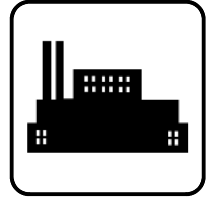


# Service Parts

## Generator Sets



Models:

**230-300REOZD**

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

See TP-6009 Parts Catalog Industrial Controller for controller parts

**ISO 9001**  
**KOHLER**  
GENERATORS  
INTERNATIONALLY REGISTERED

**KOHLER**<sup>®</sup>  
POWER SYSTEMS

TP-5978 6/01b

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# Introduction

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

At the time of print this manual applied to the generator set specification (spec) numbers listed in the Specification Number Index. On occasion this manual may apply to specs not listed in the Specification Number Index.

Information in this publication represents data available at the time of print. Kohler Co. 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.

x:in:004:002

## 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.

x:in:004:003:a

## 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 instructions.

x:in:004:004

## 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.

x:in:004:005

## 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.

x:in:004:006

# Specification Number Index

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

<b>230REOZD</b>									
PA-194316	8	19	26	1	13	27	†	10	
PA-194317	8	19	26	1	13	28	†	10	
PA-194320	*	*	26	1	*	*	†	10	
PA-194321	8	19	27	1	13	27	†	10	
PA-194323	*	*	27	1	*	*	†	10	
GM13659-GA7	*	*	GR2	GR1	*	*	†	10	
GM13659-GA8	*	*	GR1	GR1	*	*	†	10	
<b>250REOZD</b>									
PA-194332	8	19	26	1	13	29	†	19	
PA-194333	8	19	26	1	13	30	†	19	
PA-194334	8	19	26	1	13	31	†	19	
PA-194335	8	19	26	1	13	32	†	19	
PA-194336	*	*	26	1	*	*	†	19	
PA-194337	8	19	27	1	13	29	†	19	
PA-194338	8	19	27	1	13	31	†	19	
PA-194339	*	*	27	1	*	*	†	19	
GM13659-GA5	*	*	GR2	GR1	*	*	†	19	
GM13659-GA6	*	*	GR1	GR1	*	*	†	19	
<b>275REOZD</b>									
PA-194348	8	25	28	1	13	29	†	21	
PA-194349	8	25	28	1	13	30	†	21	
PA-194352	*	*	28	1	*	*	†	21	
PA-194353	8	25	29	1	13	29	†	21	
PA-194355	*	*	29	1	*	*	†	21	
GM13659-GA3	*	*	GR4	GR1	*	*	†	21	
GM13659-GA4	*	*	GR3	GR1	*	*	†	21	
<b>300REOZD</b>									
PA-194364	8	25	30	1	13	31	†	12	
PA-194365	8	25	30	1	13	32	†	12	
PA-194366	*	*	30	1	*	*	†	12	
PA-194367	8	25	31	1	13	31	†	12	
PA-194368	*	*	31	1	*	*	†	12	
GM13659-GA1	*	*	GR6	GR1	*	*	†	12	
GM13659-GA2	*	*	GR5	GR1	*	*	†	12	

\* Configured group. Refer to the generator set nameplate for the module number. Turn to the respective group on the following pages for parts breakdowns.

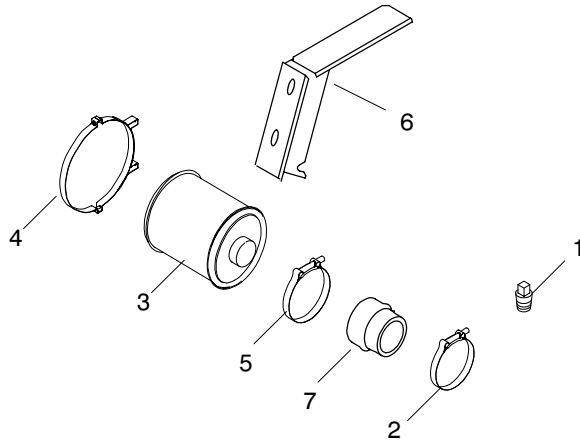
† Configured group. Refer to the generator set nameplate for the module number. See controller parts catalog TP-6009 for controller parts lists.

# Recommended Spare Parts

This table provides recommended spare part numbers for modular specs with a 16-light controller and a unit-mounted radiator.

Item	Part Number	Description	Quantity 230-275 kW
	291207	Fuse, 1.5 A, 250 V	5
	A-336415	PC board, controller (main)	1
	A-360418	Photo board	1
	A-354299	FR activator	1
	A-257099	LED board	1
	A-354653	Voltage regulator	1
	A-336432	PC board, controller (indicator)	1
	283420	Bulb	5
	X-6014-88	Hose, radiator	1
	343289	Hose, radiator	1
	343430	Hose	1
	343623	Belt	1
	272982	Cleaner, air	7
	343447	Filter, fuel	7
	343445	Filter, oil	14
	365289	Sensor, low fluid	1

# Group 101:Air Intake



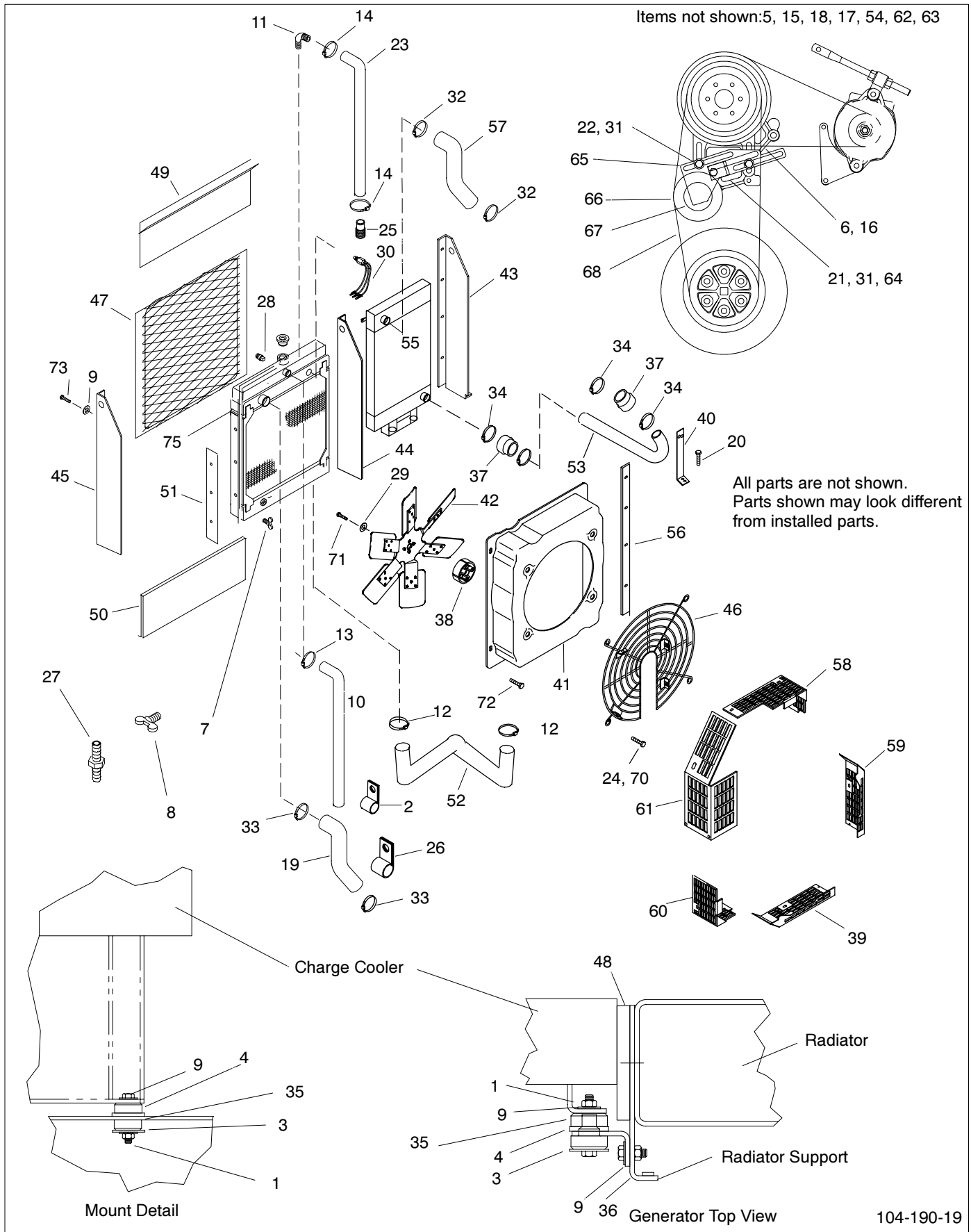
101-190-8

Item	Part Number	Description	Quantity				
			8	343479	GM13281-MA1	GM13281-MA5	343508*
1	X-75-4	Plug, pipe, 1/8"	1	1			
2	254344	Clamp, hose	1	1	1	1	
3	272982	Cleaner, air	1	1	1	1	
4	343530	Clamp, air cleaner	1	1	1	1	
5	343587	Clamp, hose	1	1	1	1	
6	343531	Bracket, ac support			1		
6	343588	Bracket, ac support	1	1		1	
7	354441	Hose, hump	1	1	1	1	

\* See Kit List section for heavy-duty air cleaner kits.

# Notes

# Group 104: Cooling System

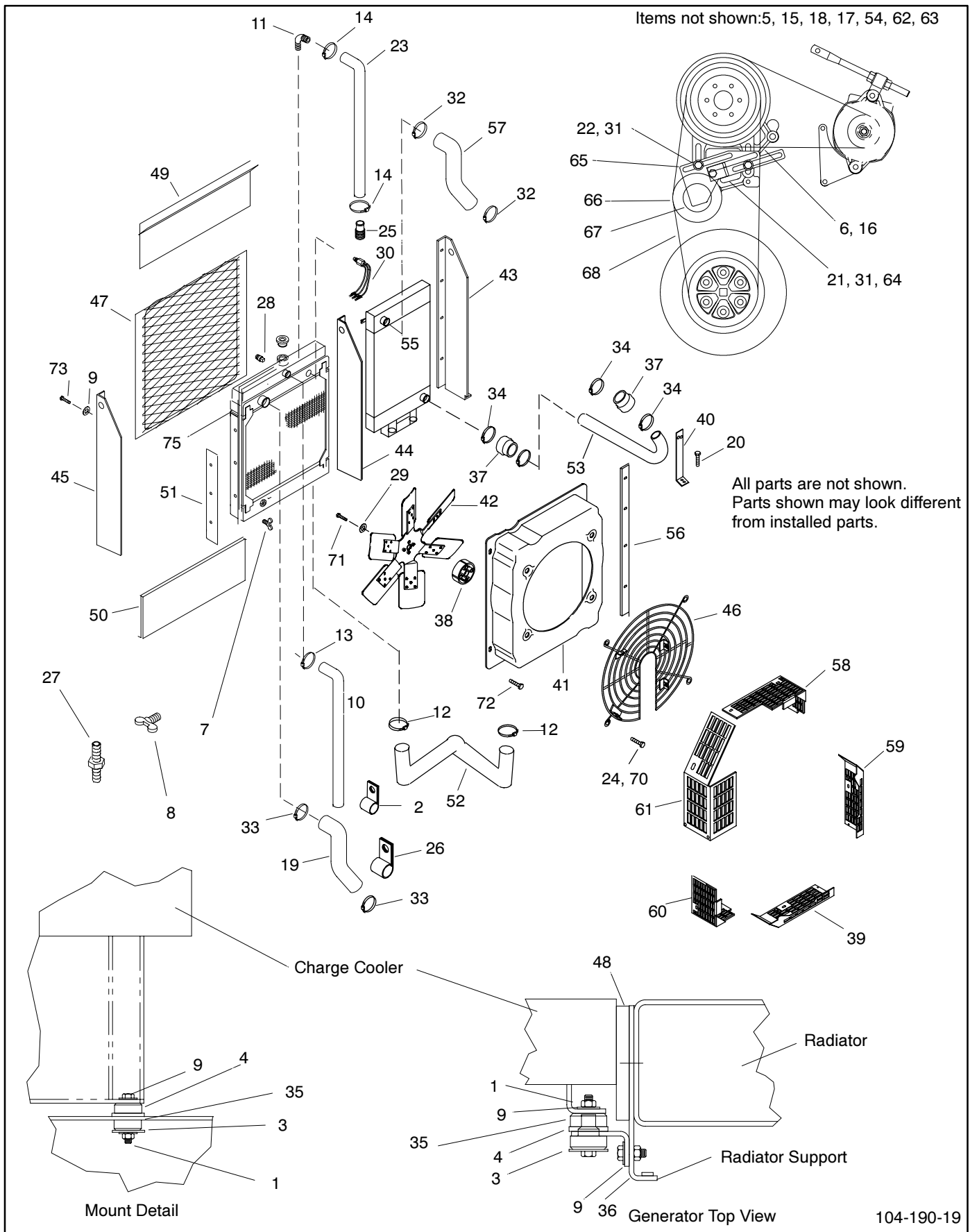


## Group 104: Cooling System

Item	Part Number	Description	Quantity				
			Variation/Kit Number				
			19	25	350425	343993	354994
1	X-101-16	Nut, elastic stop, 5/16-18	4	4	4	4	4
2	X-672-4	Clamp, insulating	1	1	1	1	1
3	X-25-143	Washer, plain	4	4	4	4	4
4	X-25-144	Washer, plain	4	4	4	4	4
5	X-25-30	Washer, plain (not shown)	2	4	4	2	2
6	X-25-44	Washer, plain	1	1	1	4	1
7	X-256-3	Valve, drain, 1/4"	3	3	3	3	3
8	X-256-5	Valve, drain	1	1	1	1	1
9	X-25-75	Washer, plain	16	16	16	16	16
10	X-356-38	Hose, radiator	1	1	1	1	1
11	X-391-20	Connector, hose elbow	1	1	1	1	1
12	X-426-2	Clamp, hose, 1-7/8-3-5/32"	2	2	2	2	2
13	X-426-8	Clamp, hose	2	2	2	2	2
14	X-426-9	Clamp, hose	2	2	2	2	2
15	X-468-7	Tie, cable (not shown)	1	1	1	1	1
16	X-55-46	Screw, HC slotted, 5/16"	1	1	1	1	1
17	X-555-1	Elbow, street (not shown)	1	1	1	1	1
18	X-6003-8	Conduit, convoluted	1	1	1	1	1
19	X-6014-88	Hose, radiator	1	1	1	1	1
20	X-6050-8	Screw, HHC	2	2	2	2	2
21	X-6052-1	Screw, HHC	2	2	2	2	2
22	X-6052-15	Screw, HHC	2	2	2	2	2
23	X-6359-9	Hose, rubber	1	1	1	1	1
24	X-6365-1	Insert, threaded	8	8	8	8	8
25	X-652-3	Fitting, hose	1	1	1	1	1
26	X-672-19	Clamp, insulated	1	1	1	1	1
27	X-751-1	Adapter, hose, 1 x 1"	1	1	1	1	1
28	X-75-53	Plug, pipe, 3/8"	1			1	1
29	X-801-3	Washer, hardened	6	6	6	6	6
30	365289	Sensor, low fluid	1	1	1	1	1
31	257951	Washer, special	3	3	3	3	3
32	274545	Clamp, hose	2	2	2	2	2
33	275527	Clamp, hose	2	2	2	2	2
34	291590	Clamp, hose	4	4	4	4	4
35	324433	Vibromount	4	4	4	4	4
36	324451	Bracket, chargecooler	2	2	2	2	2
37	324473	Hose, hump	2	2	2	2	2
38	343067	Spacer, fan	1	1	1	1	1
39	343097	Guard, belt (bottom)	1	1	1	1	1
40	343136	Bracket, mounting	1	1	1	1	1

Parts lists continues on page 9

# Group 104: Cooling System, continued



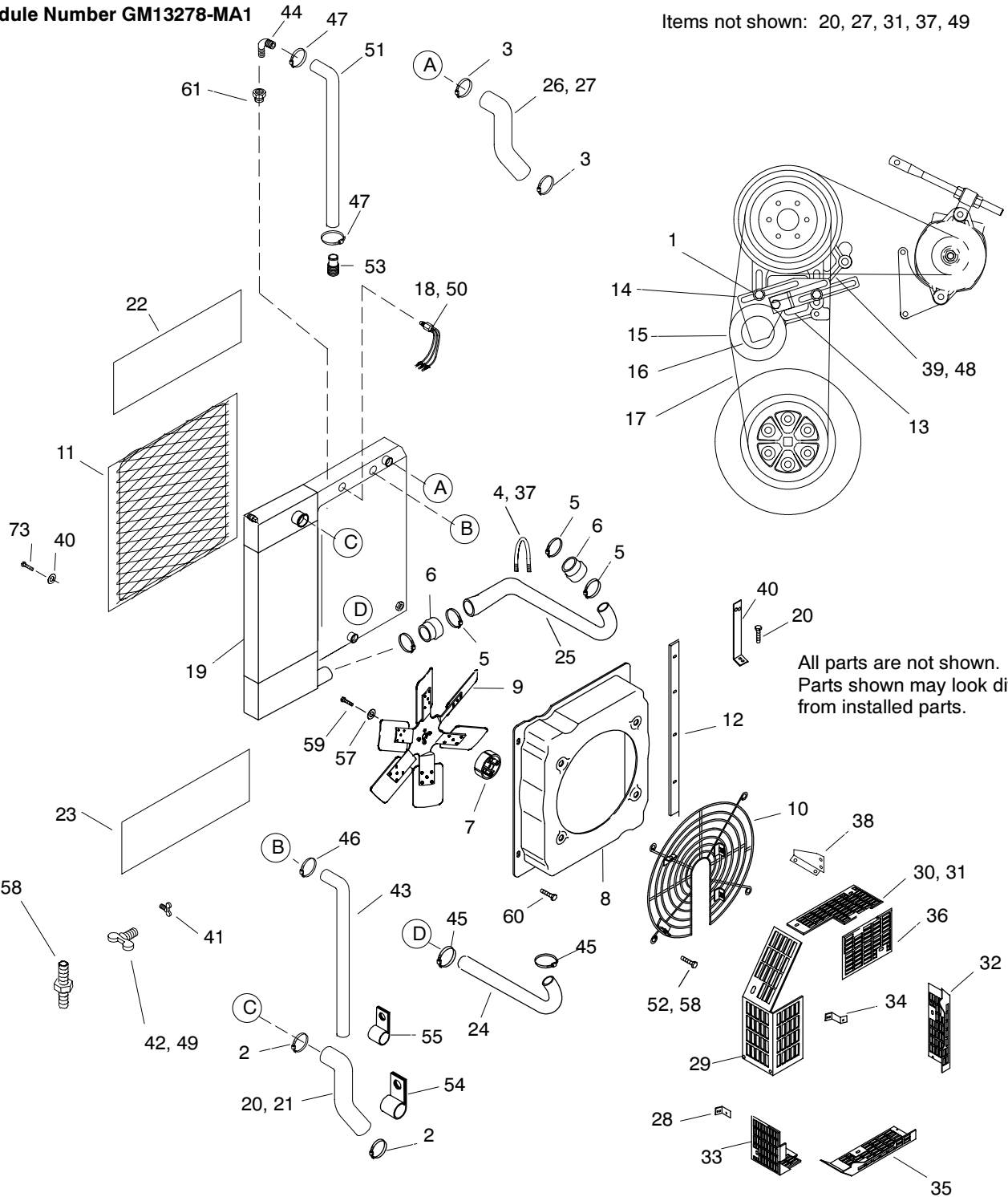
## Group 104: Cooling System, continued

Item	Part Number	Description	Quantity				
			Variation/Kit Number				
			19	25	350425	354993	354994
41	343176	Shroud, fan	1	1	1	1	1
42	343180	Fan, pusher	1	1	1	1	1
43	343182	Support, cooler	1	1	1	1	1
44	343183	Support, radiator	1	1	1	1	1
45	343184	Support, radiator	1	1	1	1	1
46	343185	Guard, fan	1	1	1	1	1
47	343186	Guard, radiator	1	1	1	1	1
48	343193	Insulation, foam	1	1	1	1	1
49	343214	Guard, radiator (top)	1	1	1	1	1
50	343215	Guard, radiator (bottom)	1	1	1	1	1
51	343288	Spacer, radiator	2	2	2	2	2
52	343289	Hose, radiator (bottom)	1	1	1	1	1
53	GM16637	Tube, charge cooler	1	1	1	1	1
54	343351	Bracket, charge tube mounting	1	1	1	1	1
55	343592	Cooler, charge air		1	1		
55	343592	Cooler, charge air	1			1	1
56	343424	Bracket, fan shroud	2	2	2	2	2
57	343430	Hose, charge cooler (top)	1	1	1	1	1
58	343434	Guard, top belt	1	1	1	1	1
59	343435	Guard, belt (RS)	1	1	1	1	1
60	343436	Guard, belt (LS)	1	1	1	1	1
61	343437	Guard, alternator belt	1	1	1	1	1
62	343439	Bracket, support	1	1	1	1	1
63	343586	Support, belt guard	1	1	1	1	1
64	343619	Bracket, pulley tensioner	1	1	1	1	1
65	343620	Bracket, pulley tensioner	1	1	1	1	1
66	343621	Pulley, idler	1	1	1	1	1
67	343622	Bushing, idler	1	1	1	1	1
68	343623	V-belt	3	3	3	3	3
69	343682	Bracket, belt guard	1	1	1	1	1
70	X-125-5	Screw	8	8	8	8	8
71	X-6238-36	Screw	6	6	6	6	6
72	X-125-3	Screw	8	8	8	8	8
73	X-125-24	Screw	10	10	10	10	10
74	X-6238-13	Screw (not shown)	1	1	1	1	1
75	A-343177	Radiator assembly	1			1	1
75	A-343525	Radiator assembly		1	1		

# Group 104: Cooling System, continued

Module Number GM13278-MA1

Items not shown: 20, 27, 31, 37, 49



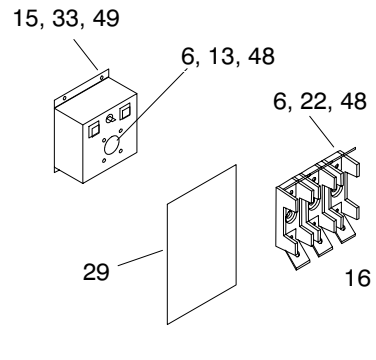
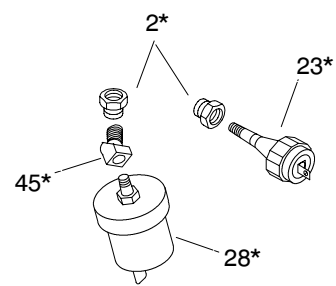
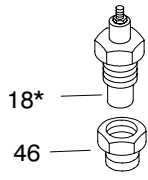
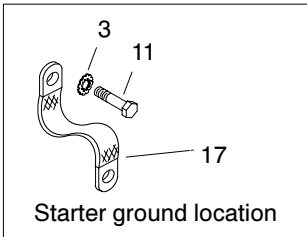
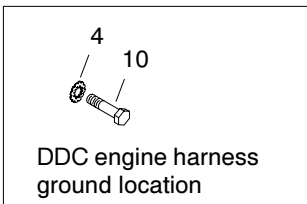
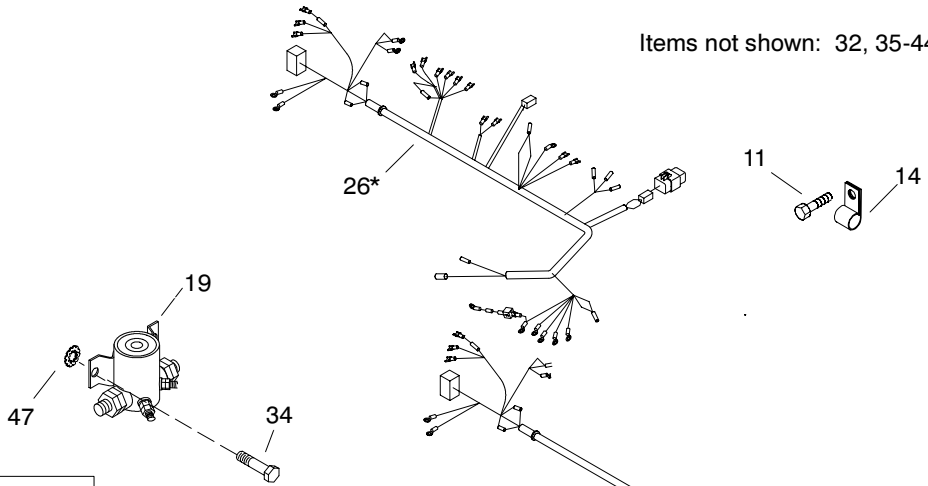
GM13278

## Group 104: Cooling System, continued

Item	Part Number	Description	Quantity
			Module Number GM13278-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.	1
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	343180	Fan, pusher	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
20	GM12036	Bracket, charge tube mounting (upper)	1
21	GM12037	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 OD	1
40	X-25-75	Washer, plain, .344 ID x .875 in. OD	18
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 deg. (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 street	1
50	X-6003-8	Conduit, convoluted	1
51	X-6359-9	Hose, rubber, straight, .25 in. ID	1
52	X-6365-2	Insert, threaded, 5/16-18 in.	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-801-3	Washer, hardened, .406 ID x .812 in. OD	6
58	X-125-5	Screw, HC	8
59	X-6238-36	Screw, HC	6
60	X-125-3	Screw, HC	8
61	X-202-27	Bushing, reducer (1/8 x 1/4 in. NPT)	1

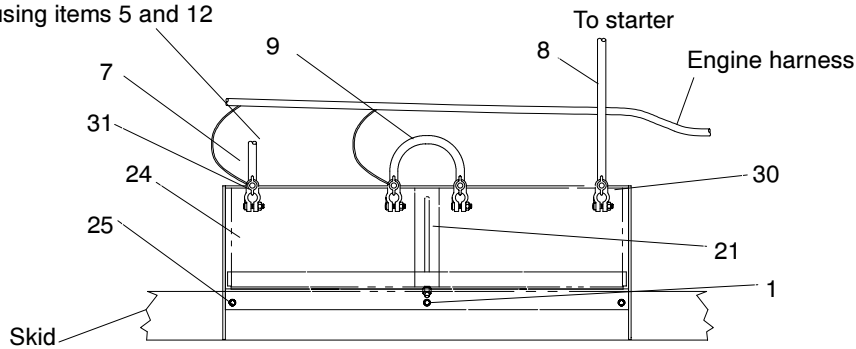
# Group 105: Engine

Items not shown: 32, 35-44



Attach to engine block using items 5 and 12

Top view of battery rack



\* See Control and Harness group for part number.

105-190-26

# Group 105: Engine

Item	Part Number	Description	Quantity												
			Variation Number												
			26	27	28	29	30	31	GR1	GR2	GR3	GR4	GR5	GR6	
1	M982-08-80	Nut, hex elastic stop	1	1	1	1	1	1	1	1	1	1	1	1	1
2	*	Bushing, reducer, 1/8 x 1/4"	2	2	2	2	2	2	2	2	2	2	2	2	2
3	X-22-14	Washer, lock, 3/8" int./ext. tooth	1	1	1	1	1	1	1	1	1	1	1	1	1
4	X-22-16	Washer, lock, 5/16" int./ext. tooth	2	2	2	2	2	2	2	2	2	2	2	2	2
5	X-22-26	Washer, lock, 1/2" int./ext. tooth	1	1	1	1	1	1	1	1	1	1	1	1	1
6	M7985A-03012-20	Screw, pan head M3 x 12	8	8	8	8	8	8	8	8	8	8	8	8	8
7	X-545-112	Cable, battery	1	1	1	1	1	1	1	1	1	1	1	1	1
8	X-545-129	Cable, battery	1	1	1	1	1	1	1	1	1	1	1	1	1
9	X-545-73	Cable, battery	1	1	1	1	1	1	1	1	1	1	1	1	1
10	M933-08016-60	Screw, HC	1	1	1	1	1	1	1	1	1	1	1	1	1
11	M933-10020-60	Screw, HC	1	1	1	1	1	1	1	1	1	1	1	1	1
12	M933-12020-60	Screw, HC	1	1	1	1	1	1	1	1	1	1	1	1	1
13	X-6214-6	Cap, plastic	1	1	1	1	1	1	1	1	1	1	1	1	1
14	X-672-32	Clamp, insulated	1	1	1	1	1	1	1	1	1	1	1	1	1
15	M934-04-50	Nut, hex 4mm	4	4	4	4	4	4	4	4	4	4	4	4	4
16	239298	Fuse, 5 A, 250 V, .25 x 1.25"	1	1	1	1	1	1	1	1	1	1	1	1	1
17	266581	Strap, ground	1	1	1	1	1	1	1	1	1	1	1	1	1
18	*	Sender, water temperature	1	1	1	1	1	1	1	1	1	1	1	1	1
19	268371	Relay	1	1	1	1	1	1	1	1	1	1	1	1	1
20	283645	Fuse 15 A, 250 V, .25 x 1.25"	2	2	2	2	2	2	2	2	2	2	2	2	2
21	286316	Bolt, angle	1	1	1	1	1	1	1	1	1	1	1	1	1
21	GM13268	Bolt, angle								1	1	1	1	1	1
22	292821	Holder, fuse	1	1	1	1	1	1	1	1	1	1	1	1	1
23	*	Switch, assembly pressure	1	1	1	1	1	1	1	1	1	1	1	1	1
24	343220	Rack, battery	1	1	1	1	1	1	1	1	1	1	1	1	1
25	343221	Clamp, battery	1	1	1	1	1	1	1	1	1	1	1	1	1
26	*	Harness, wiring (includes items 35-41)	1	1	1	1	1	1	1	1	1	1	1	1	1
27	*	Harness, wiring DDEC (includes items 42-44)	1	1	1	1	1	1	1	1	1	1	1	1	1
28	*	Sender, oil pressure	1	1	1	1	1	1	1	1	1	1	1	1	1
29	343601	Strip, marker, 3-fuse	1	1	1	1	1	1	1	1	1	1	1	1	1
30	345039	Terminal, battery	2	2	2	2	2	2	2	2	2	2	2	2	2
31	345056	Terminal, battery	2	2	2	2	2	2	2	2	2	2	2	2	2
32	A-343448	Engine assembly (not shown)	1								1				
32	A-343449	Engine assembly (not shown)		1											
32	A-343454	Engine assembly (not shown)			1							1			
32	A-343456	Engine assembly (not shown)				1						1			
32	A-343450	Engine assembly (not shown)					1							1	
32	A-343451	Engine assembly (not shown)						1						1	
33	A-343591	Box assembly, engine light	1	1	1	1	1	1	1	1	1	1	1	1	1
34	#	Hardware, 1/4-20	2	2	2	2	2	2	2	2	2	2	2	2	2
35	*	Diode, 6 A, 100 V (not shown)	3	3	3	3	3	3	3	3	3	3	3	3	3
36	*	Connector, jack, 4-position (P2) (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
37	*	Connector, plug, 9-position (P4) (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
38	*	Connector, plug, 6-position (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
39	*	Boot (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
40	*	Connector, cable (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
41	*	Connector, 24-position (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
42	*	Connector, 30-pin (P5) (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
43	*	Connector, 5-pin (P3) (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
44	*	Connector, 6-pin (P6) (not shown)	1	1	1	1	1	1	1	1	1	1	1	1	1
45	*	Elbow, 45° street	1	1	1	1	1	1	1	1	1	1	1	1	1
46	153659	Bushing, reducing, 1/2 x 3/4 in. NPT	1	1	1	1	1	1	1	1	1	1	1	1	1
47	X-22-12	Washer, lock, .262 ID x .743 in OD	4	4	4	4	4	4	4	4	4	4	4	4	4
48	M934-03-04	Nut, hex 3mm	8	8	8	8	8	8	8	8	8	8	8	8	8
49	M7985A-04020-20	Washer, lock, .262 ID x .743 in OD	4	4	4	4	4	4	4	4	4	4	4	4	4

# Common hardware. Procure locally.

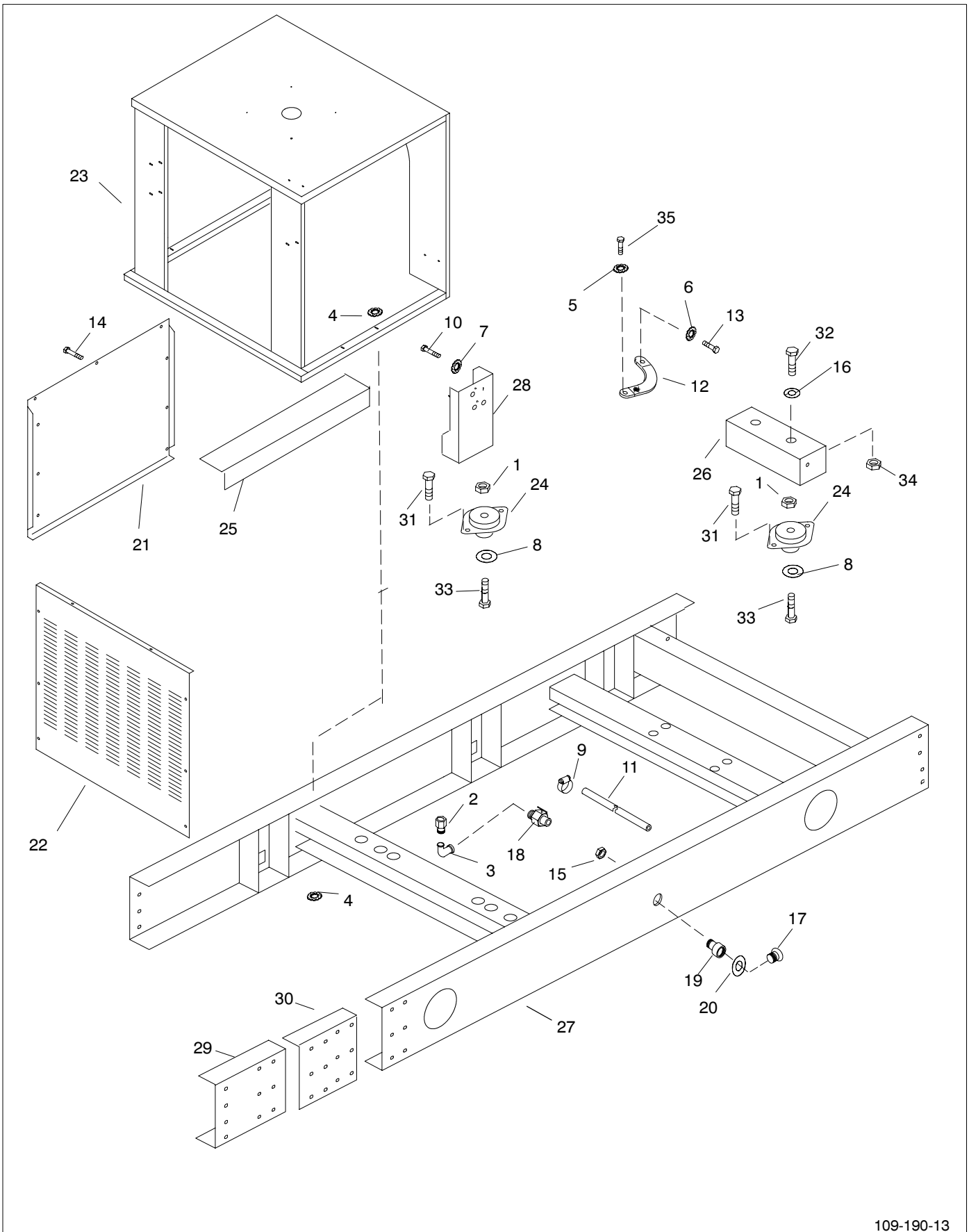
\* See Control and Harness group for part number.

## Group 107: Nameplate and Decals

Item	Part Number	Description	Quantity	
			Variation Number	
			1	GR1
1	X-6232-3	Decal, stripes	1	1
2	X-6232-6	Decal, stripe	2	2
3	X-6246-1	Decal, Kohler Power Systems	2	2
4	224233	Decal, 1-800 number	1	1
5	238402	Decal	1	1
6	249808	Decal, warning	1	1
7	249809	Decal, warning	1	1
8	249810	Decal, warning	1	1
9	GM15300	Decal, exhaust piping	1	1
10	257437	Decal, warning	1	1
11	257438	Decal, danger	3	3
12	257441	Decal, warning	1	1
13	258815	Decal, warning	1	1
14	259365	Decal	1	1
15	273739	Decal	2	2
16	273780	Decal, warning	1	1
17	327004	Nameplate	1	1
18	343165	Decal, caution—not a step	1	1
19	364116	Decal, caution	2	2
20	GM19290	Decal, fuel type		1
21	GM13776	Decal, FRII reconnection		1

# Notes

# Group 109: Skid and Plant Mounting



109-190-13

## Group 109: Skid and Plant Mounting

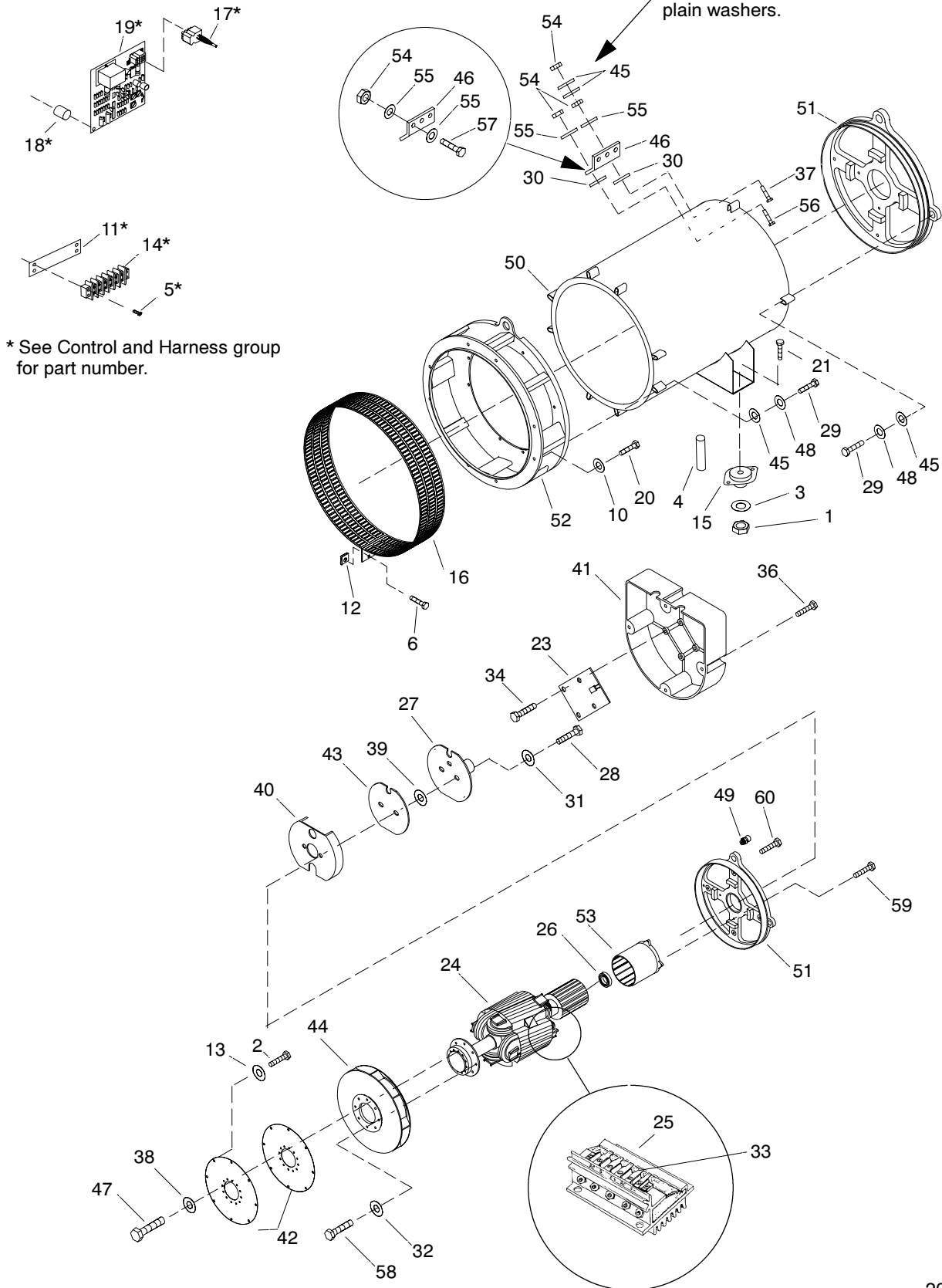
Item	Part Number	Description	Quantity		
			Variation/Kit Number		
			13	354995	GM13658-MA1
1	X-101-15	Nut, elastic stop, 5/8-11	4	4	
1	M982-16-80	Nut, hex elastic stop			4
2	X-202-41	Bushing, reducer	1	1	1
3	X-211-1	Elbow, street, 1/2"	1	1	1
4	X-22-14	Washer, lock, 3/8" int./ext. tooth	4	4	2
5	X-22-16	Washer, lock, 5/16" int./ext. tooth	1	1	1
6	X-22-26	Washer, lock, 1/2" int./ext. tooth	1	1	1
7	X-22-30	Washer, lock, 5/8" ext. tooth	8	8	2
8	X-25-112	Washer, plain	4	4	4
9	X-426-10	Clamp, hose	2	2	2
10	X-55-25	Screw, socket head	8	8	8
11	X-577-27	Hose	1	1	1
12	X-6046-5	Strap, ground	1	1	1
13	X-6052-1	Screw, HC	1	1	
13	M933-12030-60	Screw, HC			1
14	X-6216-1	Screw, PHC	12	12	12
15	X-80-1	Nut, hex	1	1	1
16	M125A-20-80	Washer	2	2	2
16	X-801-8	Washer, hardened			2
17	241062	Plug, drain	1	1	1
18	272701	Valve, oil drain	1	1	1
19	273729	Adapter, hose	1	1	1
20	276552	Washer, nylon	1	1	1
21	336001-BLK	Cover, side	2	2	2
22	336005-BLK	Cover, rear	1	1	1
23	336021	Box, junction	1	1	1
24	336024	Vibromount	4	4	4
25	336085	Bracket, junction box	2	2	2
26	343032	Support, engine (front)	1	1	1
27	343102	Skid	1	1	1
28	343103	Bracket, engine mounting	2	2	2
29	343105	Extension, skid	2	2	2
30	343107	Bracket, connection	2	2	2
31	#	Hardware, 3/8-16	4	4	
31	M931-161120-60	Screw, HC			4
32	M933-20050-60	Screw, HC	2	2	
32	M933-20050-60	Screw, HC	2	2	
32	M933-16050-60	Screw, HC			2
33	X-6021-12	Screw, HC	2	2	
33	M931-16100-60	Screw, HC			2
34	M982-20-80	Nut, elastic stop	2	2	2
35	X-125-24	Screw, HC	1	1	1

# Common hardware. Procure locally.

# Group 201: Generator and Mounting

Items not shown: 7-9

Controller ground strap located between plain washers.



201-190-27

## Group 201: Generator and Mounting

Item	Part Number	Description	Qty.	Item	Part Number	Description	Qty.
1	M982-12-80	Nut, hex stop	2	30	X-22-46	Washer lock, #6 int.	2
2	X-129-54	Screw, HC	8	31	X-22-9	Washer lock, #10 int. tooth	2
3	X-25-103	Washer, plain	2	32	X-25-93	Washer, plain	8
4	X-400-197	Spacer	2	33	X-431-25	Terminal, push-on	4
5	*	Screw, RHM, 8-32 x 3/4"	2	34	X-6071-1	Screw, thread-forming, #10 p.h.h.	4
6	X-67-125	Screw, self-tapping	4	35	X-6093-8	Sleeving (not shown)	2
7	X-750-14	Marker, wire tab no. L1 (not shown)	1	36	X-67-133	Screw, self-tapping	3
8	X-750-15	Marker, wire tab no. L2 (not shown)	1	37	X-791-6	Screw, hex head	1
9	X-750-16	Marker, wire tab no. L3 (not shown)	1	38	X-801-3	Washer, hardened	16
10	X-801-6	Washer, hardened	8	39	243321	Washer, insulating	2
11	*	Marker, strip	1	40	257077	Actuator, magnetic cup	1
12	257442	Clip, speed	4	41	257258	Cover, LED PCB	1
13	290945	Washer, hardened	8	42	257581	Disc, armature drive	4
14	*	Block, terminal	1	43	257850	Insulator, PCB split activator	1
15	324392	Vibromount	2	44	257855	Fan, generator	1
16	347268	Guard, generator fan	2	45	257951	Washer, special	12
17	*	Harness, wiring	1	46	257978	Connector, bus	1
18	*	Standoff, circuit board	5	47	270158	Screw, cylinder head	12
19	*	Circuit board assembly	1	48	290945	Washer, hardened	12
20	X-6024-14	Screw	8	49	347119	Fitting, grease	1
21	M931-12110-60	Screw	2	50	See chart below	Stator assembly	
22	See chart below	Alternator assembly (includes the following)	1	51	347236	Bracket, end	1
23	A-257099	LED board	1	52	347240	Adapter, generator	1
24	See chart below	Rotor assembly (includes items 25 & 26)	1	53	347707	Exciter, assembly field	1
25	A-354299	Split activator	1	54	#	Nut, 3/8-16	6
26	X-758-9	Ball bearing	1	55	#	Washer, 3/8"	10
27	A-360418	Photo board	1	56	X-6238-11	Screw	1
28	X-117-5	Screw, hex head, 10-24 x 5/8"	2	57	X-6238-5	Screw	3
29	X-129-25	Screw, HC expense	12	58	X-6238-11	Screw	8
				59	X-6238-17	Screw	4
				60	X-465-25	Screw	1

# Common hardware. Procure locally.

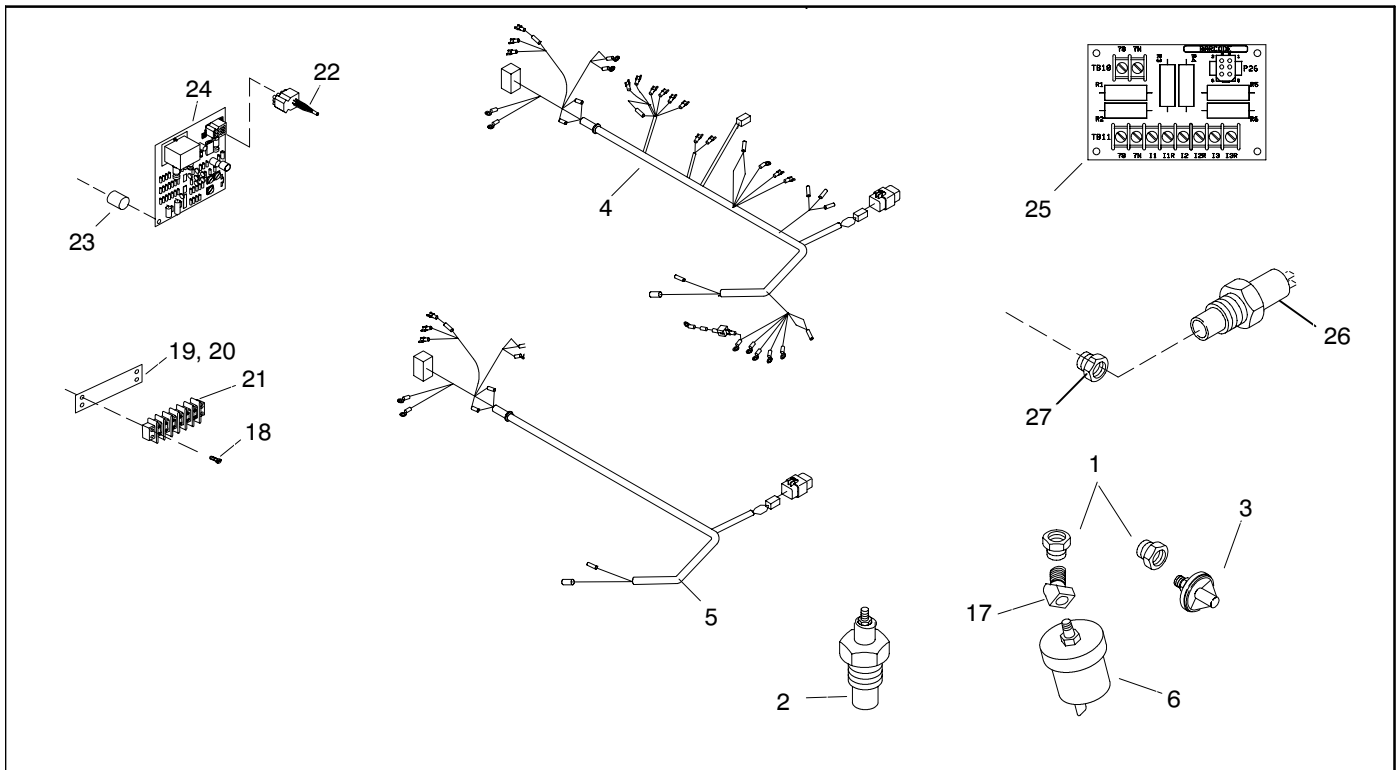
\* See Control and Harness group for part number.

### Alternator Part Number and Type

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

Variation/ Module No.	Alternator Description	Item 22, Alternator assembly	Item 24, Rotor assembly	Item 50, Stator assembly
27	4UA9	A-347209	A-347187	347197
28	4UA9, 600 V	A-347213	A-347187	347203
29	4UA10	A-347210	A-347188	347198
30	4UA10, 600 V	A-347214	A-347188	347204
31	4UA13	A-347211	A-347189	347199
32	4UA13, 600 V	A-347215	A-347189	347205
GM13657-MA1	4UA9	A-347209	A-347187	347197
GM13657-MA4	4UA9, 600 V	A-347213	A-347187	347203
GM13657-MA2	4UA10	A-347210	A-347188	347198
GM13657-MA5	4UA10, 600 V	A-347214	A-347188	347204
GM13657-MA3	4UA13	A-347211	A-347189	347199
GM13657-MA6	4UA13, 600 V	A-347215	A-347189	347205
GM16947-MA1	4UA9	B-347209	A-347187	347197
GM16947-MA2	4UA9, 600 V	B-347213	A-347187	347203
GM16947-MA3	4UA10	B-347210	A-347188	347198
GM16947-MA4	4UA10, 600 V	B-347214	A-347188	347204
GM16947-MA5	4UA13	B-347211	A-347189	347199
GM16947-MA6	4UA13, 600 V	B-347215	A-347189	347205

# Control and Harness



Item	Part Number	Description	Quantity	
			GM13669-MA1	GM16945-MA1 (550 Controller only)
1	X-202-27	Bushing, reducer, 1/8 x 1/4"	2	
2	268298	Sender, water temperature	1	
3	328309	Switch, assembly pressure	1	
4	343464	Harness, wiring (includes items 7–13)	1	
4	GM11498	Harness, wiring (includes items 7, 11–16)		1
5	343465	Harness, wiring DDEC (includes items 42–44)		
6	343473	Sender, oil pressure	1	
7	233959	Diode, 6 A, 100 V (not shown)	3	4
8	239411	Connector, jack, 4-position (P2) (not shown)	1	
9	259689	Connector, plug, 9-position (P4) (not shown)	1	
10	269190	Connector, plug, 6-position (not shown)	1	
11	290262	Boot (not shown)	1	1
12	292800	Connector, cable (not shown)	1	1
13	295145	Connector, 24-position (not shown)	1	1
14	343129	Connector, 30-pin (P5) (not shown)	1	1
15	343130	Connector, 5-pin (P3) (not shown)	1	1
16	343131	Connector, 6-pin (P6) (not shown)	1	1
17	267428	Elbow, 45° street	1	
18	M785A-04020-20	Screw, RHM, 8-32 x 3/4"	2	2
19	255080	Marker, strip	1	
20	299090	Marker, strip		1
21	295314	Block, terminal	1	1
22	354118	Harness, wiring	1	
23	360459	Standoff, circuit board	5	
24	A-354653	PCB assembly (regulator)	1	
25	GM13980	PCB assembly, CT burden resistor		1
25	282829	Vibromount		4
26	290090	Switch, temperature		1
27	168848	Bushing, reducing (1/2 x 1 in. NPT)		1

# Notes

# Group 701: Literature

Item	Part Number	Description	Quantity			
			Variation Number			
			10	12	19	21
1	TP-5700	I/M Industrial	1	1	1	1
2	TP-5750	O/M 20-2000 kW	1	1	1	1
3	TP-5611	O/M DDC 71/92/149 Series	1	1	1	1
4	TP-5978	P/C 230-300REOZD	1	1	1	1
5	TP-5979	P/C DDC 60 Series Diesel	1		1	1
5	TP-5980	P/C DDC 60 Series Diesel 300-350 kW		1		
6	TP-6116	P/C Accessories, 230-2000 kW	1	1	1	1
7	TP-5353	S/M 20-300RZ; 20-180RZ	1	1	1	1
8	TP-5843	S/M DDC 60 Series	1	1	1	1
9	TP-5988	W/D 230-400REOZD	1	1	1	1
10	TP-6009	P/C Controllers	1	1	1	1
11	TP-6083	O/M Decision-Maker 550 Controller	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
<b>Air Intake Systems</b>				
Air Cleaner, Heavy-Duty	343508	343508	343508	343508
<b>Controllers</b>				
See Parts Catalog TP-6009 for parts lists.				
<b>Cooling Systems</b>				
Heater, Block				
90-240V	354954	354954	354954	354954
308-480V	354955	354955	354955	354955
Duct Flange, Radiator	343246	343246	343246	343246
<b>Optional Kits</b>				
See Parts Catalog TP-6117 for parts lists.				
<b>Paint and Miscellaneous Parts</b>				
Paint, Kohler Cream Beige	All models use 221338 Spray Can, 221337 Gallon, GM19489 Touch-Up			
Filter Kit (includes oil and fuel filters)	GM14107	GM14107	GM14107	GM14107

x:in:004:008:a

# Cooling System Kits

Qty.	Description	Part No.
<b>Block Heater 354954</b>		
1	Pipe, 3/4 x 4"	A-107
4	Nut, elastic stop, 1/4"	X-101-8
1	Bushing, reducer	X-202-41
1	Tee, pipe, 1/2"	X-203-13
1	Pipe	X-209-21
1	Nipple, pipe, 1/2 x 1-1/2"	X-209-5
1	Elbow, pipe, 3/4"	X-215-2
1	Coupling, pipe, 1/2"	X-216-20
9	Washer, lock, 1/4" int./ext. tooth	X-22-12
4	Clamp, hose, 1.25" maximum	X-426-12
2	Connector, hose	X-582-7
1	Strap, ground	223033
4	Screw, PHC	X-6216-1
1	Hose	X-691-19
1	Hose, oil proof	X-691-37
4	Bumper	259632
1	Bracket, support	274431
1	Tag, hang	279047
1	Tag, instruction	279280
1	Block heater	279814
4	Gasket, washer	297001
1	Plug, freeze	324094
1	Bracket, block heater	343100
1	Thermostat, block heater	343222
1	Box, block heater	354315
1	Cover, block heater	354317
1	Gasket, control box	354318
1	Decal, warning	354325
1	Label, wiring diagram	354327

Qty.	Description	Part No.
<b>Block Heater 354955</b>		
1	Pipe, 3/4 x 4"	A-107
4	Nut, elastic stop, 1/4"	X-101-8
1	Bushing, reducer	X-202-41
1	Tee, pipe, 1/2"	X-203-13
1	Pipe	X-209-21
1	Nipple, pipe, 1/2 x 1-1/2"	X-209-5
1	Elbow, pipe, 3/4"	X-215-2
1	Coupling, pipe, 1/2"	X-216-20
9	Washer, lock 1/4" int./ext. tooth	X-22-12
4	Clamp, hose, 1.25" maximum	X-426-12
2	Connector, hose	X-582-7
1	Strap, ground	223033
4	Screw, PHC	X-6216-1
1	Hose	X-691-19
1	Hose, oil proof	X-691-37
4	Bumper	259632
1	Bracket, support	274431
1	Tag, hang	279047
1	Tag, instruction	279280
1	Block heater	279815
4	Gasket, washer	297001
1	Plug, freeze	324094
1	Bracket, block heater	343100
1	Thermostat, block heater	343222
1	Box, block heater control	354316
1	Cover, block heater control box	354317
1	Gasket, control box	354318
1	Decal, warning	354325
1	Label, wiring diagram	354328

<b>Duct Flange, Radiator 343246</b>		
8	Rivet, pop	X-781-11
4	Screw, drill hex	X-794-1
2	Frame, air duct (top/bottom)	343271
2	Frame, air duct (sides)	343272

## Air Intake Kits

Qty.	Description	Part No.
<b>Heavy-duty 343508</b>		
1	Cleaner assembly, air	A-279713
1	Element, air cleaner	279736
1	Tube, steel	X-522-60
1	Tube, steel	X-522-85
1	Plug, pipe, 1/8"	X-75-4
5	Clamp	254013
1	Clamp, hose	254344
2	Elbow, 90 degree	272627
1	Cap, rain	272674
2	Bracket, air cleaner	291666
1	Bracket, air cleaner support	343172
1	Bracket, mounting	343243
1	Hose, hump	343429

# Appendix A Abbreviations

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

A, amp	ampere	CG	center of gravity	fglass.	fiberglass
ABDC	after bottom dead center	CID	cubic inch displacement	FHM	flat head machine (screw)
AC	alternating current	CL	centerline	fl. oz.	fluid ounce
A/D	analog to digital	cm	centimeter	flex.	flexible
ADC	analog to digital converter	CMOS	complementary metal oxide substrate (semiconductor)	freq.	frequency
adj.	adjust, adjustment			FS	full scale
ADV	advertising dimensional drawing	cogen.	cogeneration	ft.	foot, feet
AHWT	anticipatory high water temperature	Com	communications (port)	ft. lbs.	foot pounds (torque)
AISI	American Iron and Steel Institute	conn.	connection	ft./min.	feet per minute
ALOP	anticipatory low oil pressure	cont.	continued	g	gram
alt.	alternator	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
Al	aluminum	crit.	critical	gal.	gallon
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	CRT	cathode ray tube	gen.	generator
		CSA	Canadian Standards Association	genset	generator set
AO	anticipatory only	CT	current transformer	GFI	ground fault interrupter
API	American Petroleum Institute	Cu	copper	GND, ⊕	ground
approx.	approximate, approximately	cu. in.	cubic inch	gov.	governor
AR	as required, as requested	cw.	clockwise	gph	gallons per hour
AS	as supplied, as stated, as suggested	CWC	city water-cooled	gpm	gallons per minute
ASE	American Society of Engineers	cyl.	cylinder	gr.	grade, gross
ASME	American Society of Mechanical Engineers	D/A	digital to analog	GRD	equipment ground
assy.	assembly	DAC	digital to analog converter	gr. wt.	gross weight
ASTM	American Society for Testing Materials	dB	decibel	H x W x D	height by width by depth
ATDC	after top dead center	dBA	decibel (A weighted)	HC	hex cap
ATS	automatic transfer switch	DC	direct current	HCHT	high cylinder head temperature
auto.	automatic	DCR	direct current resistance	HD	heavy duty
aux.	auxiliary	deg., °	degree	HET	high exhaust temperature
A/V	audiovisual	dept.	department	hex	hexagon
avg.	average	dia.	diameter	Hg	mercury (element)
AVR	automatic voltage regulator	DI/EO	dual inlet/end outlet	HH	hex head
AWG	American Wire Gauge	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HHC	hex head cap
AWM	appliance wiring material			HP	horsepower
bat.	battery	DIP	dual inline package	hr.	hour
BBDC	before bottom dead center	DPDT	double-pole, double-throw	HS	heat shrink
BC	battery charger, battery charging	DPST	double-pole, single-throw	hsg.	housing
BCA	battery charging alternator	DS	disconnect switch	HVAC	heating, ventilation, and air conditioning
BCI	Battery Council International	DVR	digital voltage regulator	HWT	high water temperature
BDC	before dead center	E, emer.	emergency (power source)	Hz	hertz (cycles per second)
BHP	brake horsepower	EDI	electronic data interchange	IC	integrated circuit
blk.	black (paint color), block (engine)	EFR	emergency frequency relay	ID	inside diameter, identification
blk. htr.	block heater	e.g.	for example ( <i>exempli gratia</i> )	IEC	International Electrotechnical Commission
BMEP	brake mean effective pressure	EG	electronic governor	IEEE	Institute of Electrical and Electronics Engineers
bps	bits per second	EGSA	Electrical Generating Systems Association	IMS	improved motor starting
br.	brass	EIA	Electronic Industries Association	in.	inch
BTDC	before top dead center	EI/EO	end inlet/end outlet	in. H <sub>2</sub> O	inches of water
Btu	British thermal unit	EMI	electromagnetic interference	in. Hg	inches of mercury
Btu/min.	British thermal units per minute	emiss.	emission	in. lbs.	inch pounds
C	Celsius, centigrade	eng.	engine	Inc.	incorporated
cal.	calorie	EPA	Environmental Protection Agency	ind.	industrial
CARB	California Air Resources Board	EPS	emergency power system	int.	internal
CB	circuit breaker	ER	emergency relay	int./ext.	internal/external
cc	cubic centimeter	ES	engineering special, engineered special	I/O	input/output
CCA	cold cranking amps	ESD	electrostatic discharge	IP	iron pipe
ccw.	counterclockwise	est.	estimated	ISO	International Organization for Standardization
CEC	Canadian Electrical Code	E-Stop	emergency stop	J	joule
cfh	cubic feet per hour	etc.	et cetera (and so forth)	JIS	Japanese Industry Standard
cfm	cubic feet per minute	exh.	exhaust	k	kilo (1000)
		ext.	external	K	kelvin
		F	Fahrenheit, female	KA	kiloampere
				KB	kilobyte (2 <sup>10</sup> bytes)

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

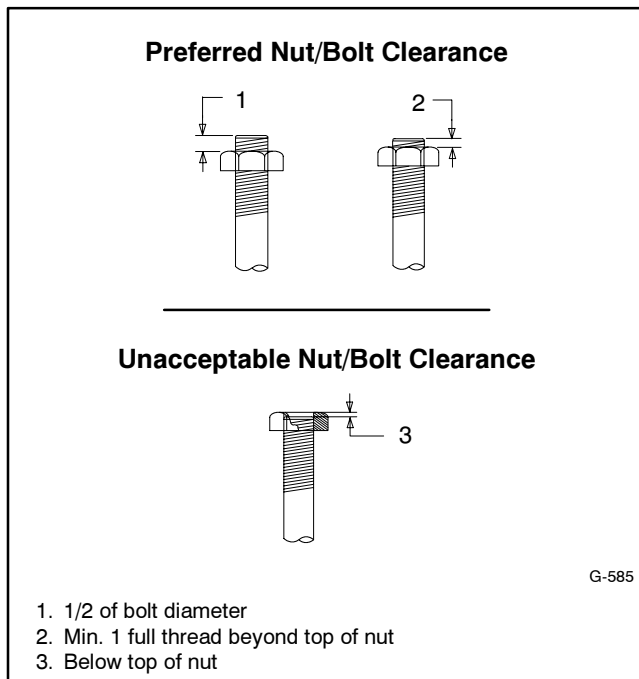
# Appendix B Common Hardware Application Guidelines

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.



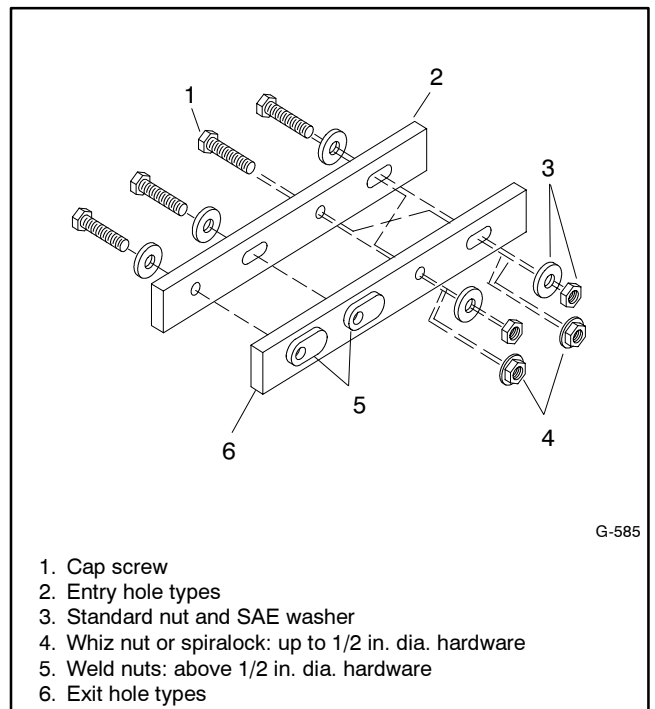
**Figure 1** Acceptable Bolt Lengths

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















Use the following torque specifications when service literature instructions give no specific torque values. The charts list values for new plated, zinc phosphate, or oiled









threads. Increase values by 15% for nonplated threads. All torque values are +0%/-10%.






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)	—	1.8 (16)
10-24	Nm (in. lb.)	2.9 (26)	3.6 (32)	—	2.9 (26)
10-32	Nm (in. lb.)	2.9 (26)	3.6 (32)	—	2.9 (26)
1/4-20	Nm (in. lb.)	6.8 (60)	10.8 (96)	14.9 (132)	6.8 (60)
1/4-28	Nm (in. lb.)	8.1 (72)	12.2 (108)	16.3 (144)	8.1 (72)
5/16-18	Nm (in. lb.)	13.6 (120)	21.7 (192)	29.8 (264)	13.6 (120)
5/16-24	Nm (in. lb.)	14.9 (132)	23.1 (204)	32.5 (288)	14.9 (132)
3/8-16	Nm (ft. lb.)	24.0 (18)	38.0 (28)	53.0 (39)	24.0 (18)
3/8-24	Nm (ft. lb.)	27.0 (20)	42.0 (31)	60.0 (44)	27.0 (20)
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	5.6 (4)	9.9 (7)	14.0 (10)	5.6 (4)
M8 x 1.25	13.6 (10)	25.0 (18)	35.0 (26)	13.6 (10)
M8 x 1.00	21.0 (16)	25.0 (18)	35.0 (26)	21.0 (16)
M10 x 1.50	27.0 (20)	49.0 (35)	68.0 (50)	27.0 (20)
M10 x 1.25	39.0 (29)	49.0 (35)	68.0 (50)	39.0 (29)
M12 x 1.75	47.0 (35)	83.0 (61)	117.0 (86)	—
M12 x 1.50	65.0 (48)	88.0 (65)	125.0 (92)	—
M14 x 2.00	74.0 (55)	132.0 (97)	185.0 (136)	—
M14 x 1.50	100.0 (74)	140.0 (103)	192.0 (142)	—
M16 x 2.00	115.0 (85)	200.0 (148)	285.0 (210)	—
M16 x 1.50	141.0 (104)	210.0 (155)	295.0 (218)	—
M18 x 2.50	155.0 (114)	275.0 (203)	390.0 (288)	—
M18 x 1.50	196.0 (145)	305.0 (225)	425.0 (315)	—

# 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	

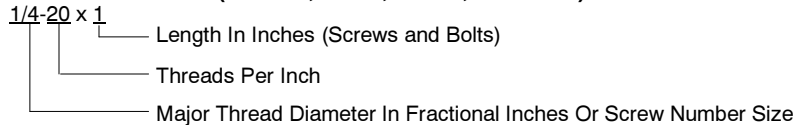
Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

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

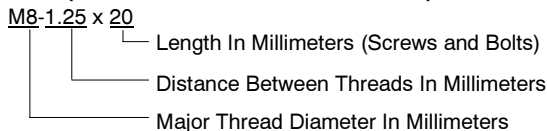
Phillips® screw is a registered trademark of Phillips Screw Company.

## Sample Dimensions

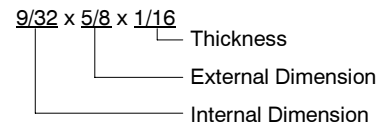
### American Standard (Screws, Bolts, Studs, and Nuts)



### 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
<b>Hex Head Bolts (Grade 5)</b>		<b>Hex Head Bolts, cont.</b>		<b>Hex Nuts</b>		
X-465-17	1/4-20 x .38	X-6024-5	7/16-14 x .75	X-6009-1	1-8	Standard
X-465-6	1/4-20 x .50	X-6024-2	7/16-14 x 1.00	X-6210-3	6-32	Whiz
X-465-2	1/4-20 x .62	X-6024-8	7/16-14 x 1.25	X-6210-4	8-32	Whiz
X-465-16	1/4-20 x .75	X-6024-3	7/16-14 x 1.50	X-6210-5	10-24	Whiz
X-465-18	1/4-20 x .88	X-6024-4	7/16-14 x 2.00	X-6210-1	10-32	Whiz
X-465-7	1/4-20 x 1.00	X-6024-11	7/16-14 x 2.75	X-6210-2	1/4-20	Spiralock
X-465-8	1/4-20 x 1.25	X-6024-12	7/16-14 x 6.50	X-6210-6	1/4-28	Spiralock
X-465-9	1/4-20 x 1.50	X-129-15	1/2-13 x .75	X-6210-7	5/16-18	Spiralock
X-465-10	1/4-20 x 1.75	X-129-17	1/2-13 x 1.00	X-6210-8	5/16-24	Spiralock
X-465-11	1/4-20 x 2.00	X-129-18	1/2-13 x 1.25	X-6210-9	3/8-16	Spiralock
X-465-12	1/4-20 x 2.25	X-129-19	1/2-13 x 1.50	X-6210-10	3/8-24	Spiralock
X-465-14	1/4-20 x 2.75	X-129-20	1/2-13 x 1.75	X-6210-11	7/16-14	Spiralock
X-465-21	1/4-20 x 5.00	X-129-21	1/2-13 x 2.00	X-6210-12	1/2-13	Spiralock
X-465-25	1/4-28 x .38	X-129-22	1/2-13 x 2.25	X-6210-15	7/16-20	Spiralock
X-465-20	1/4-28 x 1.00	X-129-23	1/2-13 x 2.50	X-6210-14	1/2-20	Spiralock
X-125-33	5/16-18 x .50	X-129-24	1/2-13 x 2.75	X-85-3	5/8-11	Standard
X-125-23	5/16-18 x .62	X-129-25	1/2-13 x 3.00	X-88-12	3/4-10	Standard
X-125-3	5/16-18 x .75	X-129-27	1/2-13 x 3.50	X-89-2	1/2-20	Standard
X-125-31	5/16-18 x .88	X-129-29	1/2-13 x 4.00			
X-125-5	5/16-18 x 1.00	X-129-30	1/2-13 x 4.50			
X-125-24	5/16-18 x 1.25	X-463-9	1/2-13 x 5.50			
X-125-34	5/16-18 x 1.50	X-129-44	1/2-13 x 6.00			
X-125-25	5/16-18 x 1.75	X-129-51	1/2-20 x .75			
X-125-26	5/16-18 x 2.00	X-129-45	1/2-20 x 1.25			
230578	5/16-18 x 2.25	X-129-52	1/2-20 x 1.50			
X-125-29	5/16-18 x 2.50	X-6021-3	5/8-11 x 1.00			
X-125-27	5/16-18 x 2.75	X-6021-4	5/8-11 x 1.25			
X-125-28	5/16-18 x 3.00	X-6021-2	5/8-11 x 1.50			
X-125-22	5/16-18 x 4.50	X-6021-1	5/8-11 x 1.75			
X-125-32	5/16-18 x 5.00	273049	5/8-11 x 2.00			
X-125-35	5/16-18 x 5.50	X-6021-5	5/8-11 x 2.25			
X-125-36	5/16-18 x 6.00	X-6021-6	5/8-11 x 2.50			
X-125-40	5/16-18 x 6.50	X-6021-7	5/8-11 x 2.75			
X-125-43	5/16-24 x 1.75	X-6021-12	5/8-11 x 3.75			
X-125-44	5/16-24 x 2.50	X-6021-11	5/8-11 x 4.50			
X-125-30	5/16-24 x .75	X-6021-10	5/8-11 x 6.00			
X-125-39	5/16-24 x 2.00	X-6021-9	5/8-18 x 2.50			
X-125-38	5/16-24 x 2.75	X-6239-1	3/4-10 x 1.00			
X-6238-2	3/8-16 x .62	X-6239-8	3/4-10 x 1.25			
X-6238-10	3/8-16 x .75	X-6239-2	3/4-10 x 1.50			
X-6238-3	3/8-16 x .88	X-6239-3	3/4-10 x 2.00			
X-6238-11	3/8-16 x 1.00	X-6239-4	3/4-10 x 2.50			
X-6238-4	3/8-16 x 1.25	X-6239-5	3/4-10 x 3.00			
X-6238-5	3/8-16 x 1.50	X-6239-6	3/4-10 x 3.50			
X-6238-1	3/8-16 x 1.75	X-792-1	1-8 x 2.25			
X-6238-6	3/8-16 x 2.00	X-792-5	1-8 x 3.00			
X-6238-17	3/8-16 x 2.25	X-792-8	1-8 x 5.00			
X-6238-7	3/8-16 x 2.50					
X-6238-8	3/8-16 x 2.75					
X-6238-9	3/8-16 x 3.00					
X-6238-19	3/8-16 x 3.25					
X-6238-12	3/8-16 x 3.50					
X-6238-20	3/8-16 x 3.75					
X-6238-13	3/8-16 x 4.50					
X-6238-18	3/8-16 x 5.50					
X-6238-25	3/8-16 x 6.50					
X-6238-14	3/8-24 x .75					
X-6238-16	3/8-24 x 1.25					
X-6238-21	3/8-24 x 4.00					
X-6238-22	3/8-24 x 4.50					

## Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

## Metric

Hex head bolts are hardness grade 8.8 unless noted.

Part No.	Dimensions	Part No.	Dimensions	Part No.	Dimensions	Type	
<b>Hex Head Bolts (partial thread)</b>			<b>Hex Head Bolts (full thread)</b>			<b>Hex Nuts</b>	
M931-05055-60	M5-0.80 x 55	M933-04006-60	M4-0.70 x 6	M934-03-50	M3-0.50	Standard	
M931-06040-60	M6-1.00 x 40	M933-05035-60	M5-0.80 x 35	M934-035-50	M3.5-0.50	Standard	
M931-06055-60	M6-1.00 x 55	M933-05050-60	M5-0.80 x 50	M934-04-50	M4-0.70	Standard	
M931-06060-60	M6-1.00 x 60	M933-06010-60	M6-1.00 x 10	M934-05-50	M5-0.80	Standard	
M931-06070-60	M6-1.00 x 70	M933-06014-60	M6-1.00 x 14	M982-05-80	M5-0.80	Elastic Stop	
M931-06070-SS	M6-1.00 x 70	M933-06016-60	M6-1.00 x 16	M934-06-60	M6-1.00	Standard	
M931-06075-60	M6-1.00 x 75	M933-06020-60	M6-1.00 x 20	M934-06-64	M6-1.00	Std. (green)	
M931-06090-60	M6-1.00 x 90	M933-06025-60	M6-1.00 x 25	M6923-06-80	M6-1.00	Spirallock	
M931-06150-60	M6-1.00 x 150	M933-06040-60	M6-1.00 x 40	M982-06-80	M6-1.00	Elastic Stop	
M931-08035-60	M8-1.25 x 35	M933-06050-60	M6-1.00 x 50	M934-08-60	M8-1.25	Standard	
M931-08040-60	M8-1.25 x 40	M933-08012-60	M8-1.25 x 12	M6923-08-80	M8-1.25	Spirallock	
M931-08040-82	M8-1.25 x 40*	M933-08016-60	M8-1.25 x 16	M982-08-80	M8-1.25	Elastic Stop	
M931-08045-60	M8-1.25 x 45	M933-08020-60	M8-1.25 x 20	M934-10-60	M10-1.50	Standard	
M931-08050-60	M8-1.25 x 50	M933-08025-60	M8-1.25 x 25	M934-10-60F	M10-1.25	Standard	
M931-08055-60	M8-1.25 x 55	M933-08030-60	M8-1.25 x 30	M6923-10-80	M10-1.50	Spirallock	
M931-08055-82	M8-1.25 x 55*	M933-08030-82	M8-1.25 x 30*	M6923-10-62	M10-1.50	Spirallock†	
M931-08060-60	M8-1.25 x 60	M933-10012-60	M10-1.50 x 12	M982-10-80	M10-1.50	Elastic Stop	
M931-08070-60	M8-1.25 x 70	M961-10020-60	M10-1.25 x 20	M934-12-60	M12-1.75	Standard	
M931-08070-82	M8-1.25 x 70*	M933-10020-60	M10-1.50 x 20	M934-12-60F	M12-1.25	Standard	
M931-08075-60	M8-1.25 x 75	M933-10025-60	M10-1.50 x 25	M6923-12-80	M12-1.75	Spirallock	
M931-08080-60	M8-1.25 x 80	M961-10030-60	M10-1.25 x 30	M982-12-80	M12-1.75	Elastic Stop	
M931-08090-60	M8-1.25 x 90	M933-10030-60	M10-1.50 x 30	M982-14-80	M14-2.00	Elastic Stop	
M931-08095-60	M8-1.25 x 95	M933-10030-82	M10-1.50 x 30*	M6923-16-80	M16-2.00	Spirallock	
M931-08100-60	M8-1.25 x 100	M961-10035-60	M10-1.25 x 35	M982-16-80	M16-2.00	Elastic Stop	
M931-08120-60	M8-1.25 x 120	M933-10035-60	M10-1.50 x 35	M934-18-80	M18-2.5	Standard	
M931-08130-60	M8-1.25 x 130	M933-12016-60	M12-1.75 x 16	M982-18-80	M18-2.50	Elastic Stop	
M931-08140-60	M8-1.25 x 140	M933-12020-60	M12-1.75 x 20	M934-20-80	M20-2.50	Standard	
M931-10040-82	M10-1.25 x 40*	M933-12025-60	M12-1.75 x 25	M982-20-80	M20-2.50	Elastic Stop	
M931-10040-60	M10-1.50 x 40	M933-12025-82	M12-1.75 x 25*	M934-22-60	M22-2.50	Standard	
M931-10045-60	M10-1.50 x 45	M961-12030-60	M12-1.25 x 30	M934-24-80	M24-3.00	Standard	
M931-10050-60	M10-1.50 x 50	M933-12030-60	M12-1.75 x 30	M982-24-80	M24-3.00	Elastic Stop	
M931-10055-60	M10-1.50 x 55	M933-12035-60	M12-1.75 x 35	M934-30-80	M30-3.50	Standard	
M931-10060-60	M10-1.50 x 60	M961-12040-82	M12-1.25 x 40*	<b>Washers</b>			
M931-10065-60	M10-1.50 x 65	M933-12040-60	M12-1.75 x 40	<b>Part No.</b>	<b>ID</b>	<b>OD</b>	<b>Bolt/ Thick. Screw</b>
M931-10070-60	M10-1.50 x 70	M933-12040-82	M12-1.75 x 40*	M125A-03-80	3.2	7.0	0.5 M3
M931-10080-60	M10-1.50 x 80	M961-14025-60	M14-1.50 x 25	M125A-04-80	4.3	9.0	0.8 M4
M931-10090-60	M10-1.50 x 90	M933-14025-60	M14-2.00 x 25	M125A-05-80	5.3	10.0	1.0 M5
M931-10090-82	M10-1.50 x 90*	M961-16025-60	M16-1.50 x 25	M125A-06-80	6.4	12.0	1.6 M6
M931-10100-60	M10-1.50 x 100	M933-16025-60	M16-2.00 x 25	M125A-08-80	8.4	16.0	1.6 M8
M931-10110-60	M10-1.50 x 110	M961-16030-82	M16-1.50 x 30*	M125A-10-80	10.5	20.0	2.0 M10
M931-10120-60	M10-1.50 x 120	M933-16030-82	M16-2.00 x 30*	M125A-12-80	13.0	24.0	2.5 M12
M931-10130-60	M10-1.50 x 130	M933-16035-60	M16-2.00 x 35	M125A-14-80	15.0	28.0	2.5 M14
M931-10140-60	M10-1.50 x 140	M961-16040-60	M16-1.50 x 40	M125A-16-80	17.0	30.0	3.0 M16
M931-10180-60	M10-1.50 x 180	M933-16040-60	M16-2.00 x 40	M125A-18-80	19.0	34.0	3.0 M18
M931-12045-60	M12-1.75 x 45	M933-16050-60	M16-2.00 x 50	M125A-20-80	21.0	37.0	3.0 M20
M960-12050-60	M12-1.25 x 50	M933-16050-82	M16-2.00 x 50*	M125A-24-80	25.0	44.0	4.0 M24
M960-12050-82	M12-1.25 x 50*	M933-16060-60	M16-2.00 x 60				
M931-12050-60	M12-1.75 x 50	M933-18035-60	M18-2.50 x 35				
M931-12055-60	M12-1.75 x 55	M933-18050-60	M18-2.50 x 50				
M931-12060-60	M12-1.75 x 60	M933-18060-60	M18-2.50 x 60				
M931-12065-60	M12-1.75 x 65	M933-20050-60	M20-2.50 x 50				
M931-12075-60	M12-1.75 x 75	M933-20055-60	M20-2.50 x 55				
M931-12080-60	M12-1.75 x 80	<b>Pan Head Machine Screws</b>					
M931-12090-60	M12-1.75 x 90	M7985A-03010-20	M3-0.50 x 10	* This metric hex bolt's hardness is grade 10.9.			
M931-12100-60	M12-1.75 x 100	M7985A-03012-20	M3-0.50 x 12	† This metric hex nut's hardness is grade 8.			
M931-12110-60	M12-1.75 x 110	M7985A-04010-20	M4-0.70 x 10				
M960-16090-60	M16-1.50 x 90	M7985A-04020-20	M4-0.70 x 20				
M931-16090-60	M16-2.00 x 90	M7985A-04100-20	M4-0.70 x 100				
M931-16100-60	M16-2.00 x 100	M7985A-05010-20	M5-0.80 x 10				
M931-20065-60	M20-2.50 x 65	M7985A-05012-20	M5-0.80 x 12				
M931-20120-60	M20-2.50 x 120	M7985A-05016-20	M5-0.80 x 16				
M931-20160-60	M20-2.50 x 160	M7985A-05100-20	M5-0.80 x 100				
M931-22090-60	M22-2.50 x 90	M7985A-06100-20	M6-1.00 x 100				
M931-22120-60	M22-2.50 x 120	<b>Flat Head Machine Screws</b>					
M931-22160-60	M22-2.50 x 160	M965A-04012-SS	M4-0.70 x 12				
M931-24090-60	M24-3.00 x 90	M965A-05012-SS	M5-0.80 x 12				
M931-24120-60	M24-3.00 x 120	M965A-05016-20	M5-0.80 x 16				
M931-24160-60	M24-3.00 x 160						





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