

## Service Parts



## Generator Sets

Models:

**230-300DSED**

See Group 701: Literature, inside this catalog for  
part numbers of engine and accessory parts catalogs

See MP-6009 Parts Catalog Industrial Controllers  
for controller parts

# Table of Contents

|                                                         |    |
|---------------------------------------------------------|----|
| Introduction .....                                      | 3  |
| Numbering System Significance .....                     | 3  |
| Illustrations .....                                     | 3  |
| How to Find Part Numbers .....                          | 3  |
| Hardware References .....                               | 3  |
| Specification Number Index .....                        | 4  |
| Group 101: Air Intake .....                             | 5  |
| Group 104: Cooling System .....                         | 6  |
| Group 105: Engine .....                                 | 8  |
| Routine Engine Service Parts .....                      | 8  |
| Group 107: Nameplate and Decals .....                   | 11 |
| Group 109: Skid and Plant Mounting .....                | 12 |
| Group 201: Generator and Mounting .....                 | 14 |
| Control and Harness .....                               | 18 |
| Group 701: Literature .....                             | 20 |
| Kit List .....                                          | 21 |
| Cooling System Kits .....                               | 22 |
| Appendix A Abbreviations .....                          | 23 |
| Appendix B Common Hardware Application Guidelines ..... | 25 |
| Appendix C General Torque Specifications .....          | 26 |
| Appendix D Common Hardware Identification .....         | 27 |
| Appendix E Common Hardware List .....                   | 28 |
| Index .....                                             | 31 |

# Introduction

This manual lists service replacement parts for 230–300 kW generator sets.

Information in this publication represents data available at the time of print. The manufacturer of DDC/MTU Power Generation products reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

This manual includes the following main sections:

**Table of Contents.** Lists the sections of the manual.

**Introduction (and other information sections).** Contains introductory material about part numbers, illustrations, and hardware.

**Specification Number Index.** Lists the generator set specs and groups.

**Group Parts Lists.** List the part numbers of parts in the groups.

**Kit Sections.** List modules and accessories and their parts.

**Appendices.** Include Abbreviations, Common Hardware Application Guidelines, General Torque Specifications, Common Hardware Identification, and Common Hardware List.

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## Numbering System Significance

This manual uses the following numbering systems:

**Specification Number.** The product identification number located on the generator set nameplate. Spec numbers break down into groups.

**Group Number.** A unique number representing a parts group needed to assemble a generator set function. For example, Group 101 is the Air Intake group.

**Variation or Module Number.** A group might have several variations. Each variation performs the same function with different parts lists. For example, a 50 Hz generator alternator and a 60 Hz generator alternator both perform the same function; however, with different parts. Each difference requires a group variation or module number.

**Part Number.** The part number identifies an individual assembly, subassembly, component, or accessory kit.

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## Illustrations

Illustrations (or exploded-view drawings) best representing the widest range of variations accompany most groups in this manual. Illustrations do not depict all details and may not show all parts. Do not use illustrations for assembly or disassembly.

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## How to Find Part Numbers

Use the following steps to locate a service replacement part.

1. Locate the generator set nameplate to **identify the generator set spec number**.
2. Locate a second generator set nameplate listing accessories to **identify installed modules**. On some models the accessory nameplate is mounted inside the generator junction box.
3. **Turn to the Specification Number Index.** The first column lists the generator set spec numbers. The headings identify the groups of parts that make up the generator set.
4. **Identify the group** most likely to include the service part number.
5. **Find the group variation number** at the intersection of the spec number row and the group column. Note the variation number.
6. **Page forward to locate the group** identified in step 4 or find the appropriate page in the Table of Contents.
7. **Find the part on the illustration** and note the item number of the part or **find the part description in the parts list**.
8. Select **the part number that corresponds to your group variation**. The first column lists the illustration item number. Find the variation identified in the Specification Number Index or the module number found on the generator set nameplate in the appropriate column on the right side of the parts list table. Find the quantity used at the intersection of the item number row and the variation column. A blank space at the intersection means the variation/module does not use that part number.

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## Hardware References

Many common hardware items do not appear in parts manuals or will appear as common hardware entries. A common hardware entry lists the size of the hardware. For example, an item that appears as “Hardware, 3/8-16” in the text means that the piece is 3/8-16 size. Obtain common hardware locally or, if contacting the factory, use the Common Hardware List in the appendix to identify the common hardware part number and specifications. See Common Hardware Application Guidelines in the appendix for mating hardware instructions.

Some hardware items require a specific size or some other characteristic. In that case, use the part number listed in the text.

**When replacing hardware, do not substitute inferior grade hardware.** Replacement hardware grade should be equal to or better than the grade of the manufacturer's original hardware. Use the Common Hardware List in the appendix to identify the common hardware hardness.

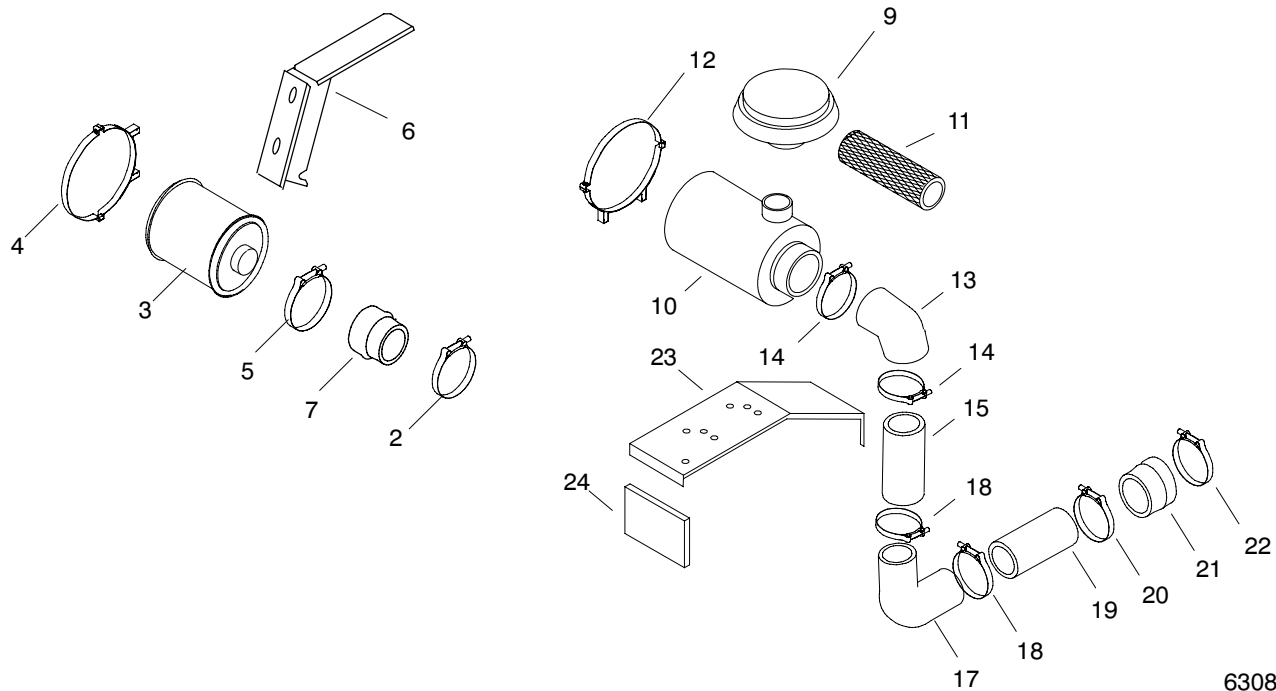
# Specification Number Index

| Group Title | Air Intake       | Cooling System | Engine | Nameplates and Decals | Skid and Plant Mounting | Generator and Mounting | Controller and Mounting | Literature |
|-------------|------------------|----------------|--------|-----------------------|-------------------------|------------------------|-------------------------|------------|
| Group No..  | 101              | 104            | 105    | 107                   | 109                     | 201                    | 301                     | 701        |
| Spec No.    | Variation Number |                |        |                       |                         |                        |                         |            |

|                |   |   |     |      |   |   |   |    |
|----------------|---|---|-----|------|---|---|---|----|
| <b>230DSED</b> |   |   |     |      |   |   |   |    |
| GM41933-GA1S   | * | * | GR1 | GR1S | * | * | † | 82 |
| <b>250DSED</b> |   |   |     |      |   |   |   |    |
| GM41933-GA2S   | * | * | GR1 | GR1S | * | * | † | 84 |
| <b>275DSED</b> |   |   |     |      |   |   |   |    |
| GM41933-GA3S   | * | * | GR2 | GR1S | * | * | † | 86 |
| <b>300DSED</b> |   |   |     |      |   |   |   |    |
| GM41933-GA4S   | * | * | GR3 | GR1S | * | * | † | 88 |

- \* Configured group. Refer to the generator set nameplate for the module number.  
Turn to the respective group on the following pages for parts breakdowns.
- † Configured group. Refer to the generator set nameplate for the module number.  
See parts catalog MP-6009 P/C Controllers for controller parts lists.

# Group 101: Air Intake

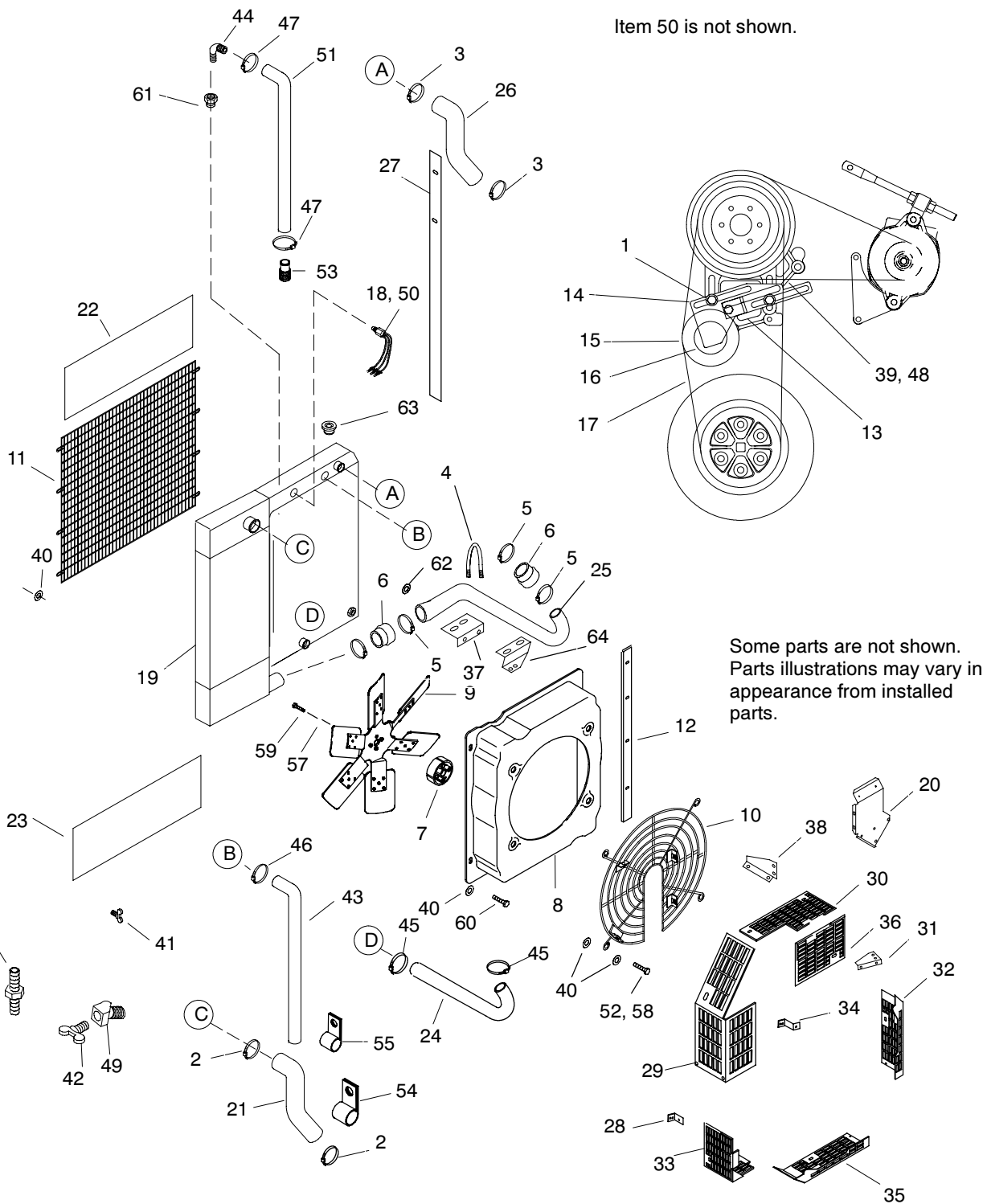


6308\_101

| Item | Part Number | Description                             | Quantity      |             |
|------|-------------|-----------------------------------------|---------------|-------------|
|      |             |                                         | Module Number |             |
|      |             |                                         | GM13281-MA6   | GM38532-MA2 |
| 2    | 254013      | Clamp, hose, 6.25/6.56 in.              | 1             |             |
| 3    | 272982      | Air cleaner, industrial                 | 1             |             |
| 4    | 343530      | Clamp, air cleaner, 11.00 in. ID        | 1             |             |
| 5    | 343587      | Clamp, hose, 7.38/7.69 in.              | 1             |             |
| 6    | 343588      | Bracket, AC support                     | 1             |             |
| 7    | 361847      | Hose, hump reducer, 7.00 to 6.00 in. ID | 1             |             |
| 9    | 272674      | Cap, rain                               |               | 1           |
| 10   | A-279713    | Air cleaner assembly                    |               | 1           |
| 11   | 279736      | Element, air cleaner                    |               | 1           |
| 11   | 279737      | Element, air cleaner (secondary)        |               | 1           |
| 12   | 291666      | Mount, air cleaner/exhaust, 16 in. ID   |               | 2           |
| 13   | 272627      | Hose, 90° elbow, 6 in. ID               |               | 1           |
| 14   | 254013      | Clamp, hose, 6.25/6.56 in.              |               | 2           |
| 15   | 274623      | Tube assembly                           |               | 1           |
| 16   | X-75-4      | Plug, pipe, 1/8 in., NPTF               |               | 1           |
| 17   | 272627      | Hose, 90° elbow, 6 in. ID               |               | 1           |
| 18   | 254013      | Clamp, hose, 6.25/6.56 in.              |               | 1           |
| 19   | X-522-85    | Tube, steel                             |               | 1           |
| 20   | 254013      | Clamp, hose, 6.25/6.56 in.              |               | 1           |
| 21   | 343731      | Hose, straight air, 6 in. ID            |               | 1           |
| 22   | 254013      | Clamp, hose, 6.25/6.56 in.              |               | 1           |
| 23   | 343243      | Bracket, mounting                       |               | 1           |
| 24   | 343172      | Bracket, air cleaner support            |               | 1           |

# Group 104: Cooling System

Item 50 is not shown.

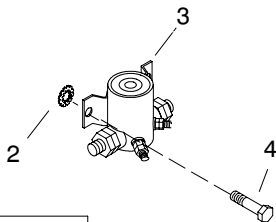


GM13278

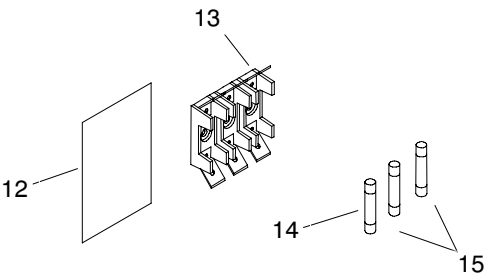
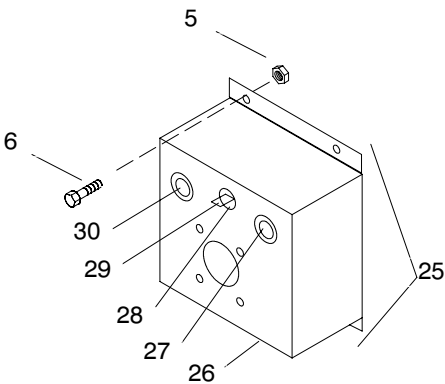
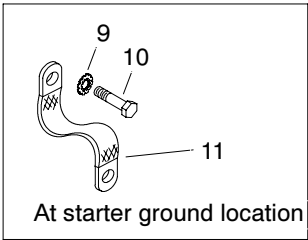
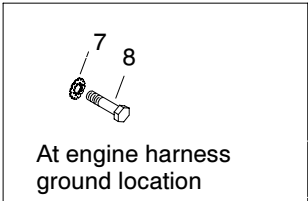
## Group 104: Cooling System, continued

| Item | Part Number | Description                               | Quantity                     |
|------|-------------|-------------------------------------------|------------------------------|
|      |             |                                           | Module Number<br>GM41993-MA1 |
| 1    | 257951      | Washer, special, .562 ID x 1.13 in. OD    | 2                            |
| 2    | 274545      | Clamp, hose, 4.31/4.62 in.                | 2                            |
| 3    | 275527      | Clamp, hose, 2.81/3.12 in.                | 2                            |
| 4    | 289372      | Clamp, muffler, 4.12 in.                  | 2                            |
| 5    | 291590      | Clamp, hose, 4/4.31 in.                   | 4                            |
| 6    | 324473      | Hose, hump, straight, 4 in. ID            | 2                            |
| 7    | 343067      | Spacer, fan, 5.12 in.                     | 1                            |
| 8    | 343176      | Shroud, fan                               | 1                            |
| 9    | GM22971     | Kit, pusher fan                           | 1                            |
| 10   | 343185      | Guard, fan                                | 1                            |
| 11   | 343186      | Guard, radiator                           | 1                            |
| 12   | 343424      | Bracket, fan shroud                       | 2                            |
| 13   | 343619      | Bracket, pulley tensioner                 | 1                            |
| 14   | 343620      | Bracket, pulley tensioner                 | 1                            |
| 15   | 343621      | Pulley, idler                             | 1                            |
| 16   | 343622      | Bushing, idler, 1.938 in. NPT             | 1                            |
| 17   | 343623      | Belt, V, 65.2 in.                         | 3                            |
| 18   | 365289      | Sensor, low fluid                         | 1                            |
| 19   | GM11650     | Radiator                                  | 1                            |
| 19   | GM28454     | Valve, plastic (not shown)                | 1                            |
| 20   | GM12036     | Bracket, charge tube mounting, upper      | 1                            |
| 21   | GM41992     | Hose, charge cooler, upper                | 1                            |
| 22   | GM12038     | Guard, upper radiator                     | 1                            |
| 23   | GM12041     | Guard, lower radiator                     | 1                            |
| 24   | GM12042     | Hose, lower radiator                      | 1                            |
| 25   | GM12043     | Tube, charge cooler                       | 1                            |
| 26   | GM12045     | Hose, upper radiator                      | 1                            |
| 27   | GM12046     | Bracket, upper radiator hose              | 1                            |
| 28   | GM12211     | Bracket, support                          | 1                            |
| 29   | GM12212     | Guard, belt top, LS                       | 1                            |
| 30   | GM12213     | Guard, belt top                           | 1                            |
| 31   | GM12214     | Support, belt guard, top                  | 1                            |
| 32   | GM12215     | Guard, belt, RS                           | 1                            |
| 33   | GM12216     | Guard, belt, LH                           | 1                            |
| 34   | GM12217     | Bracket, belt guard                       | 1                            |
| 35   | GM12218     | Guard, bottom belt                        | 1                            |
| 36   | GM12219     | Guard, rear, LH                           | 1                            |
| 37   | GM13725     | Bracket, charge cooler tube support       | 1                            |
| 38   | GM13807     | Bracket, belt guard                       | 1                            |
| 39   | X-25-44     | Washer, plain, .328 ID x .562 in. OD      | 1                            |
| 40   | X-25-75     | Washer, plain, .344 ID x .875 in. OD      | 26                           |
| 41   | X-256-3     | Valve, drain, 1/4 in. NPT                 | 2                            |
| 42   | X-256-5     | Valve, drain                              | 1                            |
| 43   | X-356-38    | Hose, radiator, straight, 1 in. ID        | 1                            |
| 44   | X-391-1     | Connector, 90°, 1/4 in. ID hose           | 1                            |
| 45   | X-426-2     | Clamp, hose, 2.31/3.25 in.                | 2                            |
| 46   | X-426-8     | Clamp, hose, .81/1.75 in.                 | 2                            |
| 47   | X-426-9     | Clamp, hose, .25/.70 in.                  | 2                            |
| 48   | X-55-46     | Screw, hex socket head machine            | 1                            |
| 49   | X-555-1     | Fitting, elbow, 1/4 x 1/4 in. street      | 1                            |
| 50   | X-6003-120  | Conduit, convoluted (not shown)           | 1                            |
| 51   | X-6359-9    | Hose, rubber, straight, .25 in. ID        | 1                            |
| 52   | X-6365-2    | Insert, threaded, 5/16-18 in. (not shown) | 8                            |
| 53   | X-652-3     | Fitting, hose                             | 1                            |
| 54   | X-672-19    | Clamp, insulated, 3.12 in.                | 1                            |
| 55   | X-672-4     | Clamp, insulated, 1.25 in.                | 1                            |
| 56   | X-751-1     | Adapter, hose, 1 x 1 in.                  | 1                            |
| 57   | X-400-75    | Spacer, .406 ID x .625 OD x .297 in.      | 6                            |
| 58   | X-125-5     | Bolt, hex head                            | 8                            |
| 59   | X-6238-36   | Bolt, hex head                            | 6                            |
| 60   | X-125-3     | Bolt, hex head                            | 8                            |
| 61   | X-202-27    | Bushing, reducer, 1/8 x 1/4 in. NPT       | 1                            |
| 62   | X-400-28    | Spacer, .282 ID x .5 OD x .531 in.        | 2                            |
| 63   | 352327      | Cap, radiator                             | 1                            |
| 64   | GM22996     | Bracket, lower charge cooler tube         | 1                            |

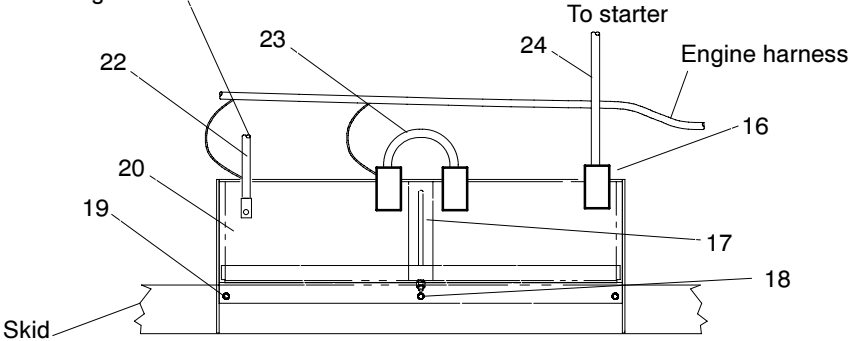
# Group 105: Engine



Item 1 is not shown.



Attach item 22 to engine block using item 21.



Top view of battery rack

## Group 105: Engine

| Item | Part Number     | Description                                       | Quantity         |     |     |
|------|-----------------|---------------------------------------------------|------------------|-----|-----|
|      |                 |                                                   | Variation Number |     |     |
|      |                 |                                                   | GR1              | GR2 | GR3 |
| 1    | GM41901         | Engine assembly (not shown)                       | 1                |     |     |
| 1    | GM41902         | Engine assembly (not shown)                       |                  | 1   |     |
| 1    | GM41903         | Engine assembly (not shown)                       |                  |     | 1   |
| 2    | X-22-12         | Washer, lock, .262 ID x .743 in. OD               | 4                | 4   | 4   |
| 3    | 268371          | Relay                                             | 1                | 1   | 1   |
| 4    | M933-06040-60   | Screw, hex cap                                    | 2                | 2   | 2   |
| 5    | M934-04-50      | Nut, hex, 4 mm                                    | 4                | 4   | 4   |
| 6    | M7985A-04020-20 | Screw, pan head                                   | 4                | 4   | 4   |
| 7    | X-22-16         | Washer, lock, 5/16, interior/exterior tooth       | 1                | 1   | 1   |
| 8    | M933-08016-60   | Screw, hex cap                                    | 1                | 1   | 1   |
| 9    | X-22-14         | Washer, lock, 3/8, interior/exterior tooth        | 1                | 1   | 1   |
| 10   | M933-10020-60   | Screw, hex cap                                    | 1                | 1   | 1   |
| 11   | 266581          | Strap, ground                                     | 1                | 1   | 1   |
| 12   | 343601          | Strip, marker, 3-fuse                             | 1                | 1   | 1   |
| 13   | 292821          | Holder, fuse                                      | 1                | 1   | 1   |
| 13   | M934-03-50      | Nut, hex, 3mm                                     | 4                | 4   | 4   |
| 13   | M7985A-03012-20 | Screw, pan head, M3 x 12                          | 4                | 4   | 4   |
| 14   | 239298          | Fuse, 5 A, 250 V, .25 x 1.25 in.                  | 1                | 1   | 1   |
| 15   | 283645          | Fuse 15 A, 250 V, .25 x 1.25 in.                  | 2                | 2   | 2   |
| 16   | GM20745         | Boot, battery lug                                 | 3                | 3   | 3   |
| 17   | GM13268         | Bolt, angle                                       | 1                | 1   | 1   |
| 18   | M982-08-80      | Nut, hex elastic stop                             | 1                | 1   | 1   |
| 19   | 343221          | Clamp, battery                                    | 1                | 1   | 1   |
| 20   | 343220          | Rack, battery                                     | 1                | 1   | 1   |
| 21   | M933-12020-60   | Screw, hex cap                                    | 1                | 1   | 1   |
| 22   | X-545-165       | Cable, battery                                    | 1                | 1   | 1   |
| 23   | X-545-73        | Cable, battery                                    | 1                | 1   | 1   |
| 24   | X-545-129       | Cable, battery                                    | 1                | 1   | 1   |
| 25   | GM46196         | Box assembly, engine light (includes items 26-30) | 1                | 1   | 1   |
| 26   | GM46195         | Box, silkscreen engine light                      | 1                | 1   | 1   |
| 27   | 343684          | Lamp, yellow/amber LED                            | 1                | 1   | 1   |
| 28   | 151511          | Ring, lock, switch                                | 1                | 1   | 1   |
| 29   | 354151          | Switch, toggle                                    | 1                | 1   | 1   |
| 30   | 343685          | Lamp, red LED                                     | 1                | 1   | 1   |

## Routine Engine Service Parts

| Item | Part Number | Description               | Quantity (per engine) |
|------|-------------|---------------------------|-----------------------|
|      |             |                           |                       |
| 1    | 279261      | Filter, fuel              | 1                     |
| 2    | GM34959     | Filter, oil               | 2                     |
| 3    | GM34440     | Thermostat w/seal         | 2                     |
| 4    | GM26349     | Belt, alternator          | 1                     |
| 5    | -           | Belt, fan (See Group 104) | 1                     |

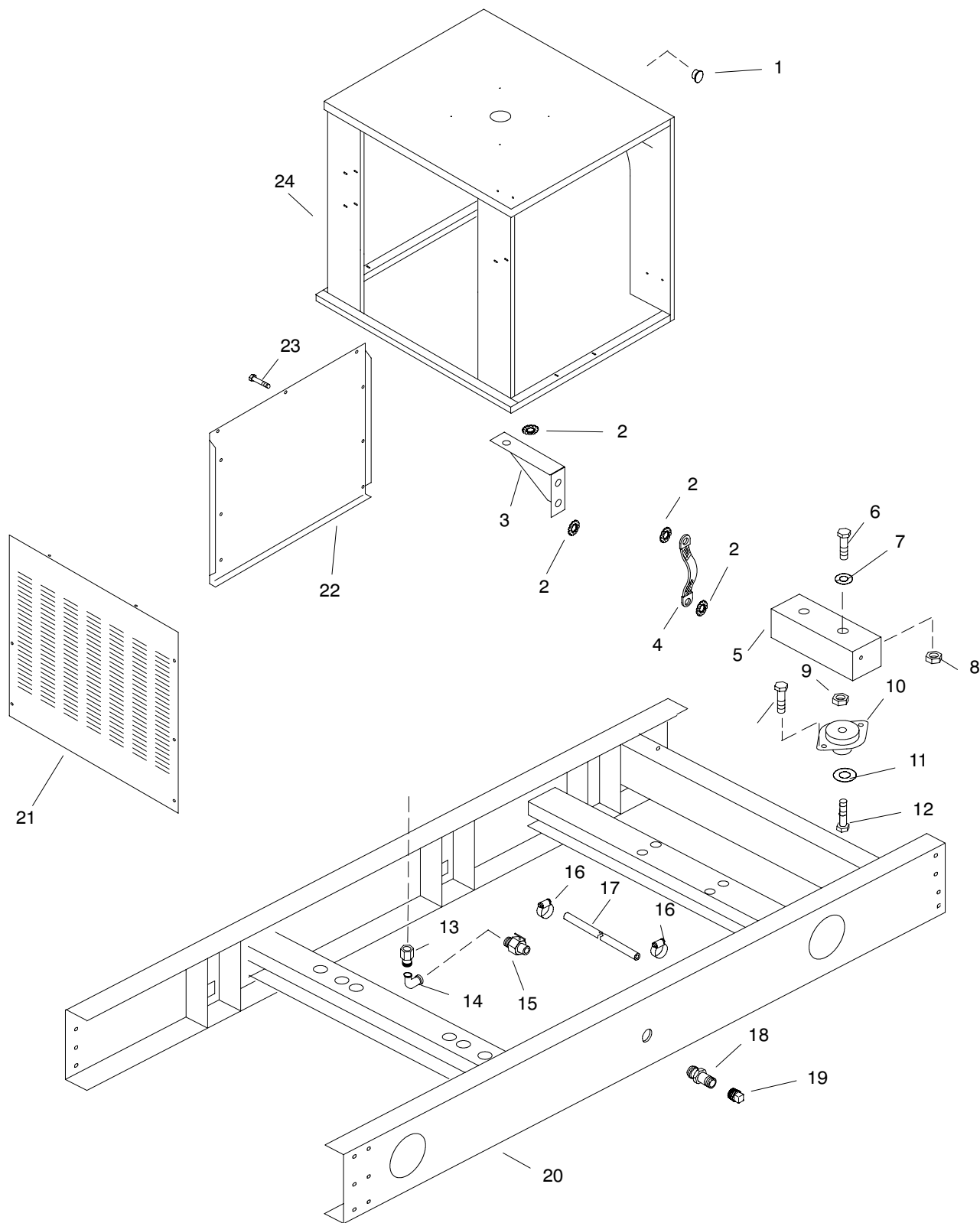
# Notes

## Group 107: Nameplate and Decals

| Item | Part Number | Description                           | Quantity              |
|------|-------------|---------------------------------------|-----------------------|
|      |             |                                       | Variation Number GR1S |
| 1    | GM23477-7   | Decal, DDC/MTU logo                   | 1                     |
| 3    | 238402      | Decal, caution positive terminal only | 1                     |
| 4    | 249808      | Decal, warning rotating parts         | 1                     |
| 5    | 249809      | Decal, caution hot engine             | 2                     |
| 6    | 249810      | Decal, warning hot coolant            | 1                     |
| 7    | GM13776     | Decal, reconnection                   | 1                     |
| 8    | 257438      | Decal, danger moving rotor            | 3                     |
| 9    | 257441      | Decal, warning lifting eye            | 1                     |
| 10   | 258815      | Decal, warning voltage backfeed       | 1                     |
| 12   | 273780      | Decal, warning explosion              | 1                     |
| 13   | 324069      | Nameplate                             | 1                     |
| 14   | 343165      | Decal, caution—not a step             | 1                     |
| 15   | 364116      | Decal, caution welding disconnect     | 2                     |
| 16   | GM15300     | Decal, exhaust piping                 | 1                     |
| 17   | GM19296     | Decal, fuel type                      | 1                     |
| 18   | GM20171     | Decal, warning fan                    | 1                     |
| 19   | GM39683     | Tag, hang lug selection               | 1                     |

Nameplate and decals not illustrated

# Group 109: Skid and Plant Mounting



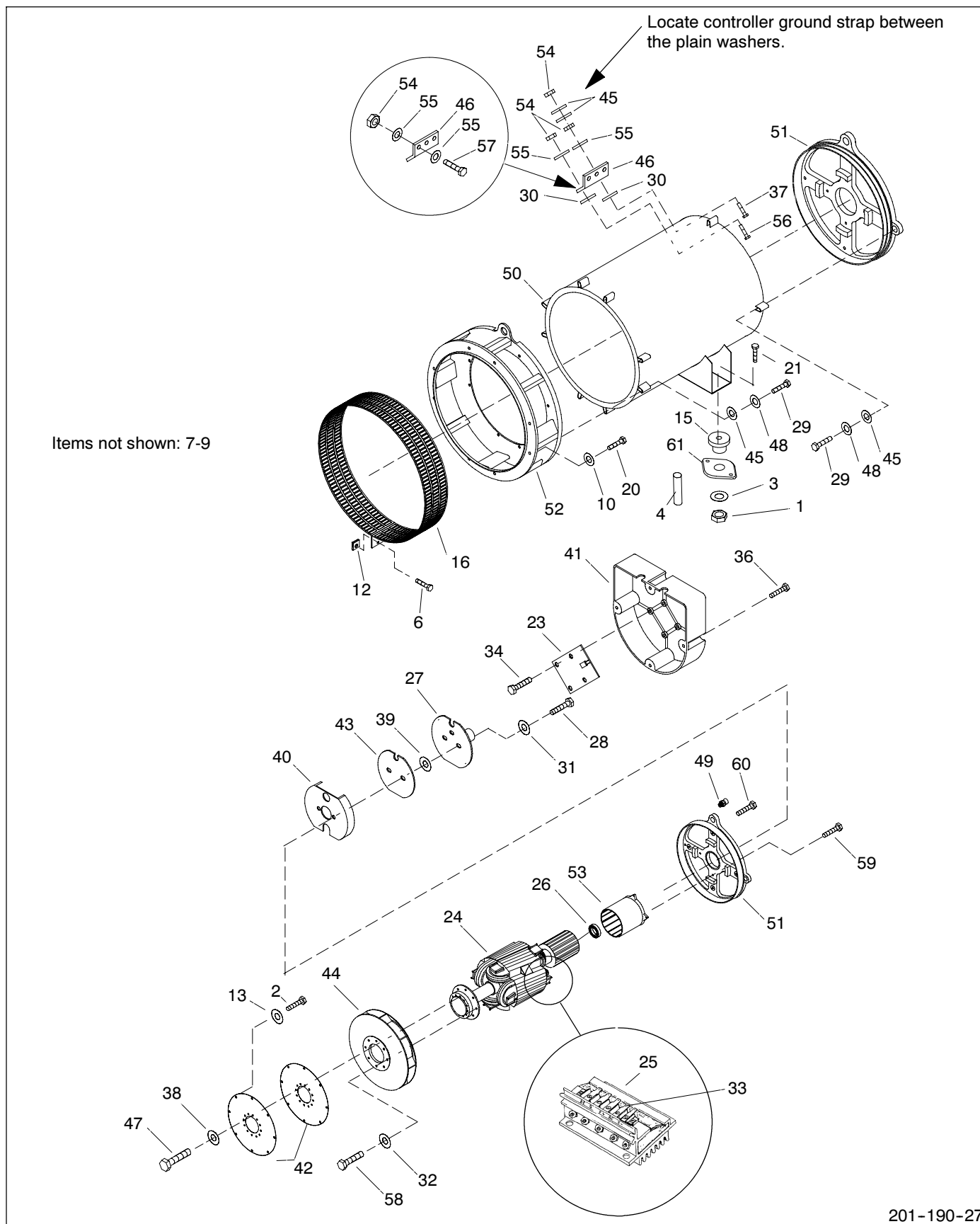
GM38533

## Group 109: Skid and Plant Mounting

| Item | Part Number   | Description                         | Quantity                     |
|------|---------------|-------------------------------------|------------------------------|
|      |               |                                     | Module Number<br>GM38533-MA1 |
| 1    | X-301-45      | Plug, button                        | 1                            |
| 2    | X-22-16       | Washer, lock, .326 ID x .883 in. OD | 8                            |
| 3    | GM19557       | Bracket, junction box mounting      | 4                            |
| 4    | GM21085       | Strap, ground, 16 in.               | 1                            |
| 5    | GM28345       | Support, engine, front              | 1                            |
| 6    | M933-20055-60 | Screw, hex cap                      | 2                            |
| 7    | X-801-8       | Washer, hardened                    | 2                            |
| 8    | M982-20-80    | Nut, elastic stop                   | 2                            |
| 9    | M982-16-80    | Nut, hex elastic stop               | 2                            |
| 10   | 336024        | Vibromount                          | 2                            |
| 11   | X-25-112      | Washer, plain                       | 2                            |
| 12   | M933-16090-60 | Screw, hex cap                      | 2                            |
| 13   | X-202-41      | Bushing, reducer                    | 1                            |
| 14   | X-211-1       | Elbow, street, 1/2 in.              | 1                            |
| 15   | 272701        | Valve, oil drain                    | 1                            |
| 16   | X-426-10      | Clamp, hose                         | 2                            |
| 17   | X-577-27      | Hose                                | 1                            |
| 18   | X-582-1       | Connector, hose                     | 1                            |
| 19   | X-75-3        | Plug, pipe, 1/2 in. NPT             | 1                            |
| 20   | GM38529       | Skid                                | 1                            |
| 21   | 336004-BLK    | Cover, rear                         | 1                            |
| 22   | 336001-BLK    | Cover, side                         | 2                            |
| 23   | X-6216-1      | Screw, Phillips hex crimpite        | 12                           |
| 24   | GM10555       | Box, junction                       | 1                            |

# Group 201: Generator and Mounting

## Permanent Magnet-Excited Alternators



201-190-27

# Group 201: Generator and Mounting

## Permanent Magnet-Excited Alternators

| Item | Part Number     | Description                                                  | Qty.<br>All<br>Models |
|------|-----------------|--------------------------------------------------------------|-----------------------|
| 1    | M982-16-80      | Nut, hex stop                                                | 2                     |
| 2    | X-129-59        | Screw, HC                                                    | 8                     |
| 3    | X-25-112        | Washer, plain                                                | 2                     |
| 4    | X-400-251       | Spacer                                                       | 2                     |
| 6    | X-67-125        | Screw, self-tapping                                          | 4                     |
| 7    | X-750-14        | Marker, wire tab no. L1<br>(not shown)                       | 1                     |
| 8    | X-750-15        | Marker, wire tab no. L2<br>(not shown)                       | 1                     |
| 9    | X-750-16        | Marker, wire tab no. L3<br>(not shown)                       | 1                     |
| 10   | X-801-6         | Washer, hardened                                             | 12                    |
| 12   | 257442          | Clip, speed                                                  | 4                     |
| 13   | 290945          | Washer, hardened                                             | 8                     |
| 15   | 354634          | Vibromount                                                   | 2                     |
| 16   | 347268          | Guard, generator fan                                         | 2                     |
| 20   | X-6024-14       | Screw                                                        | 12                    |
| 21   | M931-16100-60   | Screw                                                        | 2                     |
| 22   | See chart below | Alternator assembly<br>(includes the following)<br>LED board | 1                     |
| 23   | B-257099        | LED board                                                    | 1                     |
| 24   | See chart below | Rotor assembly<br>(includes items 25 & 26)                   | 1                     |
| 25   | A-354299        | Split activator                                              | 1                     |
| 26   | X-758-9         | Ball bearing                                                 | 1                     |
| 27   | GM34505         | Photo board                                                  | 1                     |
| 28   | X-117-5         | Screw, hex head,<br>10-24 x 5/8 in.                          | 2                     |
| 29   | X-129-25        | Screw, hex cap                                               | 12                    |
| 30   | X-22-46         | Washer lock, #6 interior                                     | 2                     |
| 31   | X-22-9          | Washer lock, #10 interior tooth                              | 2                     |

| Item | Part Number     | Description                    | Qty.<br>All<br>Models |
|------|-----------------|--------------------------------|-----------------------|
| 32   | X-25-93         | Washer, plain                  | 8                     |
| 33   | X-431-25        | Terminal, push-on              | 4                     |
| 34   | X-6071-1        | Screw, thread-forming, #10     | 4                     |
| 35   | X-6093-8        | Sleeving (not shown)           | 2                     |
| 36   | X-67-133        | Screw, self-tapping            | 3                     |
| 37   | X-791-6         | Screw, hex head                | 1                     |
| 38   | X-801-3         | Washer, hardened               | 16                    |
| 39   | 243321          | Washer, insulating             | 2                     |
| 40   | 257077          | Actuator, magnetic cup         | 1                     |
| 41   | 257258          | Cover, LED PCB                 | 1                     |
| 42   | 257581          | Disc, armature drive           | 4                     |
| 43   | 257850          | Insulator, PCB split activator | 1                     |
| 44   | 257855          | Fan, generator                 | 1                     |
| 45   | 257951          | Washer, special                | 12                    |
| 46   | 257978          | Connector, bus                 | 1                     |
| 47   | 270158          | Screw, cylinder head           | 12                    |
| 48   | 290945          | Washer, hardened               | 12                    |
| 49   | 347119          | Fitting, grease                | 1                     |
| 50   | See chart below | Stator assembly                |                       |
| 51   | 347236          | Bracket, end                   | 1                     |
| 52   | 347240          | Adapter, generator             | 1                     |
| 53   | 347707          | Exciter, assembly field        | 1                     |
| 54   | #               | Nut, 3/8-16                    | 6                     |
| 55   | #               | Washer, 3/8 in.                | 10                    |
| 56   | X-6238-11       | Screw                          | 1                     |
| 57   | X-6238-5        | Screw                          | 3                     |
| 58   | X-6238-11       | Screw                          | 8                     |
| 59   | X-6238-17       | Screw                          | 4                     |
| 60   | X-465-25        | Screw                          | 1                     |
| 61   | 354717          | Plate, generator mounting      | 2                     |

# Common hardware. Procure locally.

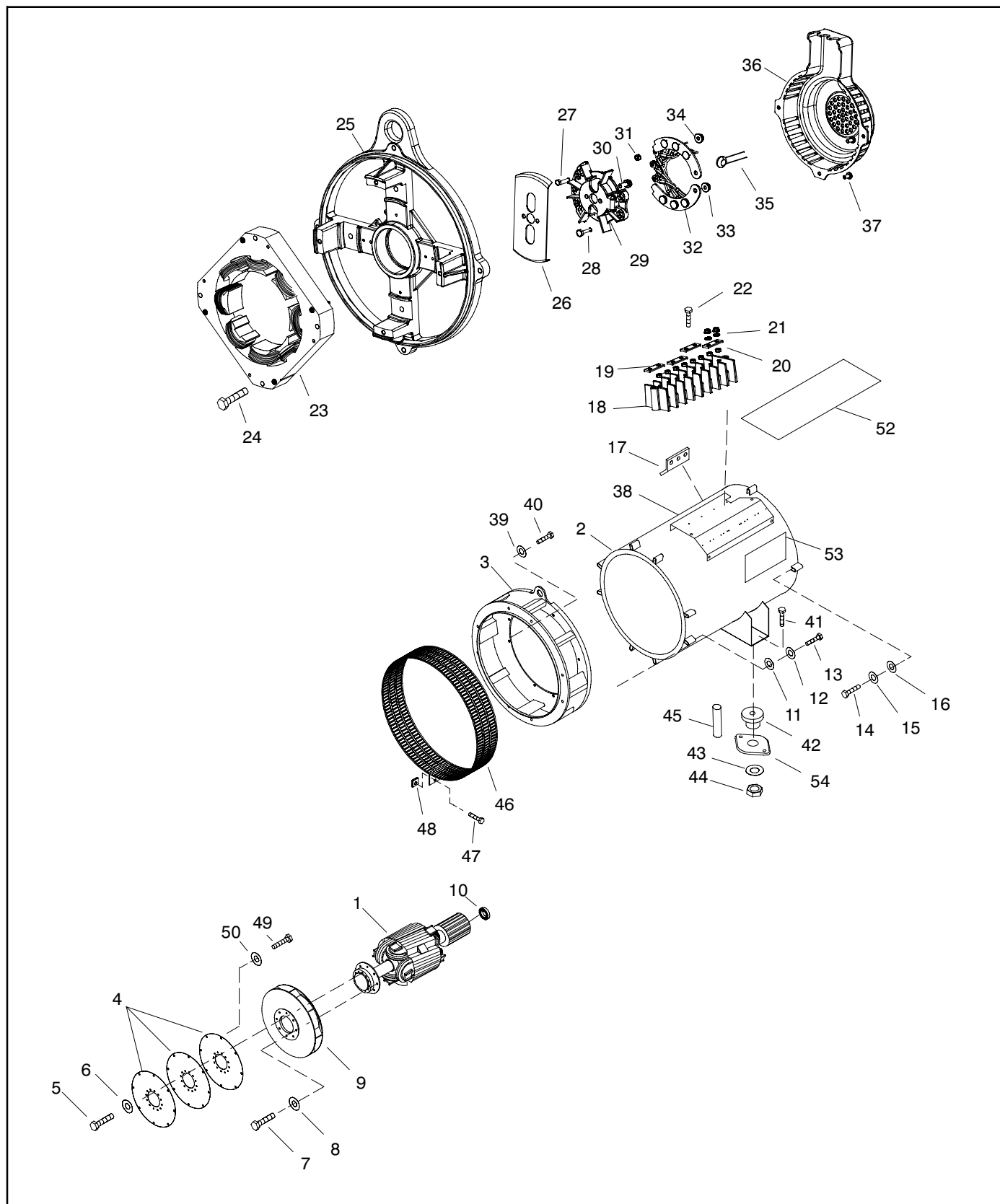
## Alternator Part Number and Type

Use this table to identify the module number's alternator, rotor, and stator part numbers.

| Module<br>Number | Alternator<br>Description | Item 22,<br>Alternator<br>assembly | Item 24,<br>Rotor<br>assembly | Item 50,<br>Stator<br>assembly |
|------------------|---------------------------|------------------------------------|-------------------------------|--------------------------------|
| GM19673-MA160    | 4UA9                      | GM24411-3                          | A-347187                      | GM24409-2                      |
| GM19673-MA161    | 4UA9, 600 V               | GM24411-4                          | A-347187                      | GM24410-2                      |
| GM19673-MA162    | 4UA10                     | GM24411-5                          | A-347188                      | GM24409-3                      |
| GM19673-MA163    | 4UA10, 600 V              | GM24411-6                          | A-347188                      | GM24410-3                      |
| GM19673-MA164    | 4UA13                     | GM24411-7                          | A-347189                      | GM24409-4                      |
| GM19673-MA165    | 4UA13, 600 V              | GM24411-8                          | A-347189                      | GM24410-4                      |

# Group 201: Generator and Mounting, continued

## Wound Field Alternators



# Group 201: Generator and Mounting, continued

## Wound Field Alternators

| Item | Part No.        | Description                             | Qty. |
|------|-----------------|-----------------------------------------|------|
| 1    | See chart below | Rotor assembly                          | 1    |
| 2    | See chart below | Stator assembly                         | 1    |
| 3    | GM32011         | Adapter, generator                      | 1    |
| 4    | GM31972         | Disc, drive                             | 4    |
| 5    | M933-12040-82   | Screw, hex cap                          | 12   |
| 6    | 290945          | Washer, .531 ID x 1.06 in. OD           | 12   |
| 7    | M933-10025-60   | Screw, hex cap                          | 8    |
| 8    | X-25-93         | Washer, .406 ID x .75 in. OD            | 8    |
| 9    | 257855          | Fan, generator                          | 1    |
| 10   | X-758-9         | Bearing, ball                           | 1    |
| 11   | 257951          | Washer, .562 ID x 1.13 in. OD           | 8    |
| 12   | 290945          | Washer, .531 ID x 1.06 in. OD           | 8    |
| 13   | M931-12095-60   | Screw, hex cap                          | 8    |
| 14   | M931-12095-60   | Screw, hex cap                          | 4    |
| 15   | 290945          | Washer, .531 ID x 1.06 in. OD           | 4    |
| 16   | 257951          | Washer, .562 ID x 1.13 in. OD           | 4    |
| 17   | 257978          | Bus                                     | 1    |
| 18   | GM31969         | Block, terminal                         | 1    |
| 19   | *               | Bus                                     |      |
| 20   | *               | Nut, hex, 10 mm                         |      |
| 21   | *               | Washer, plain                           |      |
| 22   | M7500D-06020-81 | Screw                                   | 2    |
| 23   | GM32518-1       | Exciter field                           | 1    |
| 23   | GM32518-2       | Exciter field (4UA13W alternators)      | 1    |
| 24   | M931-08060-60   | Screw, hex head                         | 4    |
| 24   | M931-08085-60   | Screw, hex head<br>(4UA13W alternators) | 4    |
| 25   | GM31973         | Bracket, end                            | 1    |
| 26   | GM31967         | Actuator, magnetic                      | 1    |
| 27   | M933-05020-60   | Screw, hex cap                          | 3    |

| Item | Part No.        | Description                                          | Qty. |
|------|-----------------|------------------------------------------------------|------|
| 28   | M933-06020-60   | Screw, hex cap                                       | 2    |
| 29   | GM31960         | Hub, rotating diode assembly                         | 1    |
| 30   | M933-06016-60   | Screw, hex cap                                       | 2    |
| 31   | M934-05-50      | Nut, hex, 5 mm                                       | 3    |
| 32   | GM31963         | Plates, diode assembly                               | 1    |
| 33   | M982-06-80      | Nut, hex, elastic stop                               | 2    |
| 34   | M982-05-60      | Nut, hex, elastic stop                               | 3    |
| 35   | 228061          | Varistor, 250 V                                      | 1    |
| 36   | GM31968         | Cover, rotating diode assembly                       | 1    |
| 37   | M7500D-05010-81 | Screw, thread forming metric                         | 3    |
| 38   | 344295          | Decal, equipment ground                              | 1    |
| 39   | X-801-6         | Washer, .469 ID x .922 in. OD                        | 12   |
| 40   | X-6024-14       | Screw, hex head                                      | 12   |
| 41   | M931-16100-60   | Screw, hex cap                                       | 2    |
| 42   | 354634          | Vibromount                                           | 2    |
| 43   | X-25-112        | Washer, plain                                        | 2    |
| 44   | M982-16-80      | Nut, hex, elastic stop                               | 2    |
| 45   | X-400-251       | Spacer                                               | 2    |
| 46   | 347268          | Guard, generator fan                                 | 2    |
| 47   | X-67-125        | Screw, hex washer, thread-forming                    | 4    |
| 48   | 257442          | Clip, speed                                          | 4    |
| 49   | X-129-59        | Bolt, hex cap                                        | 8    |
| 50   | 290945          | Washer, hardened,<br>.531 ID x 1.06 in. OD           | 8    |
| 51   | See chart below | Alternator assembly<br>(includes items 1-38, 52, 53) | 1    |
| 52   | GM39793         | Decal, terminal board                                | 1    |
| 53   | GM39792         | Decal, board reconnection                            | 1    |
| 54   | 354717          | Plate, generator mounting                            | 1    |

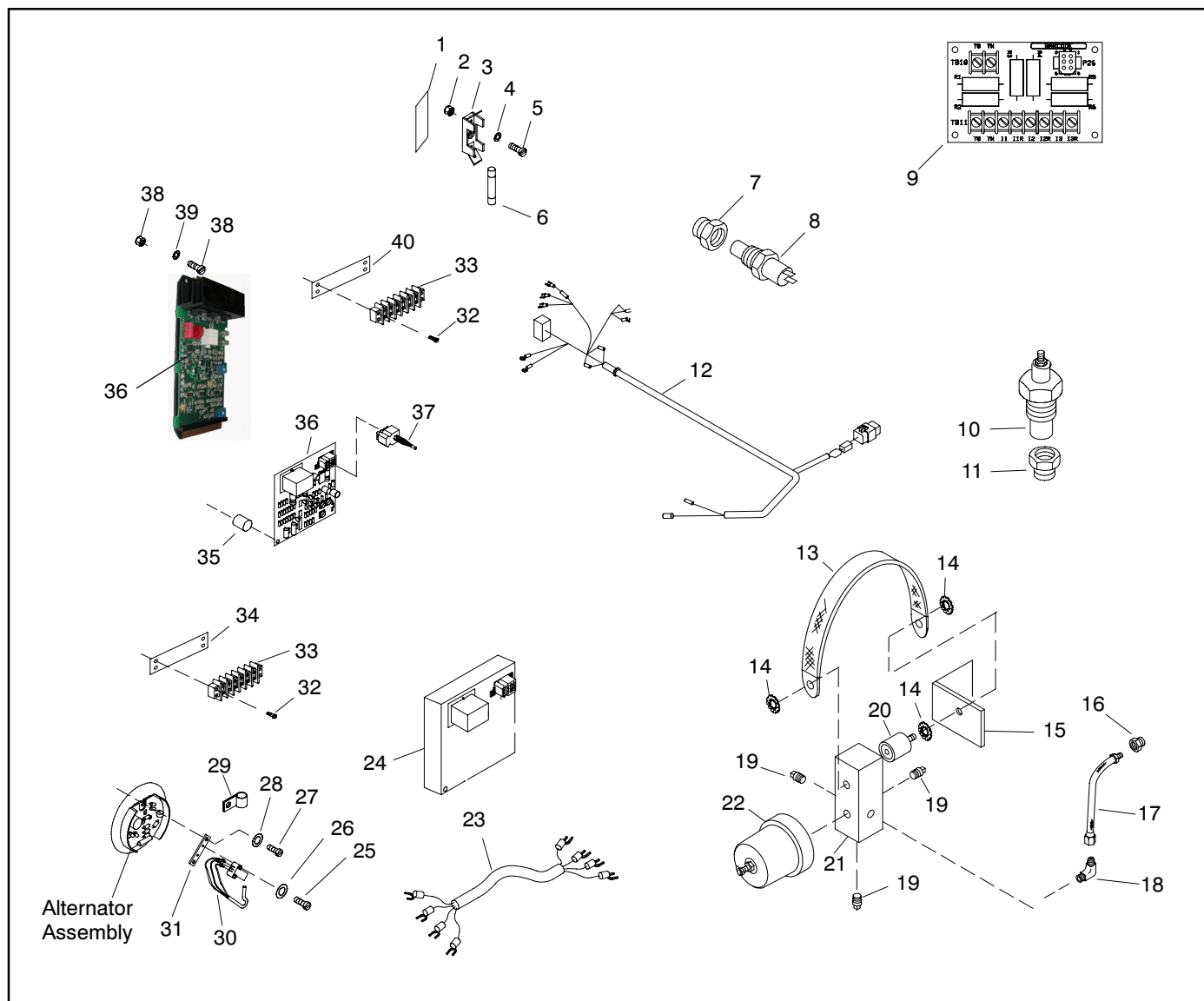
\* See Load Connection Kit for part number

## Alternator Part Number and Type

Use this table to identify the module number's alternator, rotor, and stator part numbers.

| Module No.    | Alternator Description | Item 51, Alternator assembly | Item 1, Rotor assembly | Item 2, Stator assembly |
|---------------|------------------------|------------------------------|------------------------|-------------------------|
| GM19673-MA166 | 4UA9W                  | GM39945-6                    | GM32424-4              | GM32996-2               |
| GM19673-MA167 | 4UA9W, 600 V           | GM39945-8                    | GM32424-4              | GM32997-2               |
| GM19673-MA168 | 4UA10W                 | GM39945-10                   | GM32424-6              | GM32996-3               |
| GM19673-MA169 | 4UA10W, 600 V          | GM39945-12                   | GM32424-6              | GM32997-3               |
| GM19673-MA170 | 4UA13W                 | GM39945-14                   | GM32424-8              | GM32996-4               |
| GM19673-MA171 | 4UA13W, 600 V          | GM39945-16                   | GM32424-8              | GM32997-4               |

# Control and Harness



# Control and Harness

| Item | Part Number     | Description                            | Quantity    |             |             |             |             |             |
|------|-----------------|----------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|      |                 |                                        | Module      |             |             |             |             |             |
|      |                 |                                        | GM41999-MA1 | GM41999-MA2 | GM41999-MA3 | GM42000-MA1 | GM42000-MA2 | GM42000-MA3 |
| 1    | GM39798         | Strip, marker                          |             | 1           |             |             |             |             |
| 2    | M934-03-50      | Nut, hex, 3 mm                         |             | 1           |             |             |             |             |
| 3    | 336634          | Fuse holder                            |             | 1           |             |             |             |             |
| 4    | X-22-6          | Washer, lock, .146 ID x .285 in. OD    |             | 1           |             |             |             |             |
| 5    | M7985A-03010-20 | Screw, pan head, M3 x 10               |             | 1           |             |             |             |             |
| 6    | 358337          | Fuse, 10 A, 250 V                      |             | 1           |             |             |             |             |
| 7    | 168848          | Bushing, reducing, 1/2 x 1 in. NPT     |             |             |             | 1           | 1           | 1           |
| 8    | 290090          | Switch, temperature                    |             |             |             | 1           | 1           | 1           |
| 9    | GM13980         | PCB assembly, CT burden resistor       |             |             |             | 1           | 1           | 1           |
| 9    | 282829          | Vibromount                             |             |             |             | 4           | 4           | 4           |
| 10   | 268298          | Sender, water temperature              | 1           | 1           | 1           |             |             |             |
| 11   | 153659          | Bushing, reducing, 1/2 x 3/4 in. NPT   | 1           | 1           | 1           |             |             |             |
| 12   | GM39850         | Harness, wiring DDEC engine            | 1           | 1           | 1           |             |             |             |
| 12   | GM39851         | Harness, engine                        |             |             |             | 1           |             | 1           |
| 12   | GM42004         | Harness, engine                        |             |             |             |             | 1           |             |
| 13   | 223033          | Strap, ground 5 in.                    | 1           | 1           | 1           |             |             |             |
| 14   | X-22-12         | Washer, lock, .262 ID x .743 in. OD    | 3           | 3           | 3           |             |             |             |
| 15   | GM35184         | Bracket, sender                        | 1           | 1           | 1           |             |             |             |
| 16   | X-202-27        | Bushing, reducer, 1/8 x 1/4 in.        | 1           | 1           | 1           |             |             |             |
| 17   | 270727          | Line, oil                              | 1           | 1           | 1           |             |             |             |
| 18   | X-447-10        | Elbow, male tube                       | 1           | 1           | 1           |             |             |             |
| 19   | X-75-4          | Plug, pipe, 1/8 in.                    | 3           | 3           | 3           |             |             |             |
| 20   | 259632          | Bumper                                 | 1           | 1           | 1           |             |             |             |
| 21   | 267548          | Block, oil gauge                       | 1           | 1           | 1           |             |             |             |
| 22   | 343473          | Sender, oil pressure                   | 1           | 1           | 1           |             |             |             |
| 23   | GM35357         | Harness, wiring (AC harness)           |             | 1           | 1           |             | 1           | 1           |
| 24   | GM11718         | PCB assembly, excitation interface     |             |             |             |             | 1           |             |
| 25   | X-49-35         | Screw, pan head, 4-40 x 7/8            | 2           |             | 2           | 2           |             | 2           |
| 25   | M7985A-03020-20 | Screw, pan head                        |             | 2           |             |             |             |             |
| 26   | X-22-24         | Washer, lock, .119 ID x .263 in. OD    | 2           | 2           | 2           | 2           |             | 2           |
| 27   | X-117-5         | Screw, hex head machine                | 2           |             | 2           | 2           |             | 2           |
| 28   | X-22-9          | Washer, lock, .20 ID x .373 in. OD     | 2           |             | 2           | 2           |             | 2           |
| 29   | X-672-15        | Clamp, insulated, .25 in.              | 1           |             | 1           | 1           |             | 1           |
| 30   | 241623          | Sensor, ferromagnetic                  | 1           | 1           | 1           | 1           |             | 1           |
| 31   | 257070          | Bracket, sensor mounting               | 1           |             | 1           | 1           |             | 1           |
| 32   | M7985A-04020-20 | Screw, RHM, 8-32 x 3/4 in.             | 4           | 4           | 4           | 2           | 2           | 2           |
| 33   | 295314          | Block, terminal                        | 2           | 2           | 2           | 1           | 1           | 1           |
| 34   | 299090          | Marker, strip                          | 1           | 1           | 1           | 1           | 1           | 1           |
| 35   | 360459          | Standoff, circuit board                | 5           |             | 5           |             |             |             |
| 36   | A-354653        | Voltage regulator, FR11                | 1           |             | 1           |             |             |             |
| 36   | GM40179         | Voltage regulator, wound field exciter |             | 1           |             |             |             |             |
| 37   | 354118          | Harness, regulator                     | 1           |             | 1           |             |             |             |
| 37   | GM39873         | Harness, regulator                     |             | 1           |             |             |             |             |
| 38   | #               | Hardware, M5                           |             | 4           |             |             |             |             |
| 39   | X-22-9          | Washer, lock, .20 ID x .373 in. OD     |             | 4           |             |             |             |             |
| 40   | 255080          | Marker, strip                          | 1           | 1           | 1           | 1           | 1           | 1           |

## Group 701: Literature

| Item | Part Number | Description                                      | Quantity         |    |    |    |
|------|-------------|--------------------------------------------------|------------------|----|----|----|
|      |             |                                                  | Variation Number |    |    |    |
|      |             |                                                  | 82               | 84 | 86 | 88 |
| 1    | MP-5700     | I/M Industrial                                   | 1                | 1  | 1  | 1  |
| 2    | MP-6009     | P/C Controllers                                  | 1                | 1  | 1  | 1  |
| 3    | MP-6117     | P/C Accessories, 230-2000 kW                     | 1                | 1  | 1  | 1  |
| 4    | MP-6140     | O/I/M Controller Setup and Application, 550      | 1                | 1  | 1  | 1  |
| 5    | MP-6161     | O/M Microprocessor Plus w/Comm, Basic Controller | 1                | 1  | 1  | 1  |
| 6    | MP-6200     | O/M 20-2000 kW, Digital 550 Version 2.10+        | 1                | 1  | 1  | 1  |
| 7    | MP-6349     | S/M Wound Field Alternator, 20-400 kW            | 1                | 1  | 1  | 1  |
| 8    | MP-6353     | S/M Permanent Magnet Alternator, 20-400 kW       | 1                | 1  | 1  | 1  |
| 9    | MP-6354     | W/D 200DSEB, 230-300DSED                         | 1                | 1  | 1  | 1  |
| 10   | MP-6356     | S/M Controllers, 20-2800 kW                      | 1                | 1  | 1  | 1  |
| 11   | MP-6408     | P/C 230-300DSED                                  | 1                | 1  | 1  | 1  |
| 12   | TP-6409     | P/C 230-300 kW DDC Series 60 Series Tier 3       | 1                | 1  | 1  | 1  |
| 13   | TP-6419     | O/M DDC Series 60 Tier 3                         | 1                | 1  | 1  | 1  |
| 14   | TP-6421     | S/M DDC Series 60 Tier 3                         | 1                | 1  | 1  | 1  |

# Kit List

This section lists the part numbers of modules/kits not listed in the Group Parts Lists. Refer to the generator set nameplate or the list below to identify the module/kit number installed on your generator set. See the sections following this page for the parts list of the module/kit.

|  | 230 kW | 250 kW | 275 kW | 300 kW |
|--|--------|--------|--------|--------|
|--|--------|--------|--------|--------|

## Controllers

See Parts Catalog MP-6009 for parts lists.

## Cooling Systems

Heater, Block

|                       |             |             |             |             |
|-----------------------|-------------|-------------|-------------|-------------|
| 90/120 V              | GM38859-KA1 | GM38859-KA1 | GM38859-KA1 | GM38859-KA1 |
| 190/280 V             | GM38859-KA2 | GM38859-KA2 | GM38859-KA2 | GM38859-KA2 |
| 210/240 V             | GM38859-KA3 | GM38859-KA3 | GM38859-KA3 | GM38859-KA3 |
| 380/480 V             | GM38859-KA4 | GM38859-KA4 | GM38859-KA4 | GM38859-KA4 |
| Duct Flange, Radiator | GM13896-KA3 | GM13896-KA3 | GM13896-KA3 | GM13896-KA3 |

## Optional Kits

See Parts Catalog MP-6117 for parts lists.

## Paint and Miscellaneous Parts

Paint All models use 221331 Spray Can, 221332 Gallon

# Cooling System Kits

| Qty. | Description | Part No. |
|------|-------------|----------|
|------|-------------|----------|

## Block Heater

## GM38859-KA1

|    |                                         |            |
|----|-----------------------------------------|------------|
| 1  | Box, block heater control               | 354315     |
| 1  | Label, wiring diagram                   | 354327     |
| 1  | Block heater (includes items marked *)  | GM20133    |
| 1  | *Block heater service element           | GM29477    |
| 1  | *Thermostat                             | GM29529    |
| 1  | Strap, ground                           | 223033     |
| 1  | Tag, hang                               | 279047     |
| 4  | Gasket, washer                          | 297001     |
| 1  | Thermostat, block heater                | 343222     |
| 1  | Cover, block heater control box         | 354317     |
| 1  | Gasket, control box                     | 354318     |
| 1  | Decal, warning                          | 354325     |
| 1  | Pipe, 3/4 x 4 in.                       | A-107      |
| 2  | Valve, shutoff                          | GM19670    |
| 4  | Vibromount                              | GM38784-2  |
| 1  | Bracket, block heater                   | GM38834    |
| 1  | Tag, hang                               | GM39752    |
| 4  | Nut, elastic stop, 1/4 in.              | M982-06-80 |
| 1  | Bushing, reducer, 1/2 x 3/4 in. NPT     | X-202-41   |
| 1  | Tee, pipe, 1/2 x 1/2 x 1/2 in.          | X-203-13   |
| 1  | Pipe, 1/2 in. NPT x 4.5 in.             | X-209-21   |
| 2  | Pipe, 1/2 x 1.5 in.                     | X-209-5    |
| 1  | Elbow, street, 90° x 1/2 in. NPTF       | X-211-1    |
| 1  | Elbow, pipe, 90° x 3/4 in.              | X-215-2    |
| 10 | Washer, lock, .262 ID x .743 in. OD     | X-22-12    |
| 2  | Washer, lock, .326 ID x .883 in. ID     | X-22-16    |
| 4  | Clamp, hose, .69/1.25 in.               | X-426-12   |
| 2  | Connector, hose                         | X-582-7    |
| 1  | Hose, coolant, 44 in.                   | X-6367-1   |
| 1  | Hose, coolant, 55 in.                   | X-6367-10  |
| 4  | Screw, slotted hex washer head, machine | X-97-13    |

## Block Heater

## GM38859-KA2

|    |                                         |            |
|----|-----------------------------------------|------------|
| 1  | Box, block heater control               | 354315     |
| 1  | Label, wiring diagram                   | 354327     |
| 1  | Block heater (includes items marked *)  | GM20134    |
| 1  | *Block heater service element           | GM29478    |
| 1  | *Thermostat                             | GM29529    |
| 1  | Strap, ground                           | 223033     |
| 1  | Tag, hang                               | 279047     |
| 4  | Gasket, washer                          | 297001     |
| 1  | Thermostat, block heater                | 343222     |
| 1  | Cover, block heater control box         | 354317     |
| 1  | Gasket, control box                     | 354318     |
| 1  | Decal, warning                          | 354325     |
| 1  | Pipe, 3/4 x 4 in.                       | A-107      |
| 2  | Valve, shutoff                          | GM19670    |
| 4  | Vibromount                              | GM38784-2  |
| 1  | Bracket, block heater                   | GM38834    |
| 1  | Tag, hang                               | GM39752    |
| 4  | Nut, elastic stop, 1/4 in.              | M982-06-80 |
| 1  | Bushing, reducer, 1/2 x 3/4 in. NPT     | X-202-41   |
| 1  | Tee, pipe, 1/2 x 1/2 x 1/2 in.          | X-203-13   |
| 1  | Pipe, 1/2 in. NPT x 4.5 in.             | X-209-21   |
| 2  | Pipe, 1/2 x 1.5 in.                     | X-209-5    |
| 1  | Elbow, street, 90° x 1/2 in. NPTF       | X-211-1    |
| 1  | Elbow, pipe, 90° x 3/4 in.              | X-215-2    |
| 10 | Washer, lock, .262 ID x .743 in. OD     | X-22-12    |
| 2  | Washer, lock, .326 ID x .883 in. ID     | X-22-16    |
| 4  | Clamp, hose, .69/1.25 in.               | X-426-12   |
| 2  | Connector, hose                         | X-582-7    |
| 1  | Hose, coolant, 44 in.                   | X-6367-1   |
| 1  | Hose, coolant, 55 in.                   | X-6367-10  |
| 4  | Screw, slotted hex washer head, machine | X-97-13    |

| Qty. | Description | Part No. |
|------|-------------|----------|
|------|-------------|----------|

## Block Heater

## GM38859-KA3

|    |                                         |            |
|----|-----------------------------------------|------------|
| 1  | Box, block heater control               | 354315     |
| 1  | Label, wiring diagram                   | 354327     |
| 1  | Block heater (includes items marked *)  | GM20135    |
| 1  | *Block heater service element           | GM29474    |
| 1  | *Thermostat                             | GM29529    |
| 1  | Strap, ground                           | 223033     |
| 1  | Tag, hang                               | 279047     |
| 4  | Gasket, washer                          | 297001     |
| 1  | Thermostat, block heater                | 343222     |
| 1  | Cover, block heater control box         | 354317     |
| 1  | Gasket, control box                     | 354318     |
| 1  | Decal, warning                          | 354325     |
| 1  | Pipe, 3/4 x 4 in.                       | A-107      |
| 2  | Valve, shutoff                          | GM19670    |
| 4  | Vibromount                              | GM38784-2  |
| 1  | Bracket, block heater                   | GM38834    |
| 1  | Tag, hang                               | GM39752    |
| 4  | Nut, elastic stop, 1/4 in.              | M982-06-80 |
| 1  | Bushing, reducer, 1/2 x 3/4 in. NPT     | X-202-41   |
| 1  | Tee, pipe, 1/2 x 1/2 x 1/2 in.          | X-203-13   |
| 1  | Pipe, 1/2 in. NPT x 4.5 in.             | X-209-21   |
| 2  | Pipe, 1/2 x 1.5 in.                     | X-209-5    |
| 1  | Elbow, street, 90° x 1/2 in. NPTF       | X-211-1    |
| 1  | Elbow, pipe, 90° x 3/4 in.              | X-215-2    |
| 10 | Washer, lock, .262 ID x .743 in. OD     | X-22-12    |
| 2  | Washer, lock, .326 ID x .883 in. ID     | X-22-16    |
| 4  | Clamp, hose, .69/1.25 in.               | X-426-12   |
| 2  | Connector, hose                         | X-582-7    |
| 1  | Hose, coolant, 44 in.                   | X-6367-1   |
| 1  | Hose, coolant, 55 in.                   | X-6367-10  |
| 4  | Screw, slotted hex washer head, machine | X-97-13    |

## Block Heater

## GM38859-KA4

|    |                                         |            |
|----|-----------------------------------------|------------|
| 1  | Box, block heater control               | 354316     |
| 1  | Label, wiring diagram                   | 354328     |
| 1  | Block heater (includes items marked *)  | GM20136    |
| 1  | *Block heater service element           | GM29479    |
| 1  | *Thermostat                             | GM29529    |
| 1  | Strap, ground                           | 223033     |
| 1  | Tag, hang                               | 279047     |
| 4  | Gasket, washer                          | 297001     |
| 1  | Thermostat, block heater                | 343222     |
| 1  | Cover, block heater control box         | 354317     |
| 1  | Gasket, control box                     | 354318     |
| 1  | Decal, warning                          | 354325     |
| 1  | Pipe, 3/4 x 4 in.                       | A-107      |
| 2  | Valve, shutoff                          | GM19670    |
| 4  | Vibromount                              | GM38784-2  |
| 1  | Bracket, block heater                   | GM38834    |
| 1  | Tag, hang                               | GM39752    |
| 4  | Nut, elastic stop, 1/4 in.              | M982-06-80 |
| 1  | Bushing, reducer, 1/2 x 3/4 in. NPT     | X-202-41   |
| 1  | Tee, pipe, 1/2 x 1/2 x 1/2 in.          | X-203-13   |
| 1  | Pipe, 1/2 in. NPT x 4.5 in.             | X-209-21   |
| 2  | Pipe, 1/2 x 1.5 in.                     | X-209-5    |
| 1  | Elbow, street, 90° x 1/2 in. NPTF       | X-211-1    |
| 1  | Elbow, pipe, 90° x 3/4 in.              | X-215-2    |
| 10 | Washer, lock, .262 ID x .743 in. OD     | X-22-12    |
| 2  | Washer, lock, .326 ID x .883 in. ID     | X-22-16    |
| 4  | Clamp, hose, .69/1.25 in.               | X-426-12   |
| 2  | Connector, hose                         | X-582-7    |
| 1  | Hose, coolant, 44 in.                   | X-6367-1   |
| 1  | Hose, coolant, 55 in.                   | X-6367-10  |
| 4  | Screw, slotted hex washer head, machine | X-97-13    |

## Duct Flange, Radiator

## GM13896-KA3

|   |                             |          |
|---|-----------------------------|----------|
| 8 | Rivet, pop .187 in.         | X-781-19 |
| 2 | Frame, air duct, horizontal | GM38785  |
| 2 | Frame, air duct, vertical   | GM38786  |

# Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

|           |                                                                                      |          |                                                                                |                      |                                                   |
|-----------|--------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------|----------------------|---------------------------------------------------|
| A, amp    | ampere                                                                               | cfm      | cubic feet per minute                                                          | exh.                 | exhaust                                           |
| ABDC      | after bottom dead center                                                             | CG       | center of gravity                                                              | ext.                 | external                                          |
| AC        | alternating current                                                                  | CID      | cubic inch displacement                                                        | F                    | Fahrenheit, female                                |
| A/D       | analog to digital                                                                    | CL       | centerline                                                                     | fglass.              | fiberglass                                        |
| ADC       | analog to digital converter                                                          | cm       | centimeter                                                                     | FHM                  | flat head machine (screw)                         |
| adj.      | adjust, adjustment                                                                   | CMOS     | complementary metal oxide substrate (semiconductor)                            | fl. oz.              | fluid ounce                                       |
| ADV       | advertising dimensional drawing                                                      | cogen.   | cogeneration                                                                   | flex.                | flexible                                          |
| AHWT      | anticipatory high water temperature                                                  | com      | communications (port)                                                          | freq.                | frequency                                         |
| AISI      | American Iron and Steel Institute                                                    | coml     | commercial                                                                     | FS                   | full scale                                        |
| ALOP      | anticipatory low oil pressure                                                        | Coml/Rec | Commercial/Recreational                                                        | ft.                  | foot, feet                                        |
| alt.      | alternator                                                                           | conn.    | connection                                                                     | ft. lb.              | foot pounds (torque)                              |
| Al        | aluminum                                                                             | cont.    | continued                                                                      | ft./min.             | feet per minute                                   |
| ANSI      | American National Standards Institute (formerly American Standards Association, ASA) | CPVC     | chlorinated polyvinyl chloride                                                 | g                    | gram                                              |
| AO        | anticipatory only                                                                    | crit.    | critical                                                                       | ga.                  | gauge (meters, wire size)                         |
| API       | American Petroleum Institute                                                         | CRT      | cathode ray tube                                                               | gal.                 | gallon                                            |
| approx.   | approximate, approximately                                                           | CSA      | Canadian Standards Association                                                 | gen.                 | generator                                         |
| AR        | as required, as requested                                                            | CT       | current transformer                                                            | genset               | generator set                                     |
| AS        | as supplied, as stated, as suggested                                                 | Cu       | copper                                                                         | GFI                  | ground fault interrupter                          |
| ASE       | American Society of Engineers                                                        | cu. in.  | cubic inch                                                                     | GND, ⊕               | ground                                            |
| ASME      | American Society of Mechanical Engineers                                             | cw.      | clockwise                                                                      | gov.                 | governor                                          |
| assy.     | assembly                                                                             | CWC      | city water-cooled                                                              | gph                  | gallons per hour                                  |
| ASTM      | American Society for Testing Materials                                               | cyl.     | cylinder                                                                       | gpm                  | gallons per minute                                |
| ATDC      | after top dead center                                                                | D/A      | digital to analog                                                              | gr.                  | grade, gross                                      |
| ATS       | automatic transfer switch                                                            | DAC      | digital to analog converter                                                    | GRD                  | equipment ground                                  |
| auto.     | automatic                                                                            | dB       | decibel                                                                        | gr. wt.              | gross weight                                      |
| aux.      | auxiliary                                                                            | dBA      | decibel (A weighted)                                                           | H x W x D            | height by width by depth                          |
| A/V       | audiovisual                                                                          | DC       | direct current                                                                 | HC                   | hex cap                                           |
| avg.      | average                                                                              | DCR      | direct current resistance                                                      | HCHT                 | high cylinder head temperature                    |
| AVR       | automatic voltage regulator                                                          | deg., °  | degree                                                                         | HD                   | heavy duty                                        |
| AWG       | American Wire Gauge                                                                  | dept.    | department                                                                     | HET                  | high exhaust temperature, high engine temperature |
| AWM       | appliance wiring material                                                            | dia.     | diameter                                                                       | hex                  | hexagon                                           |
| bat.      | battery                                                                              | DI/EO    | dual inlet/end outlet                                                          | Hg                   | mercury (element)                                 |
| BBDC      | before bottom dead center                                                            | DIN      | Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss) | HH                   | hex head                                          |
| BC        | battery charger, battery charging                                                    | DIP      | dual inline package                                                            | HHC                  | hex head cap                                      |
| BCA       | battery charging alternator                                                          | DPDT     | double-pole, double-throw                                                      | HP                   | horsepower                                        |
| BCI       | Battery Council International                                                        | DPST     | double-pole, single-throw                                                      | hr.                  | hour                                              |
| BDC       | before dead center                                                                   | DS       | disconnect switch                                                              | HS                   | heat shrink                                       |
| BHP       | brake horsepower                                                                     | DVR      | digital voltage regulator                                                      | hsg.                 | housing                                           |
| blk.      | black (paint color), block (engine)                                                  | E, emer. | emergency (power source)                                                       | HVAC                 | heating, ventilation, and air conditioning        |
| blk. htr. | block heater                                                                         | EDI      | electronic data interchange                                                    | HWT                  | high water temperature                            |
| BMEP      | brake mean effective pressure                                                        | EFR      | emergency frequency relay                                                      | Hz                   | hertz (cycles per second)                         |
| bps       | bits per second                                                                      | e.g.     | for example ( <i>exempli gratia</i> )                                          | IC                   | integrated circuit                                |
| br.       | brass                                                                                | EG       | electronic governor                                                            | ID                   | inside diameter, identification                   |
| BTDC      | before top dead center                                                               | EGSA     | Electrical Generating Systems Association                                      | IEC                  | International Electrotechnical Commission         |
| Btu       | British thermal unit                                                                 | EIA      | Electronic Industries Association                                              | IEEE                 | Institute of Electrical and Electronics Engineers |
| Btu/min.  | British thermal units per minute                                                     | EI/EO    | end inlet/end outlet                                                           | IMS                  | improved motor starting                           |
| C         | Celsius, centigrade                                                                  | EMI      | electromagnetic interference                                                   | in.                  | inch                                              |
| cal.      | calorie                                                                              | emiss.   | emission                                                                       | in. H <sub>2</sub> O | inches of water                                   |
| CARB      | California Air Resources Board                                                       | eng.     | engine                                                                         | in. Hg               | inches of mercury                                 |
| CB        | circuit breaker                                                                      | EPA      | Environmental Protection Agency                                                | in. lb.              | inch pounds                                       |
| cc        | cubic centimeter                                                                     | EPS      | emergency power system                                                         | Inc.                 | incorporated                                      |
| CCA       | cold cranking amps                                                                   | ER       | emergency relay                                                                | ind.                 | industrial                                        |
| ccw.      | counterclockwise                                                                     | ES       | engineering special, engineered special                                        | int.                 | internal                                          |
| CEC       | Canadian Electrical Code                                                             | ESD      | electrostatic discharge                                                        | int./ext.            | internal/external                                 |
| cert.     | certificate, certification, certified                                                | est.     | estimated                                                                      | I/O                  | input/output                                      |
| cfh       | cubic feet per hour                                                                  | E-Stop   | emergency stop                                                                 | IP                   | iron pipe                                         |
|           |                                                                                      | etc.     | et cetera (and so forth)                                                       | ISO                  | International Organization for Standardization    |
|           |                                                                                      |          |                                                                                | J                    | joule                                             |
|           |                                                                                      |          |                                                                                | JIS                  | Japanese Industry Standard                        |

|                      |                                                      |           |                                                     |             |                                                                       |
|----------------------|------------------------------------------------------|-----------|-----------------------------------------------------|-------------|-----------------------------------------------------------------------|
| k                    | kilo (1000)                                          | MTBF      | mean time between failure                           | RHM         | round head machine (screw)                                            |
| K                    | kelvin                                               | MTBO      | mean time between overhauls                         | rlly.       | relay                                                                 |
| kA                   | kiloampere                                           | mtg.      | mounting                                            | rms         | root mean square                                                      |
| KB                   | kilobyte (2 <sup>10</sup> bytes)                     | MW        | megawatt                                            | rnd.        | round                                                                 |
| kg                   | kilogram                                             | mW        | milliwatt                                           | ROM         | read only memory                                                      |
| kg/cm <sup>2</sup>   | kilograms per square centimeter                      | μF        | microfarad                                          | rot.        | rotate, rotating                                                      |
| kgm                  | kilogram-meter                                       | N, norm.  | normal (power source)                               | rpm         | revolutions per minute                                                |
| kg/m <sup>3</sup>    | kilograms per cubic meter                            | NA        | not available, not applicable                       | RS          | right side                                                            |
| kHz                  | kilohertz                                            | nat. gas  | natural gas                                         | RTV         | room temperature vulcanization                                        |
| kJ                   | kilojoule                                            | NBS       | National Bureau of Standards                        | SAE         | Society of Automotive Engineers                                       |
| km                   | kilometer                                            | NC        | normally closed                                     | scfm        | standard cubic feet per minute                                        |
| kOhm, kΩ             | kilo-ohm                                             | NEC       | National Electrical Code                            | SCR         | silicon controlled rectifier                                          |
| kPa                  | kilopascal                                           | NEMA      | National Electrical Manufacturers Association       | s, sec.     | second                                                                |
| kph                  | kilometers per hour                                  | NFPA      | National Fire Protection Association                | SI          | <i>Système international d'unités</i> , International System of Units |
| kV                   | kilovolt                                             | Nm        | newton meter                                        | SI/EO       | side in/end out                                                       |
| kVA                  | kilovolt ampere                                      | NO        | normally open                                       | sil.        | silencer                                                              |
| kVAR                 | kilovolt ampere reactive                             | no., nos. | number, numbers                                     | SN          | serial number                                                         |
| kW                   | kilowatt                                             | NPS       | National Pipe, Straight                             | SPDT        | single-pole, double-throw                                             |
| kWh                  | kilowatt-hour                                        | NPSC      | National Pipe, Straight-coupling                    | SPST        | single-pole, single-throw                                             |
| kWm                  | kilowatt mechanical                                  | NPT       | National Standard taper pipe thread per general use | spec, specs | specification(s)                                                      |
| L                    | liter                                                | NPTF      | National Pipe, Taper-Fine                           | sq.         | square                                                                |
| LAN                  | local area network                                   | NR        | not required, normal relay                          | sq. cm      | square centimeter                                                     |
| L x W x H            | length by width by height                            | ns        | nanosecond                                          | sq. in.     | square inch                                                           |
| lb.                  | pound, pounds                                        | OC        | overcrank                                           | SS          | stainless steel                                                       |
| lbm/ft <sup>3</sup>  | pounds mass per cubic feet                           | OD        | outside diameter                                    | std.        | standard                                                              |
| LCB                  | line circuit breaker                                 | OEM       | original equipment manufacturer                     | stl.        | steel                                                                 |
| LCD                  | liquid crystal display                               | OF        | overfrequency                                       | tach.       | tachometer                                                            |
| ld. shd.             | load shed                                            | opt.      | option, optional                                    | TD          | time delay                                                            |
| LED                  | light emitting diode                                 | OS        | oversize, overspeed                                 | TDC         | top dead center                                                       |
| Lph                  | liters per hour                                      | OSHA      | Occupational Safety and Health Administration       | TDEC        | time delay engine cooldown                                            |
| Lpm                  | liters per minute                                    | OV        | overvoltage                                         | TDEN        | time delay emergency to normal                                        |
| LOP                  | low oil pressure                                     | oz.       | ounce                                               | TDES        | time delay engine start                                               |
| LP                   | liquefied petroleum                                  | p., pp.   | page, pages                                         | TDNE        | time delay normal to emergency                                        |
| LPG                  | liquefied petroleum gas                              | PC        | personal computer                                   | TDOE        | time delay off to emergency                                           |
| LS                   | left side                                            | PCB       | printed circuit board                               | TDON        | time delay off to normal                                              |
| L <sub>wa</sub>      | sound power level, A weighted                        | pF        | picofarad                                           | temp.       | temperature                                                           |
| LWL                  | low water level                                      | PF        | power factor                                        | term.       | terminal                                                              |
| LWT                  | low water temperature                                | ph., ∅    | phase                                               | TIF         | telephone influence factor                                            |
| m                    | meter, milli (1/1000)                                | PHC       | Phillips head crimplite (screw)                     | TIR         | total indicator reading                                               |
| M                    | mega (10 <sup>6</sup> when used with SI units), male | PHH       | Phillips hex head (screw)                           | tol.        | tolerance                                                             |
| m <sup>3</sup>       | cubic meter                                          | PHM       | pan head machine (screw)                            | turbo.      | turbocharger                                                          |
| m <sup>3</sup> /min. | cubic meters per minute                              | PLC       | programmable logic control                          | typ.        | typical (same in multiple locations)                                  |
| mA                   | milliampere                                          | PMG       | permanent-magnet generator                          | UF          | underfrequency                                                        |
| man.                 | manual                                               | pot       | potentiometer, potential                            | UHF         | ultrahigh frequency                                                   |
| max.                 | maximum                                              | ppm       | parts per million                                   | UL          | Underwriter's Laboratories, Inc.                                      |
| MB                   | megabyte (2 <sup>20</sup> bytes)                     | PROM      | programmable read-only memory                       | UNC         | unified coarse thread (was NC)                                        |
| MCM                  | one thousand circular mils                           | psi       | pounds per square inch                              | UNF         | unified fine thread (was NF)                                          |
| MCCB                 | molded-case circuit breaker                          | pt.       | pint                                                | univ.       | universal                                                             |
| meggar               | megohmmeter                                          | PTC       | positive temperature coefficient                    | US          | undersize, underspeed                                                 |
| MHz                  | megahertz                                            | PTO       | power takeoff                                       | UV          | ultraviolet, undervoltage                                             |
| mi.                  | mile                                                 | PVC       | polyvinyl chloride                                  | V           | volt                                                                  |
| mil                  | one one-thousandth of an inch                        | qt.       | quart, quarts                                       | VAC         | volts alternating current                                             |
| min.                 | minimum, minute                                      | qty.      | quantity                                            | VAR         | voltampere reactive                                                   |
| misc.                | miscellaneous                                        | R         | replacement (emergency) power source                | VDC         | volts direct current                                                  |
| MJ                   | megajoule                                            | rad.      | radiator, radius                                    | VFD         | vacuum fluorescent display                                            |
| mJ                   | millijoule                                           | RAM       | random access memory                                | VGA         | video graphics adapter                                                |
| mm                   | millimeter                                           | RDO       | relay driver output                                 | VHF         | very high frequency                                                   |
| mOhm, mΩ             | milliohm                                             | ref.      | reference                                           | W           | watt                                                                  |
| MOhm, MΩ             | megohm                                               | rem.      | remote                                              | WCR         | withstand and closing rating                                          |
| MOV                  | metal oxide varistor                                 | Res/Coml  | Residential/Commercial                              | w/          | with                                                                  |
| MPa                  | megapascal                                           | RFI       | radio frequency interference                        | w/o         | without                                                               |
| mpg                  | miles per gallon                                     | RH        | round head                                          | wt.         | weight                                                                |
| mph                  | miles per hour                                       |           |                                                     | xfmr        | transformer                                                           |
| MS                   | military standard                                    |           |                                                     |             |                                                                       |
| m/sec.               | meters per second                                    |           |                                                     |             |                                                                       |

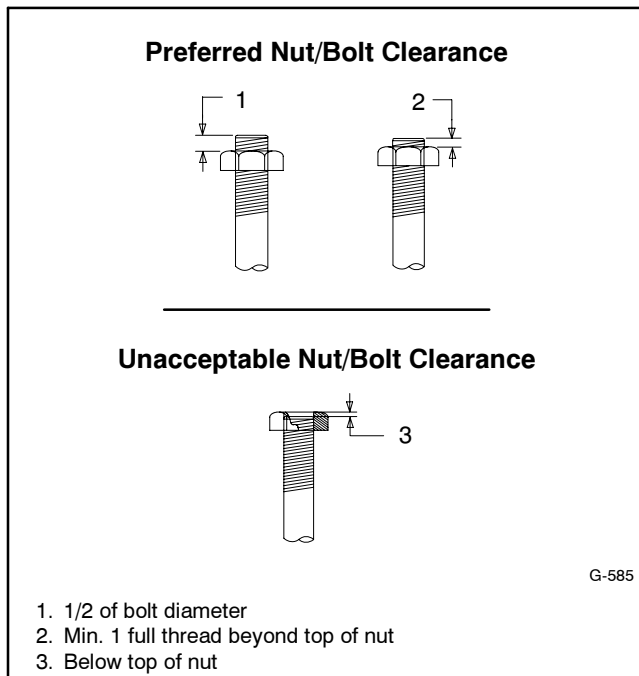
## Appendix B Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

**Bolt/Screw Length:** When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

**Washers and Nuts:** Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spirallock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.



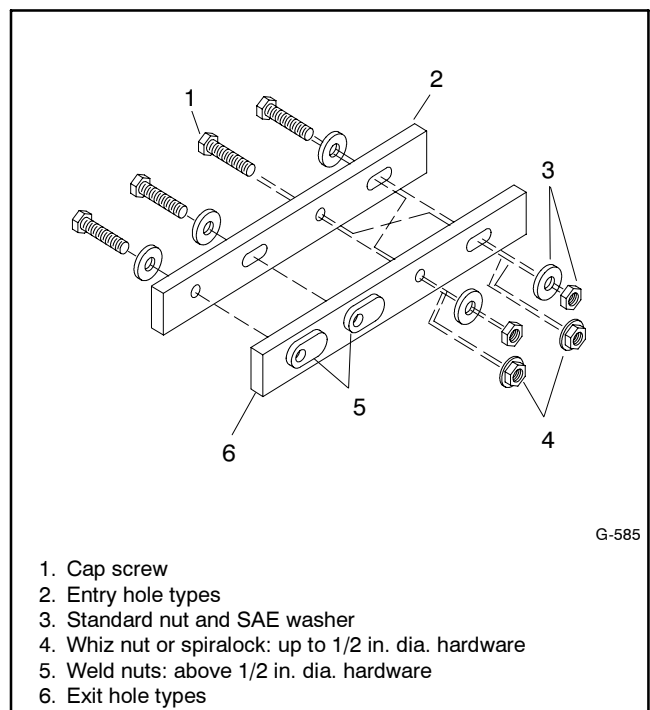
**Figure 1** Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spirallock nut. See Figure 2.

3. Follow these SAE washer rules after determining exit hole type:
  - a. Always use a washer between hardware and a slot.
  - b. Always use a washer under a nut (see 2 above for exception).
  - c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.



**Figure 2** Acceptable Hardware Combinations

## Appendix C General Torque Specifications

| American Standard Fasteners Torque Specifications |                    |                                   |             |              |                                      |
|---------------------------------------------------|--------------------|-----------------------------------|-------------|--------------|--------------------------------------|
| Size                                              | Torque Measurement | Assembled into Cast Iron or Steel |             |              | Assembled into Aluminum Grade 2 or 5 |
|                                                   |                    | Grade 2                           | Grade 5     | Grade 8      |                                      |
| 8-32                                              | Nm (in. lb.)       | 1.8 (16)                          | 2.3 (20)    | —            | See Note 3                           |
| 10-24                                             | Nm (in. lb.)       | 2.9 (26)                          | 3.6 (32)    | —            |                                      |
| 10-32                                             | Nm (in. lb.)       | 2.9 (26)                          | 3.6 (32)    | —            |                                      |
| 1/4-20                                            | Nm (in. lb.)       | 6.8 (60)                          | 10.8 (96)   | 14.9 (132)   |                                      |
| 1/4-28                                            | Nm (in. lb.)       | 8.1 (72)                          | 12.2 (108)  | 16.3 (144)   |                                      |
| 5/16-18                                           | Nm (in. lb.)       | 13.6 (120)                        | 21.7 (192)  | 29.8 (264)   |                                      |
| 5/16-24                                           | Nm (in. lb.)       | 14.9 (132)                        | 23.1 (204)  | 32.5 (288)   |                                      |
| 3/8-16                                            | Nm (ft. lb.)       | 24.0 (18)                         | 38.0 (28)   | 53.0 (39)    |                                      |
| 3/8-24                                            | Nm (ft. lb.)       | 27.0 (20)                         | 42.0 (31)   | 60.0 (44)    |                                      |
| 7/16-14                                           | Nm (ft. lb.)       | 39.0 (29)                         | 60.0 (44)   | 85.0 (63)    |                                      |
| 7/16-20                                           | Nm (ft. lb.)       | 43.0 (32)                         | 68.0 (50)   | 95.0 (70)    |                                      |
| 1/2-13                                            | Nm (ft. lb.)       | 60.0 (44)                         | 92.0 (68)   | 130.0 (96)   |                                      |
| 1/2-20                                            | Nm (ft. lb.)       | 66.0 (49)                         | 103.0 (76)  | 146.0 (108)  |                                      |
| 9/16-12                                           | Nm (ft. lb.)       | 81.0 (60)                         | 133.0 (98)  | 187.0 (138)  |                                      |
| 9/16-18                                           | Nm (ft. lb.)       | 91.0 (67)                         | 148.0 (109) | 209.0 (154)  |                                      |
| 5/8-11                                            | Nm (ft. lb.)       | 113.0 (83)                        | 183.0 (135) | 259.0 (191)  |                                      |
| 5/8-18                                            | Nm (ft. lb.)       | 128.0 (94)                        | 208.0 (153) | 293.0 (216)  |                                      |
| 3/4-10                                            | Nm (ft. lb.)       | 199.0 (147)                       | 325.0 (240) | 458.0 (338)  |                                      |
| 3/4-16                                            | Nm (ft. lb.)       | 222.0 (164)                       | 363.0 (268) | 513.0 (378)  |                                      |
| 1-8                                               | Nm (ft. lb.)       | 259.0 (191)                       | 721.0 (532) | 1109.0 (818) |                                      |
| 1-12                                              | Nm (ft. lb.)       | 283.0 (209)                       | 789.0 (582) | 1214.0 (895) |                                      |

| Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.) |                                   |             |             |                                          |
|------------------------------------------------------------------|-----------------------------------|-------------|-------------|------------------------------------------|
| Size (mm)                                                        | Assembled into Cast Iron or Steel |             |             | Assembled into Aluminum Grade 5.8 or 8.8 |
|                                                                  | Grade 5.8                         | Grade 8.8   | Grade 10.9  |                                          |
| M6 x 1.00                                                        | 6.2 (4.6)                         | 9.5 (7)     | 13.6 (10)   | See Note 3                               |
| M8 x 1.25                                                        | 15.0 (11)                         | 23.0 (17)   | 33.0 (24)   |                                          |
| M8 x 1.00                                                        | 16.0 (11)                         | 24.0 (18)   | 34.0 (25)   |                                          |
| M10 x 1.50                                                       | 30.0 (22)                         | 45.0 (34)   | 65.0 (48)   |                                          |
| M10 x 1.25                                                       | 31.0 (23)                         | 47.0 (35)   | 68.0 (50)   |                                          |
| M12 x 1.75                                                       | 53.0 (39)                         | 80.0 (59)   | 115.0 (85)  |                                          |
| M12 x 1.50                                                       | 56.0 (41)                         | 85.0 (63)   | 122.0 (90)  |                                          |
| M14 x 2.00                                                       | 83.0 (61)                         | 126.0 (93)  | 180.0 (133) |                                          |
| M14 x 1.50                                                       | 87.0 (64)                         | 133.0 (98)  | 190.0 (140) |                                          |
| M16 x 2.00                                                       | 127.0 (94)                        | 194.0 (143) | 278.0 (205) |                                          |
| M16 x 1.50                                                       | 132.0 (97)                        | 201.0 (148) | 287.0 (212) |                                          |
| M18 x 2.50                                                       | 179.0 (132)                       | 273.0 (201) | 390.0 (288) |                                          |
| M18 x 1.50                                                       | 189.0 (140)                       | 289.0 (213) | 413.0 (305) |                                          |

### Notes:

1. Do not use these values when the torque values are specified on the assembly drawing.
2. These values are based on new plates threads. Increase values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have two diameters of thread engagement or may require 30% or more reduction in the torque.
4. Torques are calculated as equivalent stress loading to American hardware and approximately a preload of 90% of yield strength and friction coefficient of 0.125.

# Appendix D Common Hardware Identification

| Screw/Bolts/Studs                            |                                                                                     |
|----------------------------------------------|-------------------------------------------------------------------------------------|
| Head Styles                                  |                                                                                     |
| Hex Head or Machine Head                     |    |
| Hex Head or Machine Head with Washer         |    |
| Flat Head (FHM)                              |    |
| Round Head (RHM)                             |    |
| Pan Head                                     |    |
| Hex Socket Head Cap or Allen™ Head Cap       |    |
| Hex Socket Head or Allen™ Head Shoulder Bolt |    |
| Sheet Metal Screw                            |    |
| Stud                                         |    |
| Drive Styles                                 |                                                                                     |
| Hex                                          |    |
| Hex and Slotted                              |   |
| Phillips®                                    |  |
| Slotted                                      |  |
| Hex Socket                                   |  |

| Nuts                         |                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------|
| Nut Styles                   |                                                                                     |
| Hex Head                     |    |
| Lock or Elastic              |    |
| Square                       |    |
| Cap or Acorn                 |    |
| Wing                         |    |
| Washers                      |                                                                                     |
| Washer Styles                |                                                                                     |
| Plain                        |    |
| Split Lock or Spring         |    |
| Spring or Wave               |    |
| External Tooth Lock          |    |
| Internal Tooth Lock          |    |
| Internal-External Tooth Lock |  |

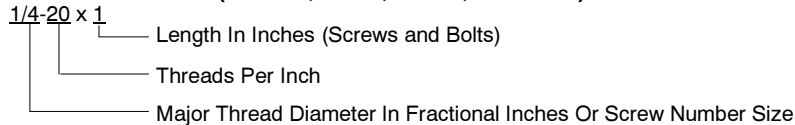
| Hardness Grades                       |                                                                                     |
|---------------------------------------|-------------------------------------------------------------------------------------|
| American Standard                     |                                                                                     |
| Grade 2                               |  |
| Grade 5                               |  |
| Grade 8                               |  |
| Grade 8/9 (Hex Socket Head)           |  |
| Metric                                |                                                                                     |
| Number stamped on hardware; 5.8 shown |  |

Allen™ head screw is a trademark of Holo-Krome Co.

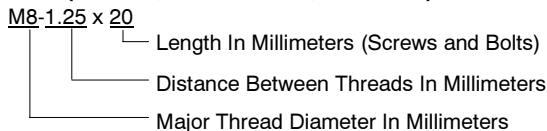
Phillips® screw is a registered trademark of Phillips Screw Company.

## Sample Dimensions

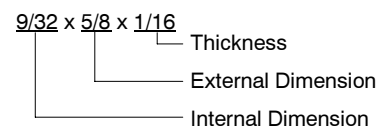
### American Standard (Screws, Bolts, Studs, and Nuts)



### Metric (Screws, Bolts, Studs, and Nuts)



### Plain Washers



### Lock Washers



## Appendix E Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

## American Standard

| Part No.                 | Dimensions     | Part No.              | Dimensions     | Part No.  | Dimensions | Type      |      |      |
|--------------------------|----------------|-----------------------|----------------|-----------|------------|-----------|------|------|
| Hex Head Bolts (Grade 5) |                | Hex Head Bolts, cont. |                | Hex Nuts  |            |           |      |      |
| X-465-17                 | 1/4-20 x .38   | X-6238-14             | 3/8-24 x .75   |           |            |           |      |      |
| X-465-6                  | 1/4-20 x .50   | X-6238-16             | 3/8-24 x 1.25  | X-6009-1  | 1-8        | Standard  |      |      |
| X-465-2                  | 1/4-20 x .62   | X-6238-21             | 3/8-24 x 4.00  | X-6210-3  | 6-32       | Whiz      |      |      |
| X-465-16                 | 1/4-20 x .75   | X-6238-22             | 3/8-24 x 4.50  | X-6210-4  | 8-32       | Whiz      |      |      |
| X-465-18                 | 1/4-20 x .88   |                       |                | X-6210-5  | 10-24      | Whiz      |      |      |
| X-465-7                  | 1/4-20 x 1.00  | X-6024-5              | 7/16-14 x .75  | X-6210-1  | 10-32      | Whiz      |      |      |
| X-465-8                  | 1/4-20 x 1.25  | X-6024-2              | 7/16-14 x 1.00 |           |            |           |      |      |
| X-465-9                  | 1/4-20 x 1.50  | X-6024-8              | 7/16-14 x 1.25 | X-6210-2  | 1/4-20     | Spiralock |      |      |
| X-465-10                 | 1/4-20 x 1.75  | X-6024-3              | 7/16-14 x 1.50 | X-6210-6  | 1/4-28     | Spiralock |      |      |
| X-465-11                 | 1/4-20 x 2.00  | X-6024-4              | 7/16-14 x 2.00 | X-6210-7  | 5/16-18    | Spiralock |      |      |
| X-465-12                 | 1/4-20 x 2.25  | X-6024-11             | 7/16-14 x 2.75 | X-6210-8  | 5/16-24    | Spiralock |      |      |
| X-465-14                 | 1/4-20 x 2.75  | X-6024-12             | 7/16-14 x 6.50 | X-6210-9  | 3/8-16     | Spiralock |      |      |
| X-465-21                 | 1/4-20 x 5.00  | X-129-15              | 1/2-13 x .75   | X-6210-10 | 3/8-24     | Spiralock |      |      |
| X-465-25                 | 1/4-28 x .38   | X-129-17              | 1/2-13 x 1.00  | X-6210-11 | 7/16-14    | Spiralock |      |      |
| X-465-20                 | 1/4-28 x 1.00  | X-129-18              | 1/2-13 x 1.25  | X-6210-12 | 1/2-13     | Spiralock |      |      |
|                          |                | X-129-19              | 1/2-13 x 1.50  | X-6210-15 | 7/16-20    | Spiralock |      |      |
| X-125-33                 | 5/16-18 x .50  | X-129-20              | 1/2-13 x 1.75  | X-6210-14 | 1/2-20     | Spiralock |      |      |
| X-125-23                 | 5/16-18 x .62  | X-129-21              | 1/2-13 x 2.00  |           |            |           |      |      |
| X-125-3                  | 5/16-18 x .75  | X-129-22              | 1/2-13 x 2.25  | X-85-3    | 5/8-11     | Standard  |      |      |
| X-125-31                 | 5/16-18 x .88  | X-129-23              | 1/2-13 x 2.50  | X-88-12   | 3/4-10     | Standard  |      |      |
| X-125-5                  | 5/16-18 x 1.00 | X-129-24              | 1/2-13 x 2.75  | X-89-2    | 1/2-20     | Standard  |      |      |
| X-125-24                 | 5/16-18 x 1.25 | X-129-25              | 1/2-13 x 3.00  |           |            |           |      |      |
| X-125-34                 | 5/16-18 x 1.50 | X-129-27              | 1/2-13 x 3.50  |           |            |           |      |      |
| X-125-25                 | 5/16-18 x 1.75 | X-129-29              | 1/2-13 x 4.00  |           |            |           |      |      |
| X-125-26                 | 5/16-18 x 2.00 | X-129-30              | 1/2-13 x 4.50  |           |            |           |      |      |
| 230578                   | 5/16-18 x 2.25 | X-463-9               | 1/2-13 x 5.50  |           |            |           |      |      |
| X-125-29                 | 5/16-18 x 2.50 | X-129-44              | 1/2-13 x 6.00  |           |            |           |      |      |
| X-125-27                 | 5/16-18 x 2.75 |                       |                |           |            |           |      |      |
| X-125-28                 | 5/16-18 x 3.00 | X-129-51              | 1/2-20 x .75   | X-25-46   | .125       | .250      | .022 | #4   |
| X-125-22                 | 5/16-18 x 4.50 | X-129-45              | 1/2-20 x 1.25  | X-25-9    | .156       | .375      | .049 | #6   |
| X-125-32                 | 5/16-18 x 5.00 | X-129-52              | 1/2-20 x 1.50  | X-25-48   | .188       | .438      | .049 | #8   |
| X-125-35                 | 5/16-18 x 5.50 |                       |                | X-25-36   | .219       | .500      | .049 | #10  |
| X-125-36                 | 5/16-18 x 6.00 | X-6021-3              | 5/8-11 x 1.00  | X-25-40   | .281       | .625      | .065 | 1/4  |
| X-125-40                 | 5/16-18 x 6.50 | X-6021-4              | 5/8-11 x 1.25  | X-25-85   | .344       | .687      | .065 | 5/16 |
|                          |                | X-6021-2              | 5/8-11 x 1.50  | X-25-37   | .406       | .812      | .065 | 3/8  |
| X-125-43                 | 5/16-24 x 1.75 | X-6021-1              | 5/8-11 x 1.75  | X-25-34   | .469       | .922      | .065 | 7/16 |
| X-125-44                 | 5/16-24 x 2.50 | 273049                | 5/8-11 x 2.00  | X-25-26   | .531       | 1.062     | .095 | 1/2  |
| X-125-30                 | 5/16-24 x .75  | X-6021-5              | 5/8-11 x 2.25  | X-25-15   | .656       | 1.312     | .095 | 5/8  |
| X-125-39                 | 5/16-24 x 2.00 | X-6021-6              | 5/8-11 x 2.50  | X-25-29   | .812       | 1.469     | .134 | 3/4  |
| X-125-38                 | 5/16-24 x 2.75 | X-6021-7              | 5/8-11 x 2.75  | X-25-127  | 1.062      | 2.000     | .134 | 1    |
|                          |                | X-6021-12             | 5/8-11 x 3.75  |           |            |           |      |      |
| X-6238-2                 | 3/8-16 x .62   | X-6021-11             | 5/8-11 x 4.50  |           |            |           |      |      |
| X-6238-10                | 3/8-16 x .75   | X-6021-10             | 5/8-11 x 6.00  |           |            |           |      |      |
| X-6238-3                 | 3/8-16 x .88   |                       |                |           |            |           |      |      |
| X-6238-11                | 3/8-16 x 1.00  | X-6021-9              | 5/8-18 x 2.50  |           |            |           |      |      |
| X-6238-4                 | 3/8-16 x 1.25  |                       |                |           |            |           |      |      |
| X-6238-5                 | 3/8-16 x 1.50  | X-6239-1              | 3/4-10 x 1.00  |           |            |           |      |      |
| X-6238-1                 | 3/8-16 x 1.75  | X-6239-8              | 3/4-10 x 1.25  |           |            |           |      |      |
| X-6238-6                 | 3/8-16 x 2.00  | X-6239-2              | 3/4-10 x 1.50  |           |            |           |      |      |
| X-6238-17                | 3/8-16 x 2.25  | X-6239-3              | 3/4-10 x 2.00  |           |            |           |      |      |
| X-6238-7                 | 3/8-16 x 2.50  | X-6239-4              | 3/4-10 x 2.50  |           |            |           |      |      |
| X-6238-8                 | 3/8-16 x 2.75  | X-6239-5              | 3/4-10 x 3.00  |           |            |           |      |      |
| X-6238-9                 | 3/8-16 x 3.00  | X-6239-6              | 3/4-10 x 3.50  |           |            |           |      |      |
| X-6238-19                | 3/8-16 x 3.25  |                       |                |           |            |           |      |      |
| X-6238-12                | 3/8-16 x 3.50  | X-792-1               | 1-8 x 2.25     |           |            |           |      |      |
| X-6238-20                | 3/8-16 x 3.75  | X-792-5               | 1-8 x 3.00     |           |            |           |      |      |
| X-6238-13                | 3/8-16 x 4.50  | X-792-8               | 1-8 x 5.00     |           |            |           |      |      |
| X-6238-18                | 3/8-16 x 5.50  |                       |                |           |            |           |      |      |
| X-6238-25                | 3/8-16 x 6.50  |                       |                |           |            |           |      |      |

## Metric

Hex head bolts are hardness grade 8.8 unless noted.

### Part No. Dimensions Hex Head Bolts (Partial Thread)

|               |                |
|---------------|----------------|
| M931-05055-60 | M5-0.80 x 55   |
| M931-06040-60 | M6-1.00 x 40   |
| M931-06055-60 | M6-1.00 x 55   |
| M931-06060-60 | M6-1.00 x 60   |
| M931-06060-SS | M6-1.00 x 60   |
| M931-06070-60 | M6-1.00 x 70   |
| M931-06070-SS | M6-1.00 x 70   |
| M931-06075-60 | M6-1.00 x 75   |
| M931-06090-60 | M6-1.00 x 90   |
| M931-06145-60 | M6-1.00 x 145  |
| M931-06150-60 | M6-1.00 x 150  |
| M931-08035-60 | M8-1.25 x 35   |
| M931-08040-60 | M8-1.25 x 40   |
| M931-08045-60 | M8-1.25 x 45   |
| M931-08050-60 | M8-1.25 x 50   |
| M931-08055-60 | M8-1.25 x 55   |
| M931-08055-82 | M8-1.25 x 55*  |
| M931-08060-60 | M8-1.25 x 60   |
| M931-08070-60 | M8-1.25 x 70   |
| M931-08070-82 | M8-1.25 x 70*  |
| M931-08075-60 | M8-1.25 x 75   |
| M931-08080-60 | M8-1.25 x 80   |
| M931-08090-60 | M8-1.25 x 90   |
| M931-08095-60 | M8-1.25 x 95   |
| M931-08100-60 | M8-1.25 x 100  |
| M931-08110-60 | M8-1.25 x 110  |
| M931-08120-60 | M8-1.25 x 120  |
| M931-08130-60 | M8-1.25 x 130  |
| M931-08140-60 | M8-1.25 x 140  |
| M931-08150-60 | M8-1.25 x 150  |
| M931-08200-60 | M8-1.25 x 200  |
| M931-10040-82 | M10-1.25 x 40* |
| M931-10040-60 | M10-1.50 x 40  |
| M931-10045-60 | M10-1.50 x 45  |
| M931-10050-60 | M10-1.50 x 50  |
| M931-10050-82 | M10-1.25 x 50* |
| M931-10055-60 | M10-1.50 x 55  |
| M931-10060-60 | M10-1.50 x 60  |
| M931-10065-60 | M10-1.50 x 65  |
| M931-10070-60 | M10-1.50 x 70  |
| M931-10080-60 | M10-1.50 x 80  |
| M931-10080-82 | M10-1.25 x 80* |
| M931-10090-60 | M10-1.50 x 90  |
| M931-10090-82 | M10-1.50 x 90* |
| M931-10100-60 | M10-1.50 x 100 |
| M931-10110-60 | M10-1.50 x 110 |
| M931-10120-60 | M10-1.50 x 120 |
| M931-10130-60 | M10-1.50 x 130 |
| M931-10140-60 | M10-1.50 x 140 |
| M931-10180-60 | M10-1.50 x 180 |
| M931-10235-60 | M10-1.50 x 235 |
| M931-10260-60 | M10-1.50 x 260 |
| M960-10330-60 | M10-1.25 x 330 |
| M931-12045-60 | M12-1.75 x 45  |
| M960-12050-60 | M12-1.25 x 50  |
| M960-12050-82 | M12-1.25 x 50* |
| M931-12050-60 | M12-1.75 x 50  |
| M931-12050-82 | M12-1.75 x 50* |
| M931-12055-60 | M12-1.75 x 55  |
| M931-12060-60 | M12-1.75 x 60  |
| M931-12060-82 | M12-1.75 x 60* |
| M931-12065-60 | M12-1.75 x 65  |
| M931-12075-60 | M12-1.75 x 75  |
| M931-12080-60 | M12-1.75 x 80  |
| M931-12090-60 | M12-1.75 x 90  |
| M931-12100-60 | M12-1.75 x 100 |
| M931-12110-60 | M12-1.75 x 110 |

### Part No. Dimensions Hex Head Bolts (Partial Thread), continued

|               |                 |
|---------------|-----------------|
| M960-16090-60 | M16-1.50 x 90   |
| M931-16090-60 | M16-2.00 x 90   |
| M931-16100-60 | M16-2.00 x 100  |
| M931-16100-82 | M16-2.00 x 100* |
| M931-16120-60 | M16-2.00 x 120  |
| M931-16150-60 | M16-2.00 x 150  |
| M931-20065-60 | M20-2.50 x 65   |
| M931-20090-60 | M20-2.50 x 90   |
| M931-20100-60 | M20-2.50 x 100  |
| M931-20120-60 | M20-2.50 x 120  |
| M931-20140-60 | M20-2.50 x 140  |
| M931-20160-60 | M20-2.50 x 160  |
| M931-22090-60 | M22-2.50 x 90   |
| M931-22120-60 | M22-2.50 x 120  |
| M931-22160-60 | M22-2.50 x 160  |
| M931-24090-60 | M24-3.00 x 90   |
| M931-24120-60 | M24-3.00 x 120  |
| M931-24160-60 | M24-3.00 x 160  |
| M931-24200-60 | M24-3.00 x 200  |

### Hex Head Bolts (Full Thread)

|               |                |
|---------------|----------------|
| M933-04006-60 | M4-0.70 x 6    |
| M933-05030-60 | M5-0.80 x 30   |
| M933-05035-60 | M5-0.80 x 35   |
| M933-05050-60 | M5-0.80 x 50   |
| M933-06010-60 | M6-1.00 x 10   |
| M933-06012-60 | M6-1.00 x 12   |
| M933-06014-60 | M6-1.00 x 14   |
| M933-06016-60 | M6-1.00 x 16   |
| M933-06020-60 | M6-1.00 x 20   |
| M933-06025-60 | M6-1.00 x 25   |
| M933-06030-60 | M6-1.00 x 30   |
| M933-06040-60 | M6-1.00 x 40   |
| M933-06050-60 | M6-1.00 x 50   |
| M933-07025-60 | M7-1.00 x 25   |
| M933-08010-60 | M8-1.25 x 10   |
| M933-08012-60 | M8-1.25 x 12   |
| M933-08016-60 | M8-1.25 x 16   |
| M933-08020-60 | M8-1.25 x 20   |
| M933-08025-60 | M8-1.25 x 25   |
| M933-08030-60 | M8-1.25 x 30   |
| M933-08030-82 | M8-1.25 x 30*  |
| M933-10012-60 | M10-1.50 x 12  |
| M961-10020-60 | M10-1.25 x 20  |
| M933-10020-60 | M10-1.50 x 20  |
| M933-10025-60 | M10-1.50 x 25  |
| M961-10025-60 | M10-1.25 x 25  |
| M933-10025-82 | M10-1.50 x 25* |
| M961-10030-60 | M10-1.25 x 30  |
| M933-10030-60 | M10-1.50 x 30  |
| M933-10030-82 | M10-1.50 x 30* |
| M961-10035-60 | M10-1.25 x 35  |
| M933-10035-60 | M10-1.50 x 35  |
| M933-10035-82 | M10-1.50 x 35* |
| M961-10040-60 | M10-1.25 x 40  |

### Part No. Dimensions Hex Head Bolts (Full Thread), continued

|                |                |
|----------------|----------------|
| M933-12016-60  | M12-1.75 x 16  |
| M933-12020-60  | M12-1.75 x 20  |
| M961-12020-60F | M12-1.50 x 20  |
| M933-12025-60  | M12-1.75 x 25  |
| M933-12025-82  | M12-1.75 x 25* |
| M961-12030-60  | M12-1.25 x 30  |
| M933-12030-82  | M12-1.75 x 30* |
| M961-12030-82F | M12-1.50 x 30* |
| M933-12030-60  | M12-1.75 x 30  |
| M933-12035-60  | M12-1.75 x 35  |
| M961-12040-82  | M12-1.25 x 40* |
| M933-12040-60  | M12-1.75 x 40  |
| M933-12040-82  | M12-1.75 x 40* |
| M961-14025-60  | M14-1.50 x 25  |
| M933-14025-60  | M14-2.00 x 25  |
| M961-14050-82  | M14-1.50 x 50* |
| M961-16025-60  | M16-1.50 x 25  |
| M933-16025-60  | M16-2.00 x 25  |
| M961-16030-82  | M16-1.50 x 30* |
| M933-16030-82  | M16-2.00 x 30* |
| M933-16035-60  | M16-2.00 x 35  |
| M961-16040-60  | M16-1.50 x 40  |
| M933-16040-60  | M16-2.00 x 40  |
| M961-16045-82  | M16-1.50 x 45* |
| M933-16045-82  | M16-2.00 x 45* |
| M933-16050-60  | M16-2.00 x 50  |
| M933-16050-82  | M16-2.00 x 50* |
| M933-16060-60  | M16-2.00 x 60  |
| M933-16070-60  | M16-2.00 x 70  |
| M933-18035-60  | M18-2.50 x 35  |
| M933-18050-60  | M18-2.50 x 50  |
| M933-18060-60  | M18-2.50 x 60  |
| M933-20050-60  | M20-2.50 x 50  |
| M933-20055-60  | M20-2.50 x 55  |
| M933-24060-60  | M24-3.00 x 60  |
| M933-24065-60  | M24-3.00 x 65  |
| M933-24070-60  | M24-3.00 x 70  |

### Pan Head Machine Screws

|                 |               |
|-----------------|---------------|
| M7985A-03010-20 | M3-0.50 x 10  |
| M7985A-03012-20 | M3-0.50 x 12  |
| M7985A-04010-20 | M4-0.70 x 10  |
| M7985A-04016-20 | M4-0.70 x 16  |
| M7985A-04020-20 | M4-0.70 x 20  |
| M7985A-04050-20 | M4-0.70 x 50  |
| M7985A-04100-20 | M4-0.70 x 100 |
| M7985A-05010-20 | M5-0.80 x 10  |
| M7985A-05012-20 | M5-0.80 x 12  |
| M7985A-05016-20 | M5-0.80 x 16  |
| M7985A-05020-20 | M5-0.80 x 20  |
| M7985A-05025-20 | M5-0.80 x 25  |
| M7985A-05030-20 | M5-0.80 x 30  |
| M7985A-05080-20 | M5-0.80 x 80  |
| M7985A-05100-20 | M5-0.80 x 100 |
| M7985A-06100-20 | M6-1.00 x 100 |

### Flat Head Machine Screws

|                |              |
|----------------|--------------|
| M965A-04012-SS | M4-0.70 x 12 |
| M965A-05012-SS | M5-0.80 x 12 |
| M965A-05016-20 | M5-0.80 x 16 |
| M965A-06012-20 | M6-1.00 x 12 |

\* This metric hex bolt's hardness is grade 10.9.

## Metric, continued

| Part No.        | Dimensions | Type         |
|-----------------|------------|--------------|
| <b>Hex Nuts</b> |            |              |
| M934-03-50      | M3-0.50    | Standard     |
| M934-04-50      | M4-0.70    | Standard     |
| M934-04-B       | M4-0.70    | Brass        |
| M934-05-50      | M5-0.80    | Standard     |
| M934-06-60      | M6-1.00    | Standard     |
| M934-06-64      | M6-1.00    | Std. (green) |
| M6923-06-80     | M6-1.00    | Spiralock    |
| M982-06-80      | M6-1.00    | Elastic Stop |
| M934-08-60      | M8-1.25    | Standard     |
| M6923-08-80     | M8-1.25    | Spiralock    |
| M982-08-80      | M8-1.25    | Elastic Stop |
| M934-10-60      | M10-1.50   | Standard     |
| M934-10-60F     | M10-1.25   | Standard     |
| M6923-10-80     | M10-1.50   | Spiralock    |
| M6923-10-62     | M10-1.50   | Spiralock†   |
| M982-10-80      | M10-1.50   | Elastic Stop |
| M934-12-60      | M12-1.75   | Standard     |
| M934-12-60F     | M12-1.25   | Standard     |
| M6923-12-80     | M12-1.75   | Spiralock    |
| M982-12-80      | M12-1.75   | Elastic Stop |
| M982-14-60      | M14-2.00   | Elastic Stop |
| M6923-16-80     | M16-2.00   | Spiralock    |
| M982-16-80      | M16-2.00   | Elastic Stop |
| M934-18-80      | M18-2.5    | Standard     |
| M982-18-60      | M18-2.50   | Elastic Stop |
| M934-20-80      | M20-2.50   | Standard     |
| M982-20-80      | M20-2.50   | Elastic Stop |
| M934-22-60      | M22-2.50   | Standard     |
| M934-24-80      | M24-3.00   | Standard     |
| M982-24-60      | M24-3.00   | Elastic Stop |
| M934-30-80      | M30-3.50   | Standard     |

## Washers

| Part No.    | ID   | OD   | Thick. | Bolt/<br>Screw |
|-------------|------|------|--------|----------------|
| M125A-03-80 | 3.2  | 7.0  | 0.5    | M3             |
| M125A-04-80 | 4.3  | 9.0  | 0.8    | M4             |
| M125A-05-80 | 5.3  | 10.0 | 1.0    | M5             |
| M125A-06-80 | 6.4  | 12.0 | 1.6    | M6             |
| M125A-08-80 | 8.4  | 16.0 | 1.6    | M8             |
| M125A-10-80 | 10.5 | 20.0 | 2.0    | M10            |
| M125A-12-80 | 13.0 | 24.0 | 2.5    | M12            |
| M125A-14-80 | 15.0 | 28.0 | 2.5    | M14            |
| M125A-16-80 | 17.0 | 30.0 | 3.0    | M16            |
| M125A-18-80 | 19.0 | 34.0 | 3.0    | M18            |
| M125A-20-80 | 21.0 | 37.0 | 3.0    | M20            |
| M125A-24-80 | 25.0 | 44.0 | 4.0    | M24            |

† This metric hex nut's hardness is grade 8.

# Index

Listed below are part numbers and page numbers of modules listed in this manual. Italicized numbers refer to the page numbers on which modules appear.

GM13281-MA6, 5  
GM19673-MA160, 16  
GM19673-MA161, 16  
GM19673-MA162, 16  
GM19673-MA163, 16  
GM19673-MA164, 16  
GM19673-MA165, 16  
GM19673-MA166, 19

GM19673-MA167, 19  
GM19673-MA168, 19  
GM19673-MA169, 19  
GM19673-MA170, 19  
GM19673-MA171, 19  
GM38532-MA2, 5  
GM38533-MA1, 13

GM41993-MA1, 7  
GM41999-MA1, 21  
GM41999-MA2, 21  
GM41999-MA3, 21  
GM42000-MA1, 21  
GM42000-MA2, 21  
GM42000-MA3, 21



DDC/MTU Power Generation  
605 North 8th Street, Suite 501  
Sheboygan, Wisconsin 53081 USA  
Phone 920-451-0846, Fax 920-451-0843  
[ddcmtupowergeneration.com](http://ddcmtupowergeneration.com)