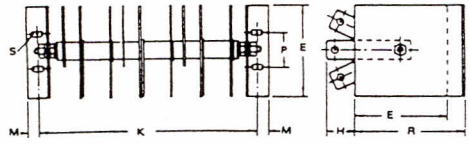
Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	8.2	16.4	16.4	24.6	24.6	40.0
70	6.6	13.2	13.2	19.8	19.8	32.3
100	4.7	9.4	9.4	14.1	14.1	23.0

DIODE SERIES 21 • HEAT SINK SIZE 2 x 2 x 1/16 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	7.8	15.6	15.6	23.4	23.4	38.1
70	6.0	12.0	12.0	18.0	18.0	29.3
100	4.3	8.6	8.6	12.9	12.9	21.0

DIODE SERIES 21 • HEAT SINK SIZE 3 x 3 x 1/16 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	11.0	22.0	22.0	33.0	33.0	53.8
70	8.8	17.6	17.6	26.4	26.4	43.0
100	6.3	12.6	12.6	18.9	18.9	30.8



CIRCUIT	SIZE	DIM.	INCHES MIN.	MAX.
1ø Bridge	2 × 2	K	5.00	5.25
1ø Bridge	3 × 3	K	5.87	6.12
3ø Bridge	2 × 2	K	7.25	7.50
3ø Bridge	3 × 3	K	8.12	8.37
	2 × 2	M	0.30	0.32
Same		P	0.74	0.76
for		E	1.99	2.01
both		R	2.61	2.63
circuits		H	0.86	0.88
		S	0.56 × 0.28 Nom.	
	3 × 3	M	0.36	0.38
Same		P	1.49	1.51
for		E	2.99	3.01
both		R	3.67	3.69
circuits		H	0.99	1.01
		S	0.31 × 0.18 Nom.	

3″ × 3″ K • 5″ × 5″ G
Series 34 & 37 Diodes

DIODE SERIES 34 • HEAT SINK SIZE 3 x 3 x 1/16 INCHES

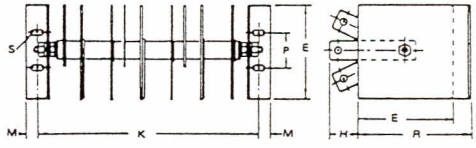
Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	18.0	36.0	36.0	54.0	54.0	88.0
70	14.5	29.0	29.0	43.5	43.5	70.9
100	10.5	21.0	21.0	31.5	31.5	51.3

DIODE SERIES 34 • HEAT SINK SIZE 5 x 5 x 1/16 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	25.5	50.0	50.0	75.0	75.0	122.3
70	20.2	40.4	40.4	60.6	60.6	98.8
100	14.5	29.0	29.0	43.5	43.5	70.9

DIODE SERIES 37 • HEAT SINK SIZE 5 x 5 x 1/16 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1-PHASE 1/2 WAVE	1-PHASE CTR.TAP	1-PHASE BRIDGE	3-PHASE 1/2 WAVE	3-PHASE BRIDGE	3-PHASE CTR.TAP
40	29.3	57.5	57.5	86.3	86.3	140.6
70	23.2	46.5	46.5	69.7	69.5	113.6
100	16.6	33.3	33.3	50.0	50.0	81.5



CIRCUIT	SIZE	DIM.	INCHES MIN.	MAX.
1ø Bridge	3 × 3	K	5.75	6.25
1ø Bridge	5 × 5	K	5.75	6.25
3ø Bridge	3 × 3	K	8.00	8.50
3ø Bridge	5 × 5	K	8.00	8.50
	3 × 3	M	0.36	0.38
Same		P	1.49	1.51
for		E	2.99	3.01
both		R	3.67	3.69
circuits		H	0.99	1.01
		S	0.56 × 0.28 Nom.	
	5 × 5	M	0.36	0.38
Same		P	2.49	2.51
for		E	4.99	5.01
both		R	5.99	6.01
circuits		H	1.24	1.26
		S	0.56 × 0.28 Nom.	

NOTES:

1. Current ratings shown are for natural convection cooling, resistive or inductive loads for single phase circuits and all loads for three phase circuits.
2. Use 2.0 times the above current ratings for forced convection cooling at 1000LFM.
3. For single phase battery, capacitive, or motor loads; the output current shown above should be derated to 80% of the values shown.
4. Assemblies with heat sink sizes other than those shown are available on request for special applications. Refer to silicon power rectifier assembly coding system.

PLATE HEAT SINK DESIGNS

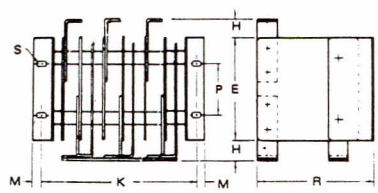
5″ x 5″ G • 7″ x 7″ N
Series 43 Diode

DIODE SERIES 43 • HEAT SINK SIZE 5 x 5 x 1/8 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1/2 WAVE	1-PHASE CTR.TAP	BRIDGE	1/2 WAVE	3-PHASE BRIDGE	CTR.TAP
40	42.0	84.0	84.0	126.0	126.0	205.4
70	32.0	64.0	64.0	96.0	96.5	156.5
100	24.0	48.0	48.0	72.0	72.0	117.4

DIODE SERIES 43 • HEAT SINK SIZE 7 x 7 x 1/8 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1/2 WAVE	1-PHASE CTR.TAP	BRIDGE	1/2 WAVE	3-PHASE BRIDGE	CTR.TAP
40	52.0	104.0	104.0	156.0	156.0	254.3
70	40.0	80.0	80.0	120.0	120.0	195.6
100	28.0	56.0	56.0	84.0	84.0	137.0



CIRCUIT	SIZE	DIM.	INCHES MIN.	MAX.
1ø Bridge	5 x 5	K	9.25	9.75
1ø Bridge	7 x 7	K	9.25	9.75
3ø Bridge	5 x 5	K	13.0	13.5
3ø Bridge	7 x 7	K	13.0	13.5
	5 x 5	M	0.36	0.38
Same		P	2.49	2.51
for		E	4.99	5.01
both		R	5.99	6.01
circuits		H	0.98	1.00
		S	0.56 x 0.28 Nom.	
	7 x 7	M	0.36	0.38
Same		P	3.74	3.76
for		E	6.99	7.01
both		R	7.99	8.01
circuits		H	0.98	1.00
		S	0.56 x 0.28 Nom.	

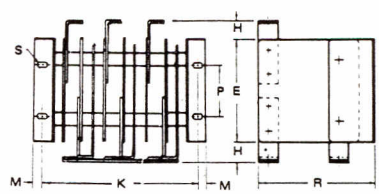
5″ x 5″ G • 7″ x 7″ N
Series 504 Diode

DIODE SERIES 504 • HEAT SINK SIZE 5 x 5 x 1/8 INCHES

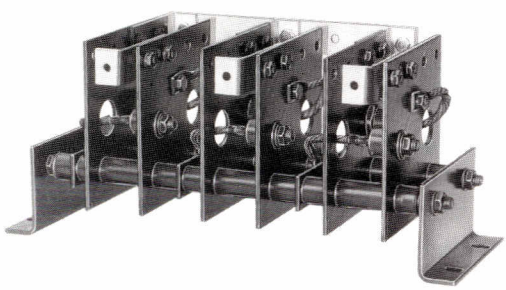
Output Current, Average Amps						
AMBIENT TEMP. °C	1/2 WAVE	1-PHASE CTR.TAP	BRIDGE	1/2 WAVE	3-PHASE BRIDGE	CTR.TAP
40	62.0	124.0	124.0	186.0	186.0	303.0
70	47.0	94.0	94.0	141.0	141.0	230.0
100	33.0	66.0	66.0	99.0	99.0	161.0

DIODE SERIES 504 • HEAT SINK SIZE 7 x 7 x 1/4 INCHES

Output Current, Average Amps						
AMBIENT TEMP. °C	1/2 WAVE	1-PHASE CTR.TAP	BRIDGE	1/2 WAVE	3-PHASE BRIDGE	CTR.TAP
40	81.0	162.0	162.0	243.0	243.0	396.0
70	63.0	126.0	126.0	189.0	189.0	308.0
100	45.0	90.0	90.0	135.0	135.0	220.0



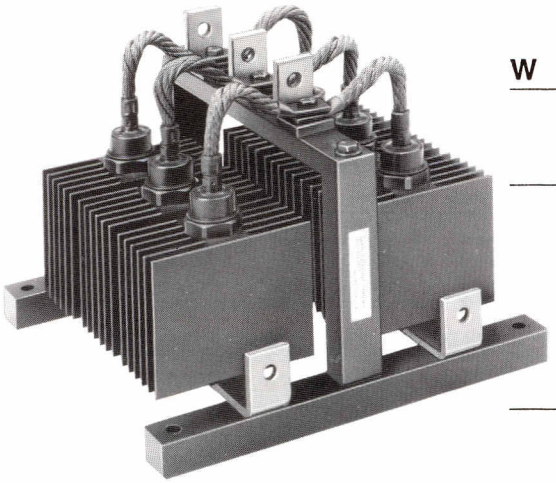
CIRCUIT	SIZE	DIM.	INCHES MIN.	MAX.
1ø Bridge	5 x 5	K	10.5	11.0
1ø Bridge	7 x 7	K	10.5	11.0
3ø Bridge	5 x 5	K	15.0	15.5
3ø Bridge	7 x 7	K	15.0	15.5
	5 x 5	M	0.36	0.38
Same		P	2.49	2.51
for		E	4.99	5.01
both		R	5.99	6.01
circuits		H	0.98	1.00
		S	0.56 x 0.28 Nom.	
	7 x 7	M	0.36	0.38
Same		P	3.74	3.76
for		E	6.99	7.01
both		R	7.99	8.01
circuits		H	0.98	1.00
		S	0.56 x 0.28 Nom.	



NOTES:

1. Current ratings shown are for natural convection cooling, resistive or inductive loads for single phase circuits and all loads for three phase circuits.
2. Use 2.0 times the above current ratings for forced convection cooling at 1000LFM.
3. For single phase battery, capacitive, or motor loads; the output current shown above should be derated to 80% of the values shown.
4. Assemblies with heat sink sizes other than those shown are available on request for special applications. Refer to silicon power rectifier assembly coding system.

EXTRUDED HEAT SINK DESIGN



SILICON RECTIFIER ASSEMBLIES CODING SYSTEM

W	43	20	B	1	1
	Type of Diode	Peak Reverse Voltage	Type of Circuit	No. of Diodes in Series	No. of Diodes in Parallel
	43 Series 504 Series	20 = 200V 30 = 300V 40 = 400V 60 = 600V 80 = 800V 100 = 1000V 120 = 1200V 160 = 1600V	***Single Phase*** B–Bridge ***Three Phase*** Z–Bridge	1 Max.	1 Max.

SINGLE PHASE BRIDGE

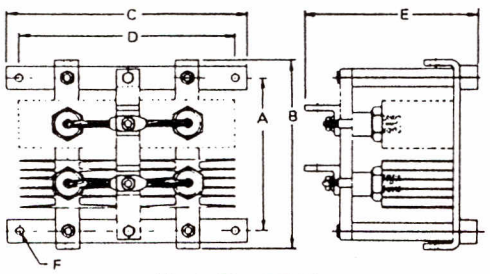
Diode Series	Ambient Temp. °C	40	60
43	Natural Convection	120	110
	Forced Convection*	320	285
504	Natural Convection	200	175
	Forced Convection*	500	450

**At 1000LFM.*

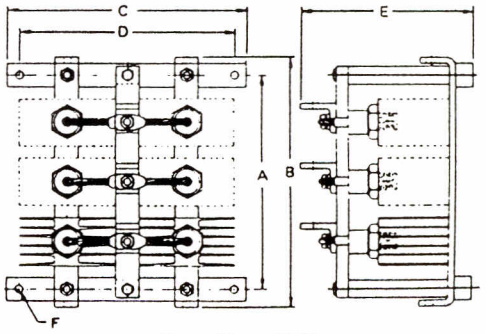
THREE PHASE BRIDGE

Diode Series	Ambient Temp. °C	40	60
43	Natural Convection	170	150
	Forced Convection*	430	380
504	Natural Convection	300	265
	Forced Convection*	750	645

**At 1000LFM.*



Single Phase Bridge



Three Phase Bridge

SINGLE PHASE BRIDGE

DIMENSION	INCHES MINIMUM	INCHES MAXIMUM
A	6.25	6.75
B	7.99	8.01
C	9.99	10.01
D	8.99	9.01
E	7.24	7.26
F	0.34 Dia.	—

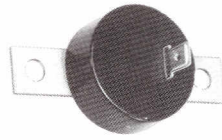
THREE PHASE BRIDGE

DIMENSION	INCHES MINIMUM	INCHES MAXIMUM
A	8.75	9.25
B	9.99	10.01
C	9.99	10.01
D	8.99	9.01
E	7.24	7.26
F	0.34 Dia.	—

ACCESSORIES

METAL OXIDE VARISTOR (MOV)

Have DARRAH mount a Metal Oxide Varistor (MOV) to your assembly to protect your diodes from transient voltage surges. Their clamping efficiency and low steady state power dissipation offer considerable advantages in protecting power semiconductors.



PA Series

DARRAH's MOV's feature high surge current capacity, instantaneous response in a compact and robust package. Selection of the MOV is governed by voltage applied and the diode voltage rating (PIV).

Available in PA or LA Series types.

LA Series

METAL OXIDE VARISTOR (MOV) PA SERIES

DARRAH PART NUMBER	INCOMING LINE VOLTAGE	MINIMUM DIODE VOLTAGE (PIV) (VRRM)
Z320PA40C	220 / 230 / 240	1000
Z480PA80A	380	1200
Z575PA80A	440 / 460 / 480	1500
Z660PA100C	550	1800
Z750PA100A	600	2000

METAL OXIDE VARISTOR (MOV) LA SERIES

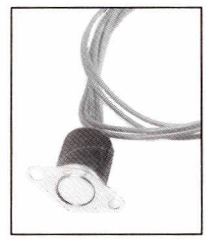
DARRAH PART NUMBER	INCOMING LINE VOLTAGE	MINIMUM DIODE VOLTAGE (PIV) (VRRM)
Z320LA40A	220 / 230 / 240	1000
Z480LA80A	380	1200
Z575LA80A	440 / 460 / 480	1500
Z660LA100B	550	1800
Z660LA100B	600	2000

THERMOSTATS

DARRAH stocks the full line of thermostats commonly found on stack assemblies. Choose from non-encapsulated or encapsulated packages in various temperature ratings.

DARRAH's exclusive encapsulated thermostat is available in 50°C and 70°C, normally closed, and tested for 2000 Volt isolation.

These thermostats are ideal for moist areas.



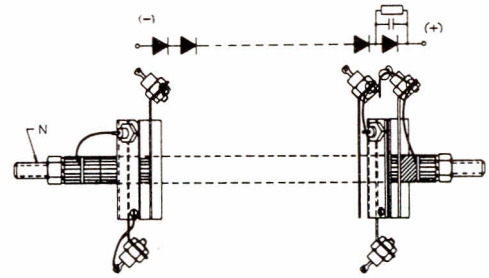
Encapsulated Type

Unencapsulated Type

HIGH VOLTAGE RECTIFIER ASSEMBLIES

Darrah's high voltage rectifier assemblies are series-connected diffused silicon diodes with reverse high voltage blocking and surge suppressor characteristics. They are most commonly used in single and three phase rectifier circuits of 1KV and higher, such as industrial and government installations that demand a higher degree of reliability. These include industrial RF generators, broadcast AM/FM & TV transmitters, electromedical units and other equipment requiring DC voltage supplies. Operating levels may be to 50KV and load currents to 60A convection, forced-air or oil cooling. Other custom combinations of these devices allow voltages and currents to satisfy any known requirements.

Heat sinks are Gold Irridite finish and each diode is R-C compensated. Pilot lights are available as optional.



PORTABLE DIODE AND SCR TESTER

DARRAH's Diode and SCR Tester puts the sophisticated testing capability of high-priced, specialized units into a portable package that is economically priced and easy to use. It includes provisions for checking diodes and SCR's for opens, shorts, leaks, and breakdown under actual operating conditions.

The TESTER is a compact 6 x 12 x 17 inches, weighs 14 pounds, and operates on 120 Volt A.C. current.

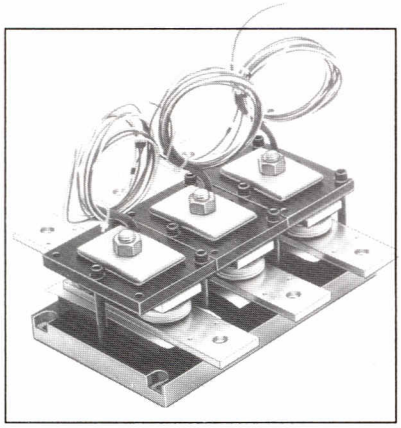
Comes complete with test leads and clamp for checking flat-pack DIODES and SCR's.

DARRAH PART NUMBER	TESTER RATING
X10001	2000 V
X10002	3000 V

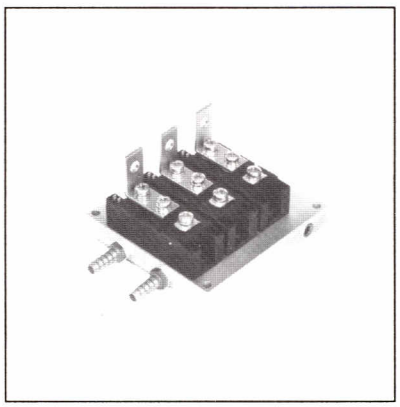
DARRAH's SERVICE CENTER

Darrah operates a complete service and repair facility. In many cases a Darrah engineer or representative can come on-site to service or repair equipment. Assemblies and related equipment can also be shipped to Darrah for maintenance or repair.

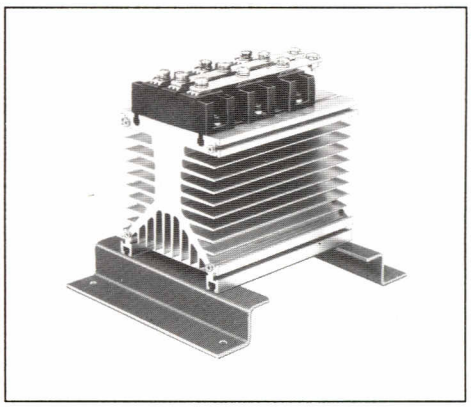
ADDITIONAL DARRAH CAPABILITIES



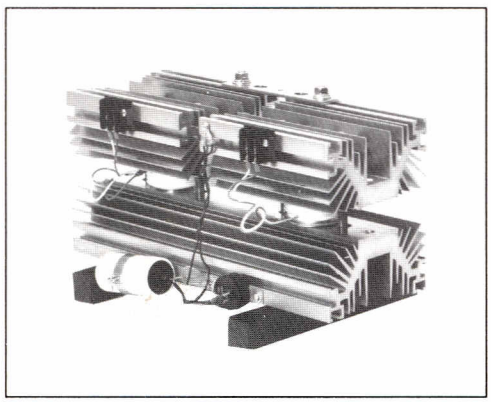
Darrah stocks a complete line of **SCR AC switch** assemblies. These are available in air or water cooled designs with current ratings to 10,000 amps (rms) and voltages to 2600 PIV.



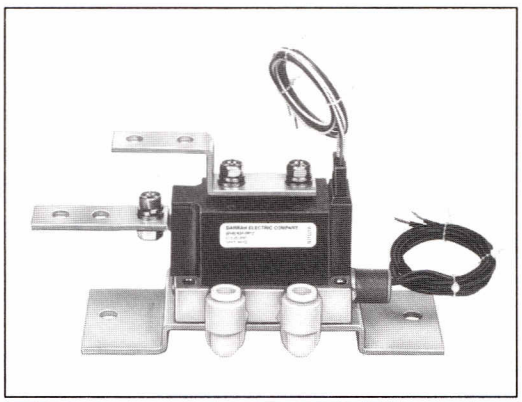
Call Darrah when designing with **liquid cooled Modules**. Choose from a variety of heat sink arrangements in copper or aluminum configurations.



Darrah Electric offers a complete line of **Module** Assemblies for air cooled designs. Circuits include Diodes, SCR's, MOSFETs, IGBTs, and Transistors. Call for our Bulletin #7396 or fax us your design for quotation.



Darrah's line of Hockey Puck **Air Cooled Assemblies** provide you with off the shelf custom designed products including all the features you need. Ask for our "Darrah Gold" bulletin # 7403 for complete details



Custom Assemblies – Send Darrah your drawings or tell us your ideas for made-to-order products to meet your production needs.

Silicon Diodes, SCR's, Transistors, MOSFETs and **Modules** are available from Darrah stock with ratings from 1.5 amps to 4800 amps.

Darrah Electric Company

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