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SERVICE SPECIFICATIONS

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## SERVICE SPECIFICATIONS — Engine Mechanical

## ENGINE MECHANICAL

## Specifications

|                                   |                                                      |                                               |                              |                                          |
|-----------------------------------|------------------------------------------------------|-----------------------------------------------|------------------------------|------------------------------------------|
| Engine tune-up                    | Engine coolant capacity (w/ Heater)                  | 15.0 liters                                   | 15.9 US qts                  | 13.2 Imp. qts                            |
|                                   | 8B20, 22, 30                                         | 13.3 liters                                   | 14.1 US qts                  | 11.7 Imp. qts                            |
|                                   | 8J60                                                 |                                               |                              |                                          |
|                                   | 8J70, 71, 73, 74, 75                                 | 13.8 liters                                   | 14.6 US qts                  | 12.1 Imp. qts                            |
|                                   | 3B                                                   | 14.2 liters                                   | 15.0 US qts                  | 12.5 Imp. qts                            |
|                                   | 13B-T M/T                                            | 13.6 liters                                   | 14.4 US qts                  | 12.0 Imp. qts                            |
|                                   | 13B-T A/T                                            |                                               |                              |                                          |
|                                   | 8U60, 61, 62, 63, 65, 70, 75, 76, 80, 81, 82, 85, 86 | 12.5 liters                                   | 13.2 US qts                  | 11.0 Imp. qts                            |
|                                   | Regular cab                                          | 13.0 liters                                   | 13.7 US qts                  | 11.4 Imp. qts                            |
|                                   | Wide cab                                             | 12.2 liters                                   | 12.9 US qts                  | 10.7 Imp. qts                            |
|                                   | BY33, 42                                             |                                               |                              |                                          |
| Engine oil capacity               | Engine oil capacity                                  |                                               |                              |                                          |
|                                   | Drain and refill                                     | 5.8 liters                                    | 6.1 US qts                   | 5.1 Imp. qts                             |
|                                   | w/o Oil filter change                                | 6.7 liters                                    | 7.1 US qts                   | 5.9 Imp. qts                             |
|                                   | w/ Oil filter change                                 | 7.3 liters                                    | 7.7 US qts                   | 6.4 Imp. qts                             |
|                                   | Dry fill                                             | 1.25 - 1.27 when fully charged at 20°C (68°F) |                              |                                          |
| Battery specific gravity          | Battery specific gravity                             |                                               |                              |                                          |
|                                   | Drive belt                                           |                                               |                              |                                          |
|                                   | Tension (Canada)                                     | New belt                                      | 145 ± 25 lb                  |                                          |
|                                   |                                                      | Used belt                                     | 100 ± 20 lb                  |                                          |
|                                   | Deflection (Others)                                  |                                               |                              |                                          |
|                                   | Single belt                                          | New belt                                      | 8 - 12 mm                    | 0.31 - 0.47 in.                          |
|                                   |                                                      | Used belt                                     | 11 - 16 mm                   | 0.43 - 0.63 in.                          |
|                                   | Double belt                                          | New belt                                      | 12 - 15 mm                   | 0.47 - 0.59 in.                          |
|                                   |                                                      | Used belt                                     | 14 - 20 mm                   | 0.55 - 0.79 in.                          |
|                                   | Tension (Reference)                                  |                                               |                              |                                          |
|                                   | Single belt                                          | New belt                                      | 55 - 65 kg                   |                                          |
|                                   |                                                      | Used belt                                     | 30 - 45 kg                   |                                          |
|                                   | Double belt                                          | New belt                                      | 45 - 55 kg                   |                                          |
|                                   |                                                      | Used belt                                     | 20 - 35 kg                   |                                          |
| Injection nozzle opening pressure | Injection nozzle opening pressure                    |                                               |                              |                                          |
|                                   | B and 3B                                             | New nozzle                                    | 115 - 125 kg/cm <sup>2</sup> | (1,636 - 1,778 psi, 11,278 - 12,258 kPa) |
|                                   |                                                      | Reused nozzle                                 | 105 - 125 kg/cm <sup>2</sup> | (1,493 - 1,778 psi, 10,296 - 12,258 kPa) |
|                                   | 11B, 13B and 13B-T                                   | New nozzle                                    | 200 - 210 kg/cm <sup>2</sup> | (2,845 - 2,987 psi, 19,613 - 20,594 kPa) |
|                                   |                                                      | Reused nozzle                                 | 180 - 210 kg/cm <sup>2</sup> | (2,560 - 2,987 psi, 17,652 - 20,594 kPa) |
| Valve clearance (Hot)             | Valve clearance (Hot)                                |                                               |                              |                                          |
|                                   | IN                                                   | 0.20 mm                                       | 0.008 in.                    |                                          |
|                                   | EX                                                   | 0.36 mm                                       | 0.014 in.                    |                                          |
| Injection timing                  | Injection timing                                     |                                               |                              |                                          |
|                                   | B and 3B                                             | 14° BTDC                                      |                              |                                          |
|                                   | 11B (w/ HAC) and 13B (w/ HAC)                        | 14° BTDC                                      |                              |                                          |
|                                   | 11B (w/o HAC) and 13B (w/o HAC)                      | 11° BTDC                                      |                              |                                          |
|                                   | 13B-T                                                | 11° BTDC                                      |                              |                                          |
| Injection order                   | Injection order                                      | 1-3-4-2                                       |                              |                                          |
| Idle speed                        | Idle speed                                           |                                               |                              |                                          |
|                                   | M T                                                  | 650 rpm                                       |                              |                                          |
|                                   | A T (13B)                                            | 770 rpm                                       |                              |                                          |
|                                   | A T (13B-T)                                          | 820 rpm                                       |                              |                                          |
| Maximum speed                     | Maximum speed                                        | 4,100 rpm                                     |                              |                                          |
| A/C idle-up setting speed         | A/C idle-up setting speed                            |                                               |                              |                                          |
|                                   | BB                                                   | 750 rpm                                       |                              |                                          |
|                                   | 01 and 011                                           | 950 rpm                                       |                              |                                          |

## SERVICE SPECIFICATIONS — Engine Mechanical

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## Specifications (Cont'd)

|                        |                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Compression pressure   | Engine revolution at 250 rpm<br>STD<br>Limit<br>Difference of pressure between each cylinder                                                                                                                                                                                                                                                                                                  | 30.0 kg/cm <sup>2</sup> (427 psi, 2,942 kPa) or more<br>20.0 kg/cm <sup>2</sup> 284 psi 1,961 kPa<br>2.0 kg/cm <sup>2</sup> (28 psi, 196 kPa) or less                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Turbocharger           | Turbocharging pressure<br>Impeller wheel axial play                                                                                                                                                                                                                                                                                                                                           | 0.42 – 0.56 kg/cm <sup>2</sup><br>(6.0 – 8.0 psi, 41 – 55 kPa)<br>0.13 mm (0.0051 in.) or less                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Cylinder head          | Cylinder block side warpage<br>Limit<br>Manifold side warpage<br>Limit<br>Valve seat<br>Refacing angle<br>Contacting angle<br>Contacting width                                                                                                                                                                                                                                                | 0.20 mm 0.0079 in.<br>0.20 mm 0.0079 in.<br>30°, 45°, 60°<br>45°<br>1.9 – 2.3 mm 0.075 – 0.091 in.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Valve guide<br>bushing | Inner diameter<br>Outer diameter                                                                                                                                                                                                                                                                                                                                                              | 9.010 – 9.030 mm 0.3547 – 0.3555 in.<br>14.023 – 14.041 mm 0.5521 – 0.5528 in.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Valve                  | Valve overall length<br>STD IN 8, 3B<br>EX 11B, 13B, 13B-T<br>Limit IN 8, 3B<br>EX 11B, 13B, 13B-T<br>Valve face angle<br>Stem diameter<br>IN 8, 3B, 11B, 13B<br>EX 13B-T<br>Stem oil clearance<br>STD IN 8, 3B, 11B, 13B<br>EX 13B-T<br>Limit IN 8, 3B, 11B, 13B<br>EX 13B-T<br>Margin thickness<br>STD IN 8, 3B<br>EX 11B, 13B, 13B-T<br>Limit IN 8, 3B<br>EX 11B, 13B, 13B-T<br>Squareness | 127.95 mm 5.0374 in.<br>127.75 mm 5.0295 in.<br>127.95 mm 5.0374 in.<br>127.45 mm 5.0177 in.<br>127.25 mm 5.0098 in.<br>127.45 mm 5.0177 in.<br>45.5°<br>8.968 – 8.984 mm 0.3531 – 0.3537 in.<br>8.954 – 8.970 mm 0.3525 – 0.3531 in.<br>8.940 – 8.956 mm 0.3520 – 0.3526 in.<br>0.026 – 0.062 mm 0.0010 – 0.0024 in.<br>0.040 – 0.076 mm 0.0016 – 0.0030 in.<br>0.054 – 0.090 mm 0.0021 – 0.0035 in.<br>0.10 mm 0.0039 in.<br>0.12 mm 0.0047 in.<br>0.13 mm 0.0051 in.<br>1.4 mm 0.055 in.<br>1.8 mm 0.071 in.<br>1.3 mm 0.051 in.<br>1.7 mm 0.067 in.<br>0.9 mm 0.035 in.<br>1.3 mm 0.051 in.<br>0.8 mm 0.031 in.<br>1.2 mm 0.047 in.<br>45.50 mm 1.7913 in.<br>54.84 mm 2.1591 in.<br>47.52 mm 1.8709 in.<br>58.30 mm 2.2953 in.<br>5.95 kg (13.1 lb, 58 N)<br>at 36.05 mm (1.4193 in.)<br>14.2 kg (31.3 lb, 139 N)<br>at 42.25 mm (1.6634 in.)<br>25.53 kg (56.3 lb, 250 N)<br>at 39.55 mm (1.5571 in.)<br>27.8 kg (61.2 lb, 273 N)<br>at 44.75 mm (1.7618 in.)<br>2.0 mm 0.079 in. |
| Valve spring           | Free length<br>STD Inner 8, 3B<br>11B, 13B, 13B-T<br>Outer 8, 3B<br>11B, 13B, 13B-T<br>Installed tension<br>Inner 8, 3B<br>11B, 13B, 13B-T<br>Outer 8, 3B<br>11B, 13B, 13B-T<br>Squareness                                                                                                                                                                                                    | 45.50 mm 1.7913 in.<br>54.84 mm 2.1591 in.<br>47.52 mm 1.8709 in.<br>58.30 mm 2.2953 in.<br>5.95 kg (13.1 lb, 58 N)<br>at 36.05 mm (1.4193 in.)<br>14.2 kg (31.3 lb, 139 N)<br>at 42.25 mm (1.6634 in.)<br>25.53 kg (56.3 lb, 250 N)<br>at 39.55 mm (1.5571 in.)<br>27.8 kg (61.2 lb, 273 N)<br>at 44.75 mm (1.7618 in.)<br>2.0 mm 0.079 in.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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## SERVICE SPECIFICATIONS — Engine Mechanical

## Specifications (Cont'd)

|                             |                                                   |                              |                                   |
|-----------------------------|---------------------------------------------------|------------------------------|-----------------------------------|
| Rocker arm and shaft        | Rocker arm inside diameter                        | 18.512 – 18.533 mm           | 0.7288 – 0.7296 in.               |
|                             | Rocker shaft diameter                             | 18.472 – 18.493 mm           | 0.7272 – 0.7281 in.               |
|                             | Rocker arm to shaft oil clearance<br>STD<br>Limit | 0.019 – 0.061 mm<br>0.10 mm  | 0.0007 – 0.0024 in.<br>0.0039 in. |
| Push rod                    | Circle runout                                     | 0.50 mm                      | 0.0197 in.                        |
| Intake and exhaust manifold | Manifold surface warpage<br>Limit                 | 0.20 mm                      | 0.0079 in.                        |
| Combustion chamber (B, 3B)  | Protrusion                                        | Minus 0.05 –<br>Plus 0.05 mm | Minus 0.0020 –<br>Plus 0.0020 in. |
| Camshaft                    | Circle runout                                     | 0.06 mm                      | 0.0024 in.                        |
|                             | Cam lobe height                                   |                              |                                   |
|                             | STD IN B, 3B                                      | 45.067 – 45.157 mm           | 1.7743 – 1.7748 in.               |
|                             | 11B, 13B                                          | 44.705 – 44.795 mm           | 1.7600 – 1.7636 in.               |
|                             | 13B-T                                             | 44.909 – 44.999 mm           | 1.7681 – 1.7716 in.               |
|                             | EX B, 3B                                          | 45.065 – 45.155 mm           | 1.7742 – 1.7778 in.               |
|                             | 11B, 13B, 13B-T                                   | 44.774 – 44.864 mm           | 1.7628 – 1.7663 in.               |
|                             | Limit IN B, 3B                                    | 44.63 mm                     | 1.7571 in.                        |
|                             | 11B, 13B                                          | 44.27 mm                     | 1.7429 in.                        |
|                             | 13B-T                                             | 44.47 mm                     | 1.7508 in.                        |
|                             | EX B, 3B                                          | 44.63 mm                     | 1.7571 in.                        |
|                             | 11B, 13B, 13B-T                                   | 44.34 mm                     | 1.7457 in.                        |
|                             | Journal diameter No. 1                            | 53.459 – 53.475 mm           | 2.1047 – 2.1053 in.               |
|                             | No. 2                                             | 53.209 – 53.225 mm           | 2.0948 – 2.0955 in.               |
|                             | No. 3                                             | 52.959 – 52.975 mm           | 2.0850 – 2.0856 in.               |
|                             | No. 4                                             | 52.709 – 52.725 mm           | 2.0752 – 2.0758 in.               |
|                             | No. 5                                             | 52.459 – 52.475 mm           | 2.0653 – 2.0659 in.               |
|                             | Bearing inside diameter No. 1                     | 53.495 – 53.568 mm           | 2.1061 – 2.1090 in.               |
|                             | No. 2                                             | 53.245 – 53.318 mm           | 2.0963 – 2.0991 in.               |
|                             | No. 3                                             | 52.995 – 53.068 mm           | 2.0864 – 2.0893 in.               |
|                             | No. 4                                             | 52.745 – 52.818 mm           | 2.0766 – 2.0794 in.               |
|                             | No. 5                                             | 52.495 – 52.568 mm           | 2.0667 – 2.0696 in.               |
| Timing gear                 | Journal oil clearance                             | 0.020 – 0.109 mm             | 0.0008 – 0.0043 in.               |
|                             | Limit                                             | 0.15 mm                      | 0.0059 in.                        |
|                             | Thrust clearance                                  | 0.06 – 0.13 mm               | 0.0024 – 0.0051 in.               |
|                             | Limit                                             | 0.30 mm                      | 0.0118 in.                        |
|                             | Gear backlash (each gear)                         | 0.058 – 0.162 mm             | 0.0023 – 0.0064 in.               |
|                             | Limit                                             | 0.30 mm                      | 0.0118 in.                        |
|                             | Idle gear thrust clearance                        | 0.06 – 0.17 mm               | 0.0024 – 0.0067 in.               |
|                             | Limit                                             | 0.30 mm                      | 0.0118 in.                        |
| Valve lifter                | Idle gear shaft diameter                          | 44.935 – 44.955 mm           | 1.7691 – 1.7699 in.               |
|                             | Idle gear inside diameter                         | 44.969 – 44.995 mm           | 1.7704 – 1.7715 in.               |
|                             | Idle gear oil clearance                           | 0.014 – 0.060 mm             | 0.0006 – 0.0024 in.               |
|                             | Limit                                             | 0.15 mm                      | 0.0059 in.                        |
|                             | Valve lifter diameter                             | 26.972 – 26.985 mm           | 1.0619 – 1.0624 in.               |
| Valve lifter                | Valve lifter bore diameter                        | 27.010 – 27.030 mm           | 1.0634 – 1.0642 in.               |
|                             | Oil clearance                                     | 0.025 – 0.065 mm             | 0.0010 – 0.0026 in.               |
|                             | Limit                                             | 0.10 mm                      | 0.0039 in.                        |

## SERVICE SPECIFICATIONS — Engine Mechanical

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## Specifications (Cont'd)

|                             |                                 |                             |                     |                     |
|-----------------------------|---------------------------------|-----------------------------|---------------------|---------------------|
| Cylinder block and cylinder | Cylinder head surface warpage   |                             | 0.20 mm             | 0.0079 in.          |
|                             | Limit                           |                             |                     |                     |
| Piston and piston ring      | Cylinder bore diameter          | STD                         | 95.00 – 95.03 mm    | 3.7402 – 3.7413 in. |
|                             |                                 | 3B, 13B, 13B-T              | 102.00 – 102.03 mm  | 4.0157 – 4.0169 in. |
|                             | Limit                           | 95.23 mm                    | 3.7492 in.          |                     |
|                             |                                 | 102.23 mm                   | 4.0248 in.          |                     |
|                             | Cylinder liner ridge protrusion |                             | 0.01 – 0.10 mm      | 0.0004 – 0.0039 in. |
|                             | Piston diameter                 | B                           | 94.90 – 94.93 mm    | 3.7362 – 3.7374 in. |
|                             |                                 | 3B                          | 101.90 – 101.93 mm  | 4.0118 – 4.0130 in. |
|                             |                                 | 11B                         | 94.94 – 94.97 mm    | 3.7378 – 3.7390 in. |
|                             |                                 | 13B                         | 101.93 – 101.96 mm  | 4.0130 – 4.0142 in. |
|                             |                                 | 13B-T                       | 101.92 – 101.95 mm  | 4.0126 – 4.0138 in. |
|                             | Piston oil clearance            | STD                         | 0.09 – 0.11 mm      | 0.0035 – 0.0043 in. |
|                             |                                 | 11B                         | 0.05 – 0.07 mm      | 0.0020 – 0.0028 in. |
|                             |                                 | 13B                         | 0.06 – 0.08 mm      | 0.0024 – 0.0031 in. |
|                             |                                 | 13B-T                       | 0.07 – 0.09 mm      | 0.0028 – 0.0035 in. |
|                             |                                 | Limit                       | 0.15 mm             | 0.0059 in.          |
|                             | Piston ring groove clearance    | No. 1                       | 0.08 – 0.12 mm      | 0.0031 – 0.0047 in. |
|                             |                                 | No. 2                       | 0.04 – 0.08 mm      | 0.0016 – 0.0031 in. |
|                             |                                 | Oil                         | 0.06 – 0.10 mm      | 0.0024 – 0.0039 in. |
|                             |                                 | 13B-T                       | 0.03 – 0.07 mm      | 0.0012 – 0.0028 in. |
|                             | Piston ring end gap             | STD                         | 0.35 – 0.64 mm      | 0.0138 – 0.0252 in. |
|                             |                                 | No. 1                       | 0.30 – 0.54 mm      | 0.0118 – 0.0213 in. |
|                             |                                 | No. 2                       | 0.35 – 0.64 mm      | 0.0138 – 0.0252 in. |
|                             |                                 | Oil                         | 0.45 – 0.69 mm      | 0.0177 – 0.0272 in. |
|                             |                                 | 13B-T                       | 0.35 – 0.64 mm      | 0.0138 – 0.0252 in. |
|                             |                                 | Limit                       | 0.40 – 0.69 mm      | 0.0157 – 0.0272 in. |
|                             |                                 | No. 1                       | 1.44 mm             | 0.0567 in.          |
|                             |                                 | No. 2                       | 1.34 mm             | 0.0528 in.          |
|                             |                                 | Oil                         | 1.44 mm             | 0.0567 in.          |
|                             |                                 | 13B-T                       | 1.49 mm             | 0.0587 in.          |
| Connecting rod              | Thrust clearance                | STD                         | 0.200 – 0.320 mm    | 0.0079 – 0.0126 in. |
|                             |                                 | Limit                       | 0.40 mm             | 0.0157 in.          |
|                             | Bushing inside diameter         | B                           | 29.009 – 29.019 mm  | 1.1421 – 1.1425 in. |
|                             |                                 | 3B                          | 32.009 – 32.019 mm  | 1.2602 – 1.2606 in. |
|                             |                                 | 11B, 13B, 13B-T             | 34.009 – 34.019 mm  | 1.3389 – 1.3393 in. |
|                             | Piston pin diameter             | B                           | 29.000 – 29.010 mm  | 1.1417 – 1.1421 in. |
|                             |                                 | 3B                          | 32.000 – 32.010 mm  | 1.2598 – 1.2602 in. |
|                             |                                 | 11B, 13B, 13B-T             | 34.000 – 34.010 mm  | 1.3386 – 1.3390 in. |
|                             | Piston pin oil clearance        | 0.004 – 0.014 mm            | 0.0002 – 0.0006 in. |                     |
|                             |                                 | 0.05 mm                     | 0.0020 in.          |                     |
|                             |                                 | 0.05 mm                     | 0.0020 in.          |                     |
|                             | Bend                            | Limit per 100 mm (3.94 in.) | 0.05 mm             | 0.0020 in.          |
|                             | Twist                           | Limit per 100 mm (3.94 in.) | 0.05 mm             | 0.0020 in.          |

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## SERVICE SPECIFICATIONS — Engine Mechanical

## Specifications (Cont'd)

|                                              |                         |                          |                  |                     |
|----------------------------------------------|-------------------------|--------------------------|------------------|---------------------|
| Crankshaft                                   | Thrust clearance        | STD                      | 0.040 – 0.250 mm | 0.0016 – 0.0098 in. |
|                                              |                         | Limit                    | 0.40 mm          | 0.0157 in.          |
|                                              | Thrust washer thickness | STD size                 | 2.430 – 2.480 mm | 0.0957 – 0.0976 in. |
|                                              |                         | O/S 0.125                | 2.493 – 2.543 mm | 0.0981 – 0.1001 in. |
| Main journal diameter                        |                         | O/S 0.250                | 2.555 – 2.605 mm | 0.1006 – 0.1026 in. |
|                                              |                         | STD size                 | 69.98 – 70.00 mm | 2.7551 – 2.7559 in. |
|                                              |                         | U/S 0.25                 | 69.74 – 69.75 mm | 2.7457 – 2.7461 in. |
|                                              |                         | U/S 0.50                 | 69.49 – 69.50 mm | 2.7358 – 2.7362 in. |
| Main journal oil clearance                   |                         | U/S 1.00                 | 68.99 – 69.00 mm | 2.7161 – 2.7165 in. |
|                                              |                         | STD                      | 0.030 – 0.074 mm | 0.0012 – 0.0029 in. |
| Main bearing thickness                       |                         | Limit                    | 0.15 mm          | 0.0059 in.          |
|                                              |                         | at center wall           |                  |                     |
| Crank pin diameter B                         |                         | STD size Yellow          | 2.480 – 2.485 mm | 0.0976 – 0.0978 in. |
|                                              |                         | STD size Green           | 2.485 – 2.490 mm | 0.0978 – 0.0980 in. |
|                                              |                         | STD size                 | 58.98 – 59.00 mm | 2.3220 – 2.3228 in. |
|                                              |                         | U/S 0.25                 | 58.74 – 58.75 mm | 2.3126 – 2.3130 in. |
| 3B, 11B, 13B, 13B-T                          |                         | U/S 0.50                 | 58.49 – 58.50 mm | 2.3028 – 2.3031 in. |
|                                              |                         | U/S 1.00                 | 57.99 – 58.00 mm | 2.2831 – 2.2835 in. |
|                                              |                         | STD size                 | 60.98 – 61.00 mm | 2.4008 – 2.4016 in. |
|                                              |                         | U/S 0.25                 | 60.74 – 60.75 mm | 2.3913 – 2.3917 in. |
| Crank pin oil clearance                      |                         | U/S 0.50                 | 60.49 – 60.50 mm | 2.3815 – 2.3819 in. |
|                                              |                         | U/S 1.00                 | 59.99 – 60.00 mm | 2.3618 – 2.3622 in. |
|                                              |                         | STD                      | 0.030 – 0.070 mm | 0.0012 – 0.0028 in. |
|                                              |                         | Limit                    | 0.10 mm          | 0.0039 in.          |
| Crank pin (connecting rod) bearing thickness |                         | at center wall           |                  |                     |
|                                              |                         | STD size Brown or Yellow | 1.480 – 1.485 mm | 0.0583 – 0.0585 in. |
|                                              |                         | STD size Black or Green  | 1.485 – 1.490 mm | 0.0585 – 0.0587 in. |
| Circle runout                                |                         | Limit                    | 0.08 mm          | 0.0031 in.          |
| Taper and out-of round                       |                         |                          |                  |                     |
| Main journal and crank pin                   |                         | Limit                    | 0.02 mm          | 0.0008 in.          |

## SERVICE SPECIFICATIONS — Engine Mechanical, Fuel System

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## Torque Specifications

| Part tightened                              | kg-cm | ft-lb     | Nm  |
|---------------------------------------------|-------|-----------|-----|
| Turbine outlet elbow x Turbocharger (13B-T) | 375   | 27        | 37  |
| Turbocharger x Exhaust manifold (13B-T)     | 465   | 34        | 46  |
| Water by-pass pipe x Turbocharger           | 75    | 65 in.-lb | 7.1 |
| Turbocharger oil pipe x Cylinder block      | 130   | 9         | 13  |
| Unit bolt                                   | 185   | 13        | 18  |
| Bolt                                        | 185   | 13        | 18  |
| Turbocharger oil pipe x Turbocharger        | 185   | 13        | 18  |
| Cylinder head x Cylinder block              | 1,200 | 87        | 118 |
| Valve rocker support x Cylinder head        | 185   | 13        | 18  |
| Cylinder head cover x Cylinder head         | 125   | 9         | 12  |
| Exhaust manifold x Cylinder head            | 475   | 34        | 47  |
| Water outlet housing x Cylinder head        | 185   | 13        | 18  |
| Intake manifold x Cylinder head             | 185   | 13        | 18  |
| Glow plug x Cylinder head (B, 3B)           | 125   | 9         | 12  |
| Camshaft timing gear x Camshaft             | 375   | 27        | 37  |
| Camshaft thrust plate x Cylinder block      | 185   | 13        | 18  |
| Idle gear x Cylinder block                  | 475   | 34        | 47  |
| Idle gear shaft union bolt                  | 110   | 8         | 11  |
| Timing gear cover x Cylinder block          | 185   | 13        | 18  |
| 12 mm bolt head                             | 375   | 27        | 37  |
| 14 mm bolt head                             | 2,450 | 177       | 240 |
| Crankshaft pulley x Crankshaft              | 185   | 13        | 18  |
| Push rod cover x Cylinder block             | 2,000 | 145       | 196 |
| Main bearing cap x Cylinder block           | 750   | 54        | 74  |
| Connecting rod cap x Connecting rod         | 1,200 | 87        | 118 |
| B                                           | 185   | 13        | 18  |
| 3B, 11B, 13B, 13B-T                         | 1,800 | 130       | 177 |
| Rear oil seal retainer x Cylinder block     | 1,200 | 87        | 118 |
| Flywheel x Crankshaft (M/T)                 |       |           |     |
| Drive plate x Crankshaft (A/T)              |       |           |     |

## FUEL SYSTEM

## Specifications

|                  |                                   |    |                     |
|------------------|-----------------------------------|----|---------------------|
| Injection nozzle | Nozzle type                       | B  | ND-DN 4 SD 24 ND 80 |
| (B, 3B)          |                                   | 3B | ND-DN 4 SDND 135    |
|                  | Nozzle opening pressure           |    | See page A-2        |
|                  | Pressure adjusting shim thickness |    | 1.00 mm 0.0394 in.  |
|                  |                                   |    | 1.05 mm 0.0413 in.  |
|                  |                                   |    | 1.10 mm 0.0433 in.  |
|                  |                                   |    | 1.15 mm 0.0453 in.  |
|                  |                                   |    | 1.20 mm 0.0472 in.  |
|                  |                                   |    | 1.25 mm 0.0492 in.  |
|                  |                                   |    | 1.30 mm 0.0512 in.  |
|                  |                                   |    | 1.35 mm 0.0531 in.  |
|                  |                                   |    | 1.40 mm 0.0551 in.  |
|                  |                                   |    | 1.45 mm 0.0571 in.  |
|                  |                                   |    | 1.50 mm 0.0591 in.  |
|                  |                                   |    | 1.55 mm 0.0610 in.  |
|                  |                                   |    | 1.60 mm 0.0630 in.  |
|                  |                                   |    | 1.65 mm 0.0650 in.  |
|                  |                                   |    | 1.70 mm 0.0669 in.  |
|                  |                                   |    | 1.75 mm 0.0689 in.  |
|                  |                                   |    | 1.80 mm 0.0709 in.  |
|                  |                                   |    | 1.85 mm 0.0728 in.  |
|                  |                                   |    | 1.90 mm 0.0748 in.  |
|                  |                                   |    | 1.95 mm 0.0768 in.  |

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## SERVICE SPECIFICATIONS — Fuel System

## FUEL SYSTEM

## Specifications

|                                        |                                   |                    |                                        |                 |
|----------------------------------------|-----------------------------------|--------------------|----------------------------------------|-----------------|
| Injection nozzle<br>11B, 13B,<br>13B-T | Nozzle type                       |                    | 11B                                    | ND-DLLA 155P 16 |
|                                        |                                   |                    | 13B                                    | ND-DLLA 150P 9  |
|                                        |                                   |                    | 13B-T                                  | ND-DLLA 150P 10 |
|                                        | Nozzle opening pressure           |                    | See page A-2                           |                 |
|                                        | Pressure adjusting shim thickness |                    | 0.700 mm                               | 0.0276 in.      |
|                                        |                                   |                    | 0.750 mm                               | 0.0295 in.      |
|                                        |                                   |                    | 0.800 mm                               | 0.0315 in.      |
|                                        |                                   |                    | 0.850 mm                               | 0.0335 in.      |
|                                        |                                   |                    | 0.900 mm                               | 0.0354 in.      |
|                                        |                                   |                    | 0.950 mm                               | 0.0374 in.      |
|                                        |                                   |                    | 0.975 mm                               | 0.0384 in.      |
|                                        |                                   |                    | 1.000 mm                               | 0.0394 in.      |
|                                        |                                   |                    | 1.025 mm                               | 0.0404 in.      |
|                                        |                                   |                    | 1.050 mm                               | 0.0413 in.      |
|                                        |                                   |                    | 1.075 mm                               | 0.0423 in.      |
|                                        |                                   |                    | 1.100 mm                               | 0.0433 in.      |
|                                        |                                   |                    | 1.125 mm                               | 0.0443 in.      |
|                                        |                                   |                    | 1.150 mm                               | 0.0453 in.      |
|                                        |                                   |                    | 1.175 mm                               | 0.0463 in.      |
|                                        |                                   |                    | 1.200 mm                               | 0.0472 in.      |
|                                        |                                   |                    | 1.225 mm                               | 0.0482 in.      |
|                                        |                                   |                    | 1.250 mm                               | 0.0492 in.      |
|                                        |                                   |                    | 1.275 mm                               | 0.0502 in.      |
|                                        |                                   |                    | 1.300 mm                               | 0.0512 in.      |
|                                        |                                   |                    | 1.325 mm                               | 0.0522 in.      |
|                                        |                                   |                    | 1.350 mm                               | 0.0531 in.      |
|                                        |                                   |                    | 1.375 mm                               | 0.0541 in.      |
|                                        |                                   |                    | 1.400 mm                               | 0.0551 in.      |
|                                        |                                   |                    | 1.425 mm                               | 0.0561 in.      |
|                                        |                                   |                    | 1.450 mm                               | 0.0571 in.      |
|                                        |                                   |                    | 1.475 mm                               | 0.0581 in.      |
|                                        |                                   |                    | 1.500 mm                               | 0.0591 in.      |
|                                        |                                   |                    | 1.550 mm                               | 0.0610 in.      |
|                                        |                                   |                    | 1.600 mm                               | 0.0630 in.      |
|                                        |                                   |                    | 1.650 mm                               | 0.0650 in.      |
|                                        |                                   |                    | 1.700 mm                               | 0.0669 in.      |
|                                        |                                   |                    | 1.750 mm                               | 0.0689 in.      |
|                                        |                                   |                    | 1.800 mm                               | 0.0709 in.      |
| Feed pump                              | Suction test                      |                    |                                        |                 |
|                                        | Suction pipe                      | inner diameter     | 8 mm                                   | 0.31 in.        |
|                                        |                                   | length             | 2 m                                    | 78.7 in.        |
|                                        |                                   | Suction height     | 1 m                                    | 39.4 in.        |
|                                        | Priming pump                      | at 60 stroke/ min. | Fuel must discharge within 25 strokes  |                 |
|                                        | Feed pump                         | at 150 rpm         | Fuel must discharge within 40 seconds  |                 |
| Discharge test                         | Pressure                          | at 600 rpm         | 1.8 – 2.2 kg/cm <sup>2</sup>           |                 |
|                                        |                                   |                    | (26 – 31 psi, 177 – 216 kPa)           |                 |
|                                        | Discharge nozzle diameter         |                    | 1.54 mm                                | 0.0606 in.      |
|                                        | Volume                            | at 1,000 rpm       | 900 cc/min. (54.9 cu in. min.) or more |                 |

## SERVICE SPECIFICATIONS — Fuel System

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## Specifications (Cont'd)

| Automatic<br>timer | Timer spring free length       |                |              |           |
|--------------------|--------------------------------|----------------|--------------|-----------|
|                    | B                              | Inner<br>Outer |              |           |
|                    | 3B                             |                | 43.7 mm      | 1.720 in. |
|                    | 11B (w/o HAC), 13B (w/o HAC)   |                | 54.2 mm      | 2.134 in. |
|                    | 11B (w/ HAC), 13B (w/ HAC)     |                | 50.7 mm      | 1.996 in. |
|                    | 13B-T                          |                | 50.3 mm      | 1.980 in. |
|                    |                                |                | 44.4 mm      | 1.748 in. |
|                    |                                |                | 48.5 mm      | 1.909 in. |
|                    | Timer advance angle            |                |              |           |
|                    | B                              | at 700 rpm     | 0.5° or less |           |
|                    |                                | at 750 rpm     | 0.3 – 1.3°   |           |
|                    |                                | at 900 rpm     | 2.7 – 3.7°   |           |
|                    |                                | at 1,100 rpm   | 3.5 – 4.5°   |           |
|                    |                                | at 1,400 rpm   | 4.8 – 5.8°   |           |
|                    |                                | at 1,750 rpm   | 6.0 – 7.0°   |           |
|                    |                                | at 1,850 rpm   | 6.0 – 7.0°   |           |
|                    | 3B                             | at 700 rpm     | 0.5° or less |           |
|                    |                                | at 800 rpm     | 0.2 – 1.1°   |           |
|                    |                                | at 1,000 rpm   | 1.3 – 2.3°   |           |
|                    |                                | at 1,400 rpm   | 3.8 – 4.8°   |           |
|                    |                                | at 1,750 rpm   | 6.0 – 7.0°   |           |
|                    |                                | at 1,900 rpm   | 6.0 – 7.0°   |           |
|                    | 11B (w/o HAC)                  | at 1,450 rpm   | 0.5° or less |           |
|                    |                                | at 1,750 rpm   | 4.5 – 5.5°   |           |
|                    | 13B (w/o HAC)                  | at 1,400 rpm   | 0.5° or less |           |
|                    |                                | at 1,700 rpm   | 4.5 – 5.5°   |           |
|                    | 11B (w/ HAC), 13B (w/ HAC)     | at 1,000 rpm   | 0.5° or less |           |
|                    |                                | at 1,700 rpm   | 3.0 – 4.0°   |           |
|                    | 13B-T                          | at 1,400 rpm   | 0.5° or less |           |
|                    |                                | at 1,700 rpm   | 3.5 – 4.5°   |           |
|                    | Timer adjusting shim thickness |                |              |           |
|                    | B, 3B                          |                | 0.1 mm       | 0.004 in. |
|                    |                                |                | 0.2 mm       | 0.008 in. |
|                    |                                |                | 0.5 mm       | 0.020 in. |
|                    |                                |                | 0.5 mm       | 0.020 in. |
|                    | 11B, 13B, 13B-T                |                | 0.6 mm       | 0.024 in. |
|                    |                                |                | 0.7 mm       | 0.028 in. |
|                    |                                |                | 0.8 mm       | 0.031 in. |
|                    |                                |                | 0.9 mm       | 0.035 in. |
|                    |                                |                | 1.0 mm       | 0.039 in. |

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## SERVICE SPECIFICATIONS — Fuel System

## Specifications (Cont'd)

|                                         |                                              |                                   |                        |
|-----------------------------------------|----------------------------------------------|-----------------------------------|------------------------|
| Injection pump<br>(B, 3B)               | Direction of rotation                        | Clockwise as seen from drive side |                        |
|                                         | Camshaft thrust clearance                    | STD                               | 0.03 – 0.05 mm         |
|                                         |                                              | Limit                             | 0.0012 – 0.0020 in.    |
|                                         | Camshaft thrust washer thickness             |                                   | 0.1 mm                 |
|                                         |                                              |                                   | 0.004 in.              |
|                                         |                                              |                                   | 0.10 mm                |
|                                         |                                              |                                   | 0.0039 in.             |
|                                         |                                              |                                   | 0.12 mm                |
|                                         |                                              |                                   | 0.0047 in.             |
|                                         |                                              |                                   | 0.14 mm                |
|                                         |                                              |                                   | 0.0055 in.             |
|                                         |                                              |                                   | 0.16 mm                |
|                                         |                                              |                                   | 0.0063 in.             |
|                                         |                                              |                                   | 0.18 mm                |
|                                         |                                              |                                   | 0.0071 in.             |
|                                         |                                              |                                   | 0.50 mm                |
|                                         |                                              |                                   | 0.0197 in.             |
| Injection pump<br>(11B, 13B, )<br>13B-T | Control rack sliding resistance              |                                   | 120 g (4.2 oz) or less |
|                                         | Delivery valve spring free length            |                                   | 37.0 mm                |
|                                         |                                              |                                   | 1.457 in.              |
|                                         | Plunger spring free length                   |                                   | 49.4 mm                |
|                                         |                                              |                                   | 1.945 in.              |
|                                         | Governor main spring free length             | B                                 | 45.6 mm                |
|                                         |                                              |                                   | 1.795 in.              |
|                                         |                                              | 38                                | 51.6 mm                |
|                                         |                                              |                                   | 2.031 in.              |
|                                         | Speed control spring free length             |                                   | 38.0 mm                |
|                                         |                                              |                                   | 1.496 in.              |
|                                         | HAC push rod stroke (w/ HAC)                 |                                   | 3.1 – 3.6 mm           |
|                                         |                                              |                                   | 0.122 – 0.142 in.      |
|                                         | HAC push rod clearance (w/ HAC) at sea level |                                   | 0.1 – 0.3 mm           |
|                                         |                                              |                                   | 0.004 – 0.012 in.      |
|                                         | Direction of rotation                        | Clockwise as seen from drive side |                        |
|                                         | Full stop cam thrust clearance               |                                   | 0.03 – 0.08 mm         |
|                                         |                                              |                                   | 0.0012 – 0.0032 in.    |
|                                         | Full stop cam thrust washer thickness        |                                   | 0.05 mm                |
|                                         |                                              |                                   | 0.0020 in.             |
|                                         |                                              |                                   | 0.10 mm                |
|                                         |                                              |                                   | 0.0039 in.             |
|                                         |                                              |                                   | 0.20 mm                |
|                                         |                                              |                                   | 0.0079 in.             |
|                                         | Steering lever thrust clearance              |                                   | 0.05 – 0.20 mm         |
|                                         |                                              |                                   | 0.0020 – 0.0079 in.    |
|                                         | Steering lever thrust washer thickness       |                                   | 0.50 mm                |
|                                         |                                              |                                   | 0.0197 in.             |
|                                         |                                              |                                   | 0.55 mm                |
|                                         |                                              |                                   | 0.0217 in.             |
|                                         |                                              |                                   | 0.60 mm                |
|                                         |                                              |                                   | 0.0236 in.             |
|                                         |                                              |                                   | 0.65 mm                |
|                                         |                                              |                                   | 0.0256 in.             |
|                                         |                                              |                                   | 0.70 mm                |
|                                         |                                              |                                   | 0.0276 in.             |
|                                         |                                              |                                   | 0.75 mm                |
|                                         |                                              |                                   | 0.0295 in.             |
|                                         |                                              |                                   | 0.80 mm                |
|                                         |                                              |                                   | 0.0315 in.             |
|                                         | Cam plate thrust clearance                   |                                   | 0.08 – 0.12 mm         |
|                                         |                                              |                                   | 0.0031 – 0.0047 in.    |
|                                         | Cam plate thrust washer thickness            |                                   | 0.2 mm                 |
|                                         |                                              |                                   | 0.008 in.              |
|                                         |                                              |                                   | 0.3 mm                 |
|                                         |                                              |                                   | 0.012 in.              |
|                                         |                                              |                                   | 0.4 mm                 |
|                                         |                                              |                                   | 0.016 in.              |
|                                         |                                              |                                   | 0.5 mm                 |
|                                         |                                              |                                   | 0.020 in.              |
|                                         | Floating arm thrust clearance                |                                   | 0.05 – 0.12 mm         |
|                                         |                                              |                                   | 0.0020 – 0.0047 in.    |
|                                         | Floating arm thrust washer thickness         |                                   | 0.05 mm                |
|                                         |                                              |                                   | 0.0020 in.             |
|                                         |                                              |                                   | 0.10 mm                |
|                                         |                                              |                                   | 0.0039 in.             |
|                                         |                                              |                                   | 0.20 mm                |
|                                         |                                              |                                   | 0.0079 in.             |
|                                         |                                              |                                   | 0.40 mm                |
|                                         |                                              |                                   | 0.0157 in.             |
|                                         | Jointing bolt thrust clearance               |                                   | 1.5 – 2.0 mm           |
|                                         |                                              |                                   | 0.059 – 0.079 in.      |
|                                         | Sliding weight shaft fitting dimensions      |                                   | 49.7 – 50.1 mm         |
|                                         |                                              |                                   | 1.957 – 1.972 in.      |
|                                         | Sliding weight shaft length                  |                                   | 30.7 mm                |
|                                         |                                              |                                   | 1.209 in.              |
|                                         |                                              |                                   | 30.9 mm                |
|                                         |                                              |                                   | 1.217 in.              |
|                                         |                                              |                                   | 31.1 mm                |
|                                         |                                              |                                   | 1.224 in.              |
|                                         |                                              |                                   | 31.3 mm                |
|                                         |                                              |                                   | 1.232 in.              |
|                                         |                                              |                                   | 31.5 mm                |
|                                         |                                              |                                   | 1.240 in.              |
|                                         |                                              |                                   | 31.7 mm                |
|                                         |                                              |                                   | 1.248 in.              |
|                                         |                                              |                                   | 31.9 mm                |
|                                         |                                              |                                   | 1.256 in.              |
|                                         | Flyweight thrust clearance (M/T)             |                                   | 0.02 – 0.10 mm         |
|                                         |                                              |                                   | 0.0008 – 0.0039 in.    |
|                                         | Flyweight thrust washer thickness (M/T)      |                                   | 1.60 mm                |
|                                         |                                              |                                   | 0.0630 in.             |
|                                         |                                              |                                   | 1.65 mm                |
|                                         |                                              |                                   | 0.0650 in.             |
|                                         |                                              |                                   | 1.70 mm                |
|                                         |                                              |                                   | 0.0670 in.             |
|                                         |                                              |                                   | 1.75 mm                |
|                                         |                                              |                                   | 0.0689 in.             |
|                                         |                                              |                                   | 1.80 mm                |
|                                         |                                              |                                   | 0.0709 in.             |

## SERVICE SPECIFICATIONS -- Fuel System

A-11

## Specifications (Cont'd)

|                                                  |                                            |                         |                     |
|--------------------------------------------------|--------------------------------------------|-------------------------|---------------------|
| Injection pump<br>11B, 13B,<br>13B-T<br>(Cont'd) | Flyweight thrust washer thickness (cont'd) | 1.85 mm                 | 0.0728 in.          |
|                                                  |                                            | 1.90 mm                 | 0.0748 in.          |
|                                                  |                                            | 1.95 mm                 | 0.0768 in.          |
|                                                  |                                            | 2.00 mm                 | 0.0787 in.          |
|                                                  |                                            | 2.10 mm                 | 0.0827 in.          |
|                                                  |                                            | 2.20 mm                 | 0.0866 in.          |
|                                                  |                                            | 2.30 mm                 | 0.0906 in.          |
|                                                  |                                            | 0.05 - 0.20 mm          | 0.0020 - 0.0079 in. |
|                                                  | Stopper arm thrust clearance               | 0.1 mm                  | 0.004 in.           |
|                                                  |                                            | 0.2 mm                  | 0.008 in.           |
|                                                  | Stopper arm thrust washer thickness        | 0.5 mm                  | 0.020 in.           |
|                                                  |                                            | 0.03 - 0.05 mm          | 0.0012 - 0.0020 in. |
|                                                  | Camshaft thrust clearance STD<br>Limit     | 0.1 mm                  | 0.004 in.           |
|                                                  |                                            | 0.10 mm                 | 0.0039 in.          |
|                                                  | Camshaft thrust washer thickness Front     | 0.12 mm                 | 0.0047 in.          |
|                                                  |                                            | 0.14 mm                 | 0.0055 in.          |
|                                                  |                                            | 0.16 mm                 | 0.0063 in.          |
|                                                  |                                            | 0.18 mm                 | 0.0071 in.          |
|                                                  |                                            | 0.50 mm                 | 0.0197 in.          |
|                                                  |                                            | 0.10 mm                 | 0.0039 in.          |
|                                                  | Rear                                       | 0.15 mm                 | 0.0059 in.          |
|                                                  |                                            | 0.30 mm                 | 0.0118 in.          |
|                                                  |                                            | 0.50 mm                 | 0.0197 in.          |
|                                                  |                                            | 120 g (4.2 oz.) or less |                     |
|                                                  | Control rack sliding resistance            | 19.8 mm                 | 0.780 in.           |
|                                                  |                                            | 49.4 mm                 | 1.945 in.           |
|                                                  | Delivery valve spring free length          | 10.2 mm                 | 0.402 in.           |
|                                                  |                                            | 24.0 mm                 | 0.945 in.           |
|                                                  | Plunger spring free length                 | 26.0 mm                 | 1.024 in.           |
|                                                  |                                            | 24.4 mm                 | 0.961 in.           |
|                                                  | Mechanical governor spring free length     | 23.8 mm                 | 0.937 in.           |
|                                                  |                                            | 3.1 - 3.6 mm            | 0.122 - 0.142 in.   |
|                                                  | Speed control spring free length           | 0.2 - 0.5 mm            | 0.008 - 0.020 in.   |
|                                                  |                                            | 4.0 - 5.0 mm            | 0.157 - 0.197 in.   |
|                                                  | Inner idle spring free length M/T<br>A/T   | 10 seconds or more      |                     |
|                                                  |                                            |                         |                     |
|                                                  | Full-load stopper pre-setting              |                         |                     |
|                                                  |                                            |                         |                     |
|                                                  | Stop cam to stopper housing distance       | 27.0 mm                 | 1.063 in.           |
|                                                  |                                            | 22.5 mm                 | 0.886 in.           |
|                                                  | 11B (w/o HAC), 13B (w/o HAC)               |                         |                     |
|                                                  |                                            |                         |                     |
|                                                  | 11B (w/ HAC), 13B (w/ HAC), 13B-T          |                         |                     |
|                                                  |                                            |                         |                     |

A-12

## SERVICE SPECIFICATIONS — Fuel System

## Injection Pump Adjustment (Pump Body)

|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|-----------------------------|------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------|------------------------------|
| Preparations of pump tester | Test nozzle type             | B<br>3B<br>11B, 13B, 13B-T                                           | DN 4 SD 24 ND 80<br>DN 4 SDND 135<br>DN 12 SD 12A<br>115 – 125 kg/cm <sup>2</sup><br>(1,636 – 1,778 psi, 11,278 – 12,258 kPa)<br>170 – 180 kg/cm <sup>2</sup><br>(2,418 – 2,560 psi, 16,671 – 17,651 kPa)                                                                                                                              |                                     |                           |                              |
|                             | Test nozzle opening pressure | B, 3B<br>11, 13B, 13B-T                                              |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             | Injection pipe               | Outer diameter<br>Inner diameter<br>Length<br>Minimum bending radius | 6.0 mm<br>2.0 mm<br>600 mm<br>25 mm (0.98 in.) or more                                                                                                                                                                                                                                                                                 | 0.236 in.<br>0.079 in.<br>23.62 in. |                           |                              |
|                             | Fuel temperature             |                                                                      | 40 – 45°C                                                                                                                                                                                                                                                                                                                              | 104 – 113°F                         |                           |                              |
|                             | Fuel feeding pressure        | B, 3B<br>11B, 13B, 13B-T                                             | 0.5 kg/cm <sup>2</sup><br>2.0 kg/cm <sup>2</sup>                                                                                                                                                                                                                                                                                       | 7.1 psi<br>28 psi                   | 49 kPa<br>196 kPa         |                              |
| Control Rack                | Sliding resistance           | Pump at 0 rpm<br>Pump at 1,000 rpm                                   | 120 g (4.2 oz) or less<br>50 g (1.8 oz) or less                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
| Injecting timing            | Pre-stroke                   | B, 3B<br>11B, 13B, 13B-T                                             | 1.90 – 2.00 mm 0.0748 – 0.0787 in.<br>3.05 – 3.15 mm 0.1201 – 0.1240 in.                                                                                                                                                                                                                                                               |                                     |                           |                              |
|                             | Injection interval           |                                                                      | 89°30' – 90°30'                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             | Tappet clearance             |                                                                      | 0.2 mm (0.008 in.) or more                                                                                                                                                                                                                                                                                                             |                                     |                           |                              |
|                             | Adjusting shim thickness     |                                                                      | 0.10 mm 0.0039 in.<br>0.15 mm 0.0059 in.<br>0.20 mm 0.0079 in.<br>0.30 mm 0.0118 in.<br>0.40 mm 0.0158 in.<br>0.50 mm 0.0197 in.<br>0.60 mm 0.0236 in.<br>0.70 mm 0.0276 in.<br>0.80 mm 0.0315 in.<br>0.90 mm 0.0354 in.<br>1.00 mm 0.0394 in.<br>1.10 mm 0.0433 in.<br>1.20 mm 0.0472 in.<br>1.30 mm 0.0519 in.<br>1.40 mm 0.0551 in. |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |
|                             | Injection volume             | Item                                                                 | Rack position mm (in.)                                                                                                                                                                                                                                                                                                                 | Pump rpm                            | Measuring stroke          | Injection volume cc (cu in.) |
| B                           |                              | 16.0 (0.630)                                                         | 100                                                                                                                                                                                                                                                                                                                                    | 200                                 | 14.0 – 16.0 (0.85 – 0.98) | 1.2 (0.07)                   |
|                             |                              | 8.6 (0.339)                                                          | 1,000                                                                                                                                                                                                                                                                                                                                  | 200                                 | 4.6 – 5.6 (0.28 – 0.34)   | 0.4 (0.02)                   |
|                             |                              | 11.7 (0.460)                                                         | 1,100                                                                                                                                                                                                                                                                                                                                  | 200                                 | 10.0 – 10.6 (0.61 – 0.65) | 0.4 (0.02)                   |
|                             |                              | 11.7 (0.460)                                                         | 1,700                                                                                                                                                                                                                                                                                                                                  | 200                                 | 10.4 – 11.4 (0.63 – 0.70) | 0.6 (0.04)                   |
|                             |                              | 6.5 (0.256)                                                          | 325                                                                                                                                                                                                                                                                                                                                    | 500                                 | 2.5 – 4.5 (0.15 – 0.34)   | 1.0 (0.06)                   |
|                             |                              |                                                                      |                                                                                                                                                                                                                                                                                                                                        |                                     |                           |                              |

## SERVICE SPECIFICATIONS — Fuel System

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## Injection Pump Adjustment (Pump Body) (Cont'd)

| Injection volume<br>(Cont'd) | Item                                                     | Rack position<br>mm (in.) | Pump rpm | Measuring<br>stroke | Injection volume<br>cc (cu in.)                               | Variation limit<br>cc (cu in.) |
|------------------------------|----------------------------------------------------------|---------------------------|----------|---------------------|---------------------------------------------------------------|--------------------------------|
|                              | 3B<br>(Cold weather<br>spec.<br>Part No.<br>22100-58022) | 17.5<br>(0.689)           | 100      | 200                 | 13.5 - 16.5<br>(0.82 - 1.01)                                  | 1.8 (0.11)                     |
|                              |                                                          | 8.0<br>(0.315)            | 1,000    | 200                 | 4.3 - 5.1<br>(0.26 - 0.31)                                    | 0.6 (0.04)                     |
|                              |                                                          | 12.9<br>(0.508)           | 1,100    | 200                 | 11.1 - 11.7<br>(0.68 - 0.71)                                  | 0.6 (0.04)                     |
|                              |                                                          | 12.9<br>(0.508)           | 1,700    | 200                 | 11.3 - 12.3<br>(0.69 - 0.75)                                  | 0.9 (0.05)                     |
|                              |                                                          | 6.5<br>(0.256)            | 325      | 500                 | 2.0 - 5.0<br>(0.12 - 0.31)                                    | 1.5 (0.09)                     |
|                              | 3B<br>(Others)                                           | 17.5<br>(0.689)           | 100      | 200                 | 14.0 - 16.0<br>(0.85 - 0.98)                                  | 1.2 (0.07)                     |
|                              |                                                          | 8.0<br>(0.315)            | 1,000    | 200                 | 4.3 - 5.1<br>(0.26 - 0.31)                                    | 0.4 (0.02)                     |
|                              |                                                          | 12.9<br>(0.508)           | 1,100    | 200                 | 11.1 - 11.7<br>(0.68 - 0.71)                                  | 0.4 (0.02)                     |
|                              |                                                          | 12.9<br>(0.508)           | 1,700    | 200                 | 11.3 - 12.3<br>(0.69 - 0.75)                                  | 0.6 (0.04)                     |
|                              |                                                          | 6.5<br>(0.256)            | 325      | 500                 | 2.5 - 4.5<br>(0.15 - 0.34)                                    | 1.0 (0.06)                     |
|                              | 11B<br>(w/o HAC)                                         | 16.0<br>(0.630)           | 100      | 200                 | 10.0 - 14.0<br>(0.61 - 0.85)                                  | 1.6 (1.10)                     |
|                              |                                                          | 10.4<br>(0.409)           | 1,100    | 200                 | 10.1 - 11.5<br>(0.62 - 0.70)                                  | 0.9 (0.05)                     |
|                              |                                                          | 10.2<br>(0.402)           | 1,800    | 200                 | 8.9 - 10.1<br>(0.54 - 0.62)                                   | 1.2 (0.07)                     |
|                              |                                                          | Approx.<br>9.1 (0.358)    | 325      | 500                 | 3.5 - 6.5<br>(0.21 - 0.40)                                    | 1.5 (0.09)                     |
|                              | 11B<br>(w/ HAC)                                          | 16.0<br>(0.630)           | 100      | 200                 | 10.0 - 14.0<br>(0.61 - 0.85)                                  | 1.6 (0.10)                     |
|                              |                                                          | 10.4<br>(0.409)           | 1,100    | 200                 | 9.5 - 10.1<br>(0.58 - 0.62)                                   | 0.9 (0.05)                     |
|                              |                                                          | 10.3<br>(0.406)           | 1,800    | 200                 | 9.3 - 10.5<br>(0.57 - 0.64)                                   | 1.2 (0.07)                     |
|                              |                                                          | Approx.<br>9.1 (0.358)    | 325      | 500                 | 3.5 - 6.5<br>(0.21 - 0.40)                                    | 1.5 (0.09)                     |
|                              | 13B M/T<br>(w/o HAC)                                     | 16.0<br>(0.630)           | 100      | 200                 | 12.4 - 16.4<br>(0.76 - 1.00)                                  | 1.6 (0.10)                     |
|                              |                                                          | 10.5<br>(0.413)           | 1,100    | 200                 | 11.2 - 11.8<br>(0.68 - 0.72)                                  | 0.9 (0.05)                     |
|                              |                                                          | 10.3<br>(0.406)           | 1,700    | 200                 | 10.8 - 12.0<br>(0.66 - 0.73)<br>*10.8 - 12.2<br>(0.66 - 0.74) | 1.2 (0.07)                     |
|                              |                                                          | Approx.<br>9.1 (0.358)    | 325      | 500                 | 3.5 - 6.5<br>(0.21 - 0.40)                                    | 1.5 (0.09)                     |
|                              | 13B M/T<br>(w/ HAC)                                      | * 16.0<br>(0.630)         | 100      | 200                 | 12.4 - 16.4<br>(0.76 - 1.00)                                  | 1.6 (0.10)                     |
|                              |                                                          | 10.5<br>(0.413)           | 1,100    | 200                 | 11.2 - 11.8<br>(0.68 - 0.72)                                  | 0.9 (0.05)                     |
|                              |                                                          | 10.4<br>(0.409)           | 1,700    | 200                 | 11.3 - 12.3<br>(0.69 - 0.75)                                  | 1.2 (0.07)                     |
|                              |                                                          | Approx.<br>9.1 (0.358)    | 325      | 500                 | 3.5 - 6.5<br>(0.21 - 0.40)                                    | 1.5 (0.09)                     |

\* BB

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## SERVICE SPECIFICATIONS — Fuel System

## Injection Pump Adjustment (Pump Body) (Cont'd)

| Injection volume<br>(Cont'd) | Item      | Rack position<br>mm (in.) | Pump rpm | Measuring<br>stroke | Injection volume<br>cc (cu in.) | Variation limit<br>cc (cu in.) |
|------------------------------|-----------|---------------------------|----------|---------------------|---------------------------------|--------------------------------|
|                              | 13B A/T   | 16.0<br>(0.630)           | 100      | 200                 | 18.8 – 22.8<br>(1.15 – 1.39)    | 1.6 (0.10)                     |
|                              |           | 10.2<br>(0.402)           | 1,100    | 200                 | 11.2 – 11.8<br>(0.68 – 0.72)    | 0.9 (0.05)                     |
|                              |           | 10.0<br>(0.393)           | 1,700    | 200                 | 10.6 – 11.8<br>(0.65 – 0.72)    | 1.2 (0.07)                     |
|                              |           | 8.4<br>(0.331)            | 400      | 500                 | 4.25 – 7.25<br>(0.26 – 0.44)    | 1.5 (0.09)                     |
|                              | 13B-T M/T | 16.0<br>(0.630)           | 100      | 200                 | 12.4 – 16.4<br>(0.76 – 1.00)    | 1.6 (0.10)                     |
|                              |           | 11.1<br>(0.437)           | 1,100    | 200                 | 13.5 – 14.3<br>(0.82 – 0.87)    | 0.9 (0.05)                     |
|                              |           | 10.9<br>(0.429)           | 1,700    | 200                 | 12.9 – 13.9<br>(0.79 – 0.85)    | 1.2 (0.07)                     |
|                              |           | Approx.<br>9.1 (0.358)    | 325      | 500                 | 3.5 – 6.5<br>(0.21 – 0.40)      | 1.5 (0.09)                     |
|                              | 13B-T A/T | 16.0<br>(0.630)           | 100      | 200                 | 17.6 – 22.8<br>(1.07 – 1.39)    | 1.6 (0.10)                     |
|                              |           | 10.8<br>(0.425)           | 1,100    | 200                 | 12.8 – 13.6<br>(0.78 – 0.83)    | 0.9 (0.05)                     |
|                              |           | 10.9<br>(0.429)           | 1,700    | 200                 | 13.6 – 14.6<br>(0.83 – 0.89)    | 1.2 (0.07)                     |
|                              |           | 8.4<br>(0.331)            | 400      | 500                 | 4.25 – 7.25<br>(0.26 – 0.44)    | 1.5 (0.09)                     |

## Injection Pump Adjustment (Governor B and 3B)

| Vacuum chamber           | Pressure drop                                            |          | 10 seconds or more                                        |                                                  |
|--------------------------|----------------------------------------------------------|----------|-----------------------------------------------------------|--------------------------------------------------|
| Governor main spring     | Item                                                     | Pump rpm | Vacuum<br>mm H <sub>2</sub> O (in. H <sub>2</sub> O, kPa) | Rack position<br>mm (in.)                        |
|                          | B                                                        | 600      | 600 (23.62, 5.88)                                         | 11.7 (0.461)                                     |
|                          |                                                          |          | 640 (25.20, 6.28)                                         | 11.4 – 11.7 (0.449 – 0.461)                      |
|                          |                                                          |          | 750 (29.53, 7.35)                                         | 9.3 – 10.7 (0.366 – 0.421)                       |
|                          | 3B<br>(Cold weather<br>spec.<br>Part No.<br>22100-58022) | 600      | 400 (15.75, 3.92)                                         | 12.7 – 13.7 (0.500 – 0.561)                      |
|                          |                                                          |          | 580 (22.83, 5.69)                                         | 12.3 – 13.2 (0.484 – 0.520)                      |
|                          |                                                          |          | 700 (27.56, 6.86)                                         | 8.7 – 10.7 (0.343 – 0.421)                       |
|                          | 3B<br>(Others)                                           | 600      | 400 (15.75, 3.92)                                         | 12.9 (0.508)                                     |
|                          |                                                          |          | 580 (22.83, 5.69)                                         | 12.5 – 12.9 (0.492 – 0.508)                      |
|                          |                                                          |          | 700 (27.56, 6.86)                                         | 8.9 – 10.5 (0.350 – 0.413)                       |
| Adjusting shim thickness |                                                          |          | 0.5 mm<br>1.0 mm<br>2.0 mm<br>3.0 mm                      | 0.020 in.<br>0.039 in.<br>0.079 in.<br>0.118 in. |
| Idle spring              | Item                                                     | Pump rpm | Vacuum<br>mm H <sub>2</sub> O (in. H <sub>2</sub> O, kPa) | Control rack position<br>mm (in.)                |
|                          | B                                                        | 600      | 850 (33.46, 8.34)                                         | 7.5 – 8.5 (0.295 – 0.335)                        |
|                          |                                                          |          | 950 (37.40, 9.32)                                         | 7.1 – 7.3 (0.280 – 0.287)                        |

| SERVICE SPECIFICATIONS — Fuel System                   |                                                                  |          |                                                           |                                   | A-15                                                   |
|--------------------------------------------------------|------------------------------------------------------------------|----------|-----------------------------------------------------------|-----------------------------------|--------------------------------------------------------|
| Injection Pump Adjustment (Governor B and 3B) (Cont'd) |                                                                  |          |                                                           |                                   |                                                        |
| Idle spring<br>(Cont'd)                                | Item                                                             | Pump rpm | Vacuum<br>mm H <sub>2</sub> O (in. H <sub>2</sub> O, kPa) | Control rack position<br>mm (in.) |                                                        |
|                                                        | 3B<br>(Cold weather<br>spec.<br>Part No.<br>22100-58022)         | 600      | 1,000 (39.37, 9.81)                                       | 6.7 – 7.3 (0.264 – 0.287)         |                                                        |
|                                                        |                                                                  |          | 1,200 (47.24, 11.77)                                      | 5.0 – 6.4 (0.197 – 0.252)         |                                                        |
|                                                        | 3B<br>(Others)                                                   | 600      | 1,000 (39.37, 9.81)                                       | 6.9 – 7.1 (0.272 – 0.280)         |                                                        |
|                                                        |                                                                  |          | 1,200 (47.24, 11.77)                                      | 5.2 – 6.2 (0.205 – 0.244)         |                                                        |
| Speed control<br>spring                                | Item                                                             | Pump rpm | Vacuum<br>mm H <sub>2</sub> O (in. H <sub>2</sub> O, kPa) | Control rack position<br>mm (in.) |                                                        |
|                                                        | B                                                                | 1,920    | 450 (17.72, 4.41)                                         | 11.7 (0.461)                      |                                                        |
|                                                        |                                                                  | 1,940    | 450 (17.72, 4.41)                                         | 11.5 – 11.7 (0.453 – 0.461)       |                                                        |
|                                                        |                                                                  | 2,050    | 450 (17.72, 4.41)                                         | 8.8 – 10.4 (0.346 – 0.409)        |                                                        |
|                                                        | 3B<br>(Cold weather<br>spec.<br>Part No.<br>22100-58022)         | 1,700    | 400 (15.75, 3.92)                                         | 12.5 – 13.3 (0.492 – 0.524)       |                                                        |
|                                                        |                                                                  | 1,760    | 400 (15.75, 3.92)                                         | 12.3 – 13.3 (0.484 – 0.524)       |                                                        |
|                                                        |                                                                  | 1,950    | 400 (15.75, 3.92)                                         | 7.7 – 10.6 (0.303 – 0.417)        |                                                        |
|                                                        |                                                                  | 2,050    | 400 (15.75, 3.92)                                         | 9.2 (0.362) or less               |                                                        |
|                                                        |                                                                  | 1,700    | 400 (15.75, 3.92)                                         | 12.7 – 13.1 (0.500 – 0.516)       |                                                        |
|                                                        | 3B<br>(Others)                                                   | 1,760    | 400 (15.75, 3.92)                                         | 12.5 – 12.9 (0.492 – 0.508)       |                                                        |
|                                                        |                                                                  | 1,950    | 400 (15.75, 3.92)                                         | 7.9 – 10.4 (0.311 – 0.409)        |                                                        |
|                                                        |                                                                  | 2,050    | 400 (15.75, 3.92)                                         | 8.9 (0.350) or less               |                                                        |
|                                                        |                                                                  | 2,050    | 400 (15.75, 3.92)                                         | 8.9 (0.350) or less               |                                                        |
| Total injection<br>volume                              | Item                                                             | Pump rpm | Vacuum<br>mm H <sub>2</sub> O (in. H <sub>2</sub> O, kPa) | Measuring<br>stroke               | Total injection volume<br>of each cylinder cc (cu in.) |
|                                                        | B w/o HAC                                                        | 700      | 120 (4.72, 1.77)                                          | 1,000                             | 182.0 – 198.0 (11.1 – 12.1)                            |
|                                                        |                                                                  | 1,100    | 120 (4.72, 1.77)                                          | 1,000                             | 202.0 – 210.0 (12.3 – 12.8)                            |
|                                                        |                                                                  | 1,700    | 120 (4.72, 1.77)                                          | 1,000                             | 210.0 – 226.0 (12.8 – 13.8)                            |
|                                                        | B w/ HAC<br>(w/o Tachometer)                                     | 700      | 120 (4.72, 1.77)                                          | 1,000                             | 190.0 – 206.0 (11.6 – 12.6)                            |
|                                                        |                                                                  | 1,100    | 120 (4.72, 1.77)                                          | 1,000                             | 202.0 – 210.0 (12.3 – 12.8)                            |
|                                                        |                                                                  | 1,700    | 120 (4.72, 1.77)                                          | 1,000                             | 212.0 – 228.0 (12.9 – 13.9)                            |
|                                                        | B w/ HAC<br>(w/ Tachometer)                                      | 700      | 150 (5.91, 1.47)                                          | 1,000                             | 190.0 – 206.0 (11.6 – 12.6)                            |
|                                                        |                                                                  | 1,100    | 300 (11.81, 2.94)                                         | 1,000                             | 202.0 – 210.0 (12.3 – 12.8)                            |
|                                                        |                                                                  | 1,700    | 450 (17.72, 4.41)                                         | 1,000                             | 212.0 – 228.0 (12.9 – 13.9)                            |
|                                                        | 3B w/o HAC<br>(Cold weather<br>spec.<br>Part No.<br>22100-58022) | 700      | 150 (5.91, 1.47)                                          | 1,000                             | 198.0 – 222.0 (12.1 – 13.5)                            |
|                                                        |                                                                  | 1,100    | 260 (10.24, 2.55)                                         | 1,000                             | 222.0 – 234.0 (13.5 – 14.3)                            |
|                                                        |                                                                  | 1,700    | 400 (15.75, 3.92)                                         | 1,000                             | 226.0 – 250.0 (13.8 – 15.3)                            |
|                                                        | 3B w/o HAC<br>(Others)                                           | 700      | 150 (5.91, 1.47)                                          | 1,000                             | 202.0 – 218.0 (12.3 – 13.3)                            |
|                                                        |                                                                  | 1,100    | 260 (10.24, 2.55)                                         | 1,000                             | 224.0 – 232.0 (13.7 – 14.2)                            |
|                                                        |                                                                  | 1,700    | 400 (15.75, 3.92)                                         | 1,000                             | 230.0 – 246.0 (14.0 – 15.0)                            |
|                                                        | 3B w/ HAC                                                        | 700      | 150 (5.91, 1.47)                                          | 1,000                             | 206.0 – 222.0 (12.6 – 13.5)                            |
|                                                        |                                                                  | 1,100    | 260 (10.24, 2.55)                                         | 1,000                             | 224.0 – 232.0 (13.7 – 14.2)                            |
|                                                        |                                                                  | 1,700    | 400 (15.75, 3.92)                                         | 1,000                             | 226.0 – 242.0 (13.8 – 14.8)                            |

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## SERVICE SPECIFICATIONS — Fuel System

## Injection Pump Adjustment (Governor 11B, 13B and 13B-T) (Cont'd)

| Idle speed control   | Item                            | Adjusting lever position | Pump rpm | Rack position               |         |           |
|----------------------|---------------------------------|--------------------------|----------|-----------------------------|---------|-----------|
|                      |                                 |                          |          | mm (in.)                    |         |           |
|                      | 11B M/T<br>13B M/T<br>13B-T M/T | Idle                     | 100      | 10.6 (0.417) or more        |         |           |
|                      |                                 |                          | 325      | 8.8 – 9.4 (0.346 – 0.370)   |         |           |
|                      |                                 |                          | 600      | 5.6 – 7.0 (0.220 – 0.276)   |         |           |
|                      |                                 |                          | 800      | 3.9 – 4.7 (0.154 – 0.185)   |         |           |
|                      |                                 |                          | 1,200    | 2.4 – 3.8 (0.094 – 0.150)   |         |           |
|                      | 13B A/T                         | Idle                     | 100      | 10.6 (0.417) or more        |         |           |
|                      |                                 |                          | 400      | 8.1 – 8.7 (0.319 – 0.343)   |         |           |
|                      |                                 |                          | 600      | 5.7 – 7.1 (0.224 – 0.280)   |         |           |
|                      |                                 |                          | 800      | 4.0 – 4.8 (0.157 – 0.189)   |         |           |
|                      |                                 |                          | 1,200    | 2.5 – 3.9 (0.098 – 0.154)   |         |           |
|                      | 13B-T A/T                       | Idle                     | 100      | 10.6 (0.417) or more        |         |           |
|                      |                                 |                          | 250      | 9.9 – 11.1 (0.390 – 0.437)  |         |           |
|                      |                                 |                          | 400      | 8.1 – 8.7 (0.319 – 0.343)   |         |           |
|                      |                                 |                          | 600      | 5.7 – 7.1 (0.224 – 0.280)   |         |           |
|                      |                                 |                          | 800      | 4.0 – 4.8 (0.157 – 0.189)   |         |           |
|                      |                                 |                          | 1,200    | 2.4 – 3.8 (0.094 – 0.150)   |         |           |
|                      | Adjusting washer thickness      |                          |          | Inner                       | 0.4 mm  | 0.016 in. |
|                      |                                 |                          |          |                             | 0.55 mm | 0.022 in. |
|                      |                                 |                          |          | Outer                       | 0.6 mm  | 0.024 in. |
|                      |                                 |                          |          |                             | 0.2 mm  | 0.008 in. |
|                      |                                 |                          |          |                             | 0.4 mm  | 0.016 in. |
|                      |                                 |                          |          |                             | 0.5 mm  | 0.020 in. |
|                      |                                 |                          |          |                             | 0.6 mm  | 0.024 in. |
| Medium speed control | 11B<br>(w/o HAC)                | Maximum                  | 500      | 10.0 – 11.0 (0.394 – 0.435) |         |           |
|                      |                                 |                          | 700      | 10.0 – 10.8 (0.394 – 0.425) |         |           |
|                      |                                 |                          | 1,100    | 10.1 – 10.7 (0.398 – 0.421) |         |           |
|                      |                                 |                          | 1,800    | 9.6 – 10.6 (0.378 – 0.417)  |         |           |
|                      |                                 |                          | 1,900    | 9.3 – 10.1 (0.366 – 0.398)  |         |           |
|                      | 11B<br>(w/ HAC)                 | Maximum                  | 500      | 10.1 – 11.1 (0.398 – 0.437) |         |           |
|                      |                                 |                          | 700      | 10.1 – 10.9 (0.398 – 0.429) |         |           |
|                      |                                 |                          | 1,100    | 10.1 – 10.7 (0.398 – 0.421) |         |           |
|                      |                                 |                          | 1,800    | 9.7 – 10.7 (0.382 – 0.421)  |         |           |
|                      |                                 |                          | 1,900    | 9.4 – 10.2 (0.370 – 0.402)  |         |           |

## SERVICE SPECIFICATIONS — Fuel System

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## Injection Pump Adjustment (Governor 11B, 13B and 13B-T) (Cont'd)

| Medium speed control<br>(Cont'd) | Item                 | Adjusting lever position | Pump rpm | Rack position                                            |
|----------------------------------|----------------------|--------------------------|----------|----------------------------------------------------------|
|                                  |                      |                          |          | mm (in.)                                                 |
|                                  | 13B M/T<br>(w/o HAC) | Maximum                  | 500      | 10.2 - 11.2 (0.402 - 0.441)                              |
|                                  |                      |                          | 700      | 10.0 - 10.8 (0.394 - 0.425)                              |
|                                  |                      |                          | 1,100    | 10.2 - 10.8 (0.402 - 0.425)                              |
|                                  |                      |                          | 1,700    | 10.0 - 10.7 (0.394 - 0.421)                              |
|                                  |                      |                          | 1,800    | 9.4 - 10.4 (0.370 - 0.409)<br>9.3 - 10.3 (0.366 - 0.406) |
|                                  |                      |                          |          |                                                          |
|                                  | 13B M/T<br>(w/ HAC)  | Maximum                  | 500      | 10.3 - 11.3 (0.406 - 0.445)                              |
|                                  |                      |                          | 700      | 10.0 - 10.8 (0.394 - 0.425)                              |
|                                  |                      |                          | 1,100    | 10.2 - 10.8 (0.402 - 0.425)                              |
|                                  |                      |                          | 1,700    | 9.9 - 10.9 (0.390 - 0.429)                               |
|                                  |                      |                          | 1,800    | 9.7 - 10.5 (0.382 - 0.413)                               |
|                                  |                      |                          |          | Approx. 10.4 (0.409)                                     |
|                                  | 13B A/T              | Maximum                  | 500      | 9.5 - 10.3 (0.374 - 0.406)                               |
|                                  |                      |                          | 700      | 9.9 - 10.5 (0.390 - 0.413)                               |
|                                  |                      |                          | 1,100    | 9.6 - 10.3 (0.378 - 0.406)                               |
|                                  |                      |                          | 1,700    | 8.9 - 9.9 (0.350 - 0.390)                                |
|                                  |                      |                          | 1,800    | 10.7 - 11.5 (0.421 - 0.453)                              |
|                                  | 13B-T M/T            | Maximum                  | 500      | 10.8 - 11.6 (0.425 - 0.457)                              |
|                                  |                      |                          | 700      | 10.8 - 11.4 (0.425 - 0.449)                              |
|                                  |                      |                          | 1,100    | 10.5 - 11.3 (0.413 - 0.445)                              |
|                                  |                      |                          | 1,700    | 9.4 - 10.2 (0.370 - 0.402)                               |
|                                  |                      |                          | 1,800    | 10.6 - 11.4 (0.417 - 0.449)                              |
|                                  | 13B-T A/T            | Maximum                  | 500      | 10.3 - 11.1 (0.406 - 0.437)                              |
|                                  |                      |                          | 700      | 10.5 - 11.1 (0.413 - 0.437)                              |
|                                  |                      |                          | 1,100    | 10.5 - 11.3 (0.413 - 0.445)                              |
|                                  |                      |                          | 1,700    | 9.5 - 10.3 (0.374 - 0.406)                               |
|                                  |                      |                          | 1,900    |                                                          |
| Maximum speed control            | 11B                  |                          | 2,100    | 7.0 - 8.4 (0.276 - 0.331)                                |
|                                  |                      |                          |          |                                                          |
|                                  | 13B M/T<br>(w/ HAC)  | Maximum                  | 2,200    | 6.2 (0.244) or less                                      |
|                                  |                      |                          | 2,100    | 7.0 - 8.4 (0.276 - 0.331)                                |
|                                  | 13B-T M/T            |                          | 2,100    | 6.0 (0.236) or less                                      |
|                                  |                      |                          | 2,200    | 6.3 - 7.7 (0.248 - 0.303)                                |
|                                  | 13B A/T              | Maximum                  | 2,100    | 6.0 (0.236) or less                                      |
|                                  |                      |                          | 2,200    | 6.3 - 7.7 (0.248 - 0.303)                                |
|                                  | 13B-T A/T            | Maximum                  | 2,100    | 6.2 (0.244) or less                                      |
|                                  |                      |                          | 2,200    |                                                          |

\* BB

A-18

## SERVICE SPECIFICATIONS — Fuel System

## Injection Pump Adjustment (Governor 11B, 13B and 13B-T) (Cont'd)

| Boost compensator (13B-T) | Item              | Adjusting lever position | Pump rpm                                                    | Boost compensator pressure<br>kg/cm <sup>2</sup> (psi, kPa) | Rack position    |                                                        |
|---------------------------|-------------------|--------------------------|-------------------------------------------------------------|-------------------------------------------------------------|------------------|--------------------------------------------------------|
|                           |                   |                          |                                                             |                                                             | mm (in)          |                                                        |
|                           | 13B-T M/T         | Maximum                  | 500                                                         | 0                                                           | 10.3 – 10.9      | (0.406 – 0.429)                                        |
|                           |                   |                          |                                                             | 0.12 (1.7, 12)                                              | 10.7 – 11.5      | (0.421 – 0.453)                                        |
|                           | 13B-T A/T         | Maximum                  | 500                                                         | 0                                                           | 10.45 – 11.05    | (0.411 – 0.435)                                        |
|                           |                   |                          |                                                             | 0.12 (1.7, 12)                                              | 10.6 – 11.4      | (0.417 – 0.449)                                        |
| Total injection volume    | Item              | Adjusting lever position | Boost compensator Pressure<br>kg/cm <sup>2</sup> (psi, kPa) | Pump rpm                                                    | Measuring stroke | Total injection volume of each cylinder<br>cc (cu in.) |
|                           |                   |                          |                                                             |                                                             |                  |                                                        |
|                           | 11B (w/o HAC)     | Maximum                  | —                                                           | 500                                                         | 1,000            | 124.0 – 160.0<br>(7.57 – 9.76)                         |
|                           |                   |                          |                                                             | 1,100                                                       | 1,000            | 190.0 – 202.0<br>(11.59 – 12.33)                       |
|                           |                   |                          |                                                             | 1,800                                                       | 1,000            | 178.0 – 202.0<br>(10.86 – 12.33)                       |
|                           | 11B (w/ HAC)      | Maximum                  | —                                                           | 500                                                         | 1,000            | 132.0 – 168.0<br>(8.06 – 10.25)                        |
|                           |                   |                          |                                                             | 1,100                                                       | 1,000            | 190.0 – 202.0<br>(11.59 – 12.33)                       |
|                           |                   |                          |                                                             | 1,800                                                       | 1,000            | 186.0 – 210.0<br>(11.35 – 12.82)                       |
|                           | 13B M/T (w/o HAC) | Maximum                  | —                                                           | 500                                                         | 1,000            | 154.0 – 190.0<br>(9.40 – 11.59)                        |
|                           |                   |                          |                                                             | 1,100                                                       | 1,000            | 224.0 – 236.0<br>(13.67 – 14.40)                       |
|                           |                   |                          |                                                             | 1,700                                                       | 1,000            | 216.0 – 240.0<br>(13.18 – 14.65)                       |
|                           | 13B M/T (w/ HAC)  | Maximum                  | —                                                           | 500                                                         | 1,000            | 162.0 – 198.0<br>(9.89 – 12.08)                        |
|                           |                   |                          |                                                             | 1,100                                                       | 1,000            | 224.0 – 236.0<br>(13.67 – 14.40)                       |
|                           |                   |                          |                                                             | 1,700                                                       | 1,000            | 224.0 – 248.0<br>(13.67 – 15.13)                       |
|                           | 13B A/T           | Maximum                  | —                                                           | 500                                                         | 1,000            | 156.0 – 180.0<br>(9.52 – 10.98)                        |
|                           |                   |                          |                                                             | 1,100                                                       | 1,000            | 224.0 – 236.0<br>(13.67 – 14.40)                       |
|                           |                   |                          |                                                             | 1,700                                                       | 1,000            | 212.0 – 236.0<br>(12.94 – 14.40)                       |

## SERVICE SPECIFICATIONS — Fuel System

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## Injection Pump Adjustment (Governor 11B, 13B and 13B-T) (Cont'd)

| Total injection volume<br>(Cont'd) | Item                     | Adjusting lever position | Boost compensator Pressure<br>kg/cm <sup>2</sup> (psi, kPa) | Pump rpm | Measuring stroke          | Total injection volume of each cylinder<br>cc (cu in.) |
|------------------------------------|--------------------------|--------------------------|-------------------------------------------------------------|----------|---------------------------|--------------------------------------------------------|
|                                    | 13B-T<br>M/T             | Maximum                  | 0.27 (3.9, 26)                                              | 500      | 1,000                     | 182.0 – 218.0<br>(11.11 – 13.30)                       |
|                                    |                          |                          | 0.27 (3.9, 26)                                              | 1,100    | 1,000                     | 272.0 – 284.0<br>(16.60 – 17.33)                       |
|                                    |                          |                          | 0.27 (3.9, 26)                                              | 1,700    | 1,000                     | 256.0 – 280.0<br>(15.62 – 17.09)                       |
|                                    |                          |                          | 0                                                           | 500      | 1,000                     | 158.0 – 170.0<br>(9.64 – 10.37)                        |
|                                    | 13B-T<br>A/T             | Maximum                  | 0.27 (3.9, 26)                                              | 500      | 1,000                     | 190.0 – 226.0<br>(11.59 – 13.79)                       |
|                                    |                          |                          | 0.27 (3.9, 26)                                              | 1,100    | 1,000                     | 258.0 – 270.0<br>(15.74 – 16.48)                       |
|                                    |                          |                          | 0.27 (3.9, 26)                                              | 1,700    | 1,000                     | 270.0 – 294.0<br>(16.48 – 17.94)                       |
|                                    |                          |                          | 0                                                           | 500      | 1,000                     | 188.0 – 200.0<br>(11.47 – 12.20)                       |
| Stop lever                         | Adjusting lever position |                          | Pump rpm                                                    |          | Rack position<br>mm (in.) |                                                        |
|                                    | Idle                     |                          | 0                                                           |          | 5.5 (0.217) or less       |                                                        |

## Torque Specifications

| Part tightened                                     | kg-cm           | ft-lb     | N-m |
|----------------------------------------------------|-----------------|-----------|-----|
| Nozzle holder retaining nut x Nozzle holder body   |                 |           |     |
| 8, 3B                                              | 700             | 51        | 69  |
| 11B, 13B, 13B-T                                    | 350             | 25        | 34  |
| Injection nozzle x Cylinder head                   | 8, 3B           | 700       | 51  |
| 11B, 13B, 13B-T                                    | 185             | 13        | 18  |
| Nozzle leakage pipe x Injection nozzle             | 8, 3B           | 450       | 33  |
| 11B, 13B, 13B-T                                    | 250             | 18        | 25  |
| Injection pipe x Injection nozzle                  |                 | 250       | 18  |
| Chamber plug x Feed pump housing                   | 19 mm bolt head | 500       | 36  |
| 32 mm bolt head                                    | 1,500           | 109       | 147 |
| Priming pump x Feed pump housing                   | 500             | 36        | 49  |
| Feed pump x Injection pump                         | 95              | 82 in.-lb | 9.3 |
| Fuel pipe x Feed pump                              | 375             | 27        | 37  |
| Delivery valve holder x Injection pump body        | 375             | 27        | 37  |
| Spline shaft x Injection pump camshaft             | 8, 3B           | 650       | 47  |
| 11B, 13B, 13B-T                                    | 925             | 69        | 91  |
| Plate plug x Injection pump body                   | 650             | 47        | 64  |
| Steel ball guide x Injection pump camshaft (8, 3B) | 550             | 40        | 54  |

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## SERVICE SPECIFICATIONS — Fuel System, Cooling System

## Torque Specifications (Cont'd)

| Part tightened                                        |                 | kg-cm | ft-lb | N-m |
|-------------------------------------------------------|-----------------|-------|-------|-----|
| Flyweight x Injection pump camshaft (11B, 13B, 13B-T) | M/T             | 525   | 38    | 51  |
|                                                       | A/T             | 550   | 40    | 54  |
| Injection pump x Timing gear case                     |                 | 375   | 27    | 37  |
| Injection pump stay x Injection pump                  | B, 3B           | 185   | 13    | 18  |
|                                                       | 11B, 13B, 13B-T | 375   | 27    | 37  |
| Injection pump stay x Stay (B, 3B)                    |                 | 185   | 185   | 18  |
| Injection pump stay x Cylinder block                  | B, 3B           | 375   | 27    | 37  |
|                                                       | 11B, 13B, 13B-T | 185   | 13    | 18  |
| Fuel hose x Injection pump                            |                 | 375   | 27    | 37  |

## COOLING SYSTEM

## Specifications

|                         |                               |                  |                                                                   |
|-------------------------|-------------------------------|------------------|-------------------------------------------------------------------|
| Engine coolant capacity |                               | See page A-2     |                                                                   |
| Thermostat              | Valve opening temperature     |                  |                                                                   |
|                         | 82°C type                     | 80 – 84°C        | 176 – 183°F                                                       |
|                         | 88°C type                     | 86 – 90°C        | 187 – 194°F                                                       |
|                         | Valve opening travel          |                  |                                                                   |
|                         | 82°C type                     | at 95°C (203°F)  | 10 mm (0.39 in.) or more                                          |
|                         | 88°C type                     | at 100°C (212°F) | 10 mm (0.39 in.) or more                                          |
| Radiator                | Relief valve opening pressure |                  |                                                                   |
|                         | STD                           |                  | 0.75 – 1.05 kg/cm <sup>2</sup><br>(10.7 – 14.9 psi, 74 – 103 kPa) |
|                         | Limit                         |                  | 0.6 kg/cm <sup>2</sup> 8.5 psi 59 kPa                             |

## Torque Specifications

| Part tightened                      |  | kg-cm | ft-lb | N-m |
|-------------------------------------|--|-------|-------|-----|
| Water pump x Cylinder block         |  | 250   | 18    | 25  |
| Water outlet x Water outlet housing |  | 185   | 13    | 18  |

## SERVICE SPECIFICATIONS — Lubrication System

A-21

## LUBRICATION SYSTEM

## Specifications

Specifications

| Engine oil capacity            |                                 |                         | See page A-2                                                                                                     |                     |                     |
|--------------------------------|---------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|
| Oil pressure                   |                                 |                         | at idle<br>at 3,000 rpm                                                                                          |                     |                     |
|                                |                                 |                         | 0.3 kg/cm <sup>2</sup> (4.2 psi, 29 kPa) or more<br>2.5 – 6.0 kg/cm <sup>2</sup><br>(36 – 85 psi, 245 – 588 kPa) |                     |                     |
| Oil pump<br>(B, 3B)            | Gear body clearance             | STD                     | 0.090 – 0.150 mm                                                                                                 | 0.0035 – 0.0059 in. |                     |
|                                |                                 | Limit                   | 0.30 mm                                                                                                          | 0.0118 in.          |                     |
|                                | Gear side clearance             | STD                     | 0.030 – 0.095 mm                                                                                                 | 0.0012 – 0.0037 in. |                     |
|                                |                                 | Limit                   | 0.15 mm                                                                                                          | 0.0059 in.          |                     |
|                                | Gear tip clearance              | STD                     | 0.393 – 0.476 mm                                                                                                 | 0.0155 – 0.0187 in. |                     |
|                                |                                 | Driven gear to crescent | Limit                                                                                                            | 0.55 mm             | 0.0217 in.          |
|                                | Drive gear to crescent          | STD                     | 0.477 – 0.567 mm                                                                                                 | 0.0188 – 0.0233 in. |                     |
|                                |                                 | Limit                   | 0.65 mm                                                                                                          | 0.0256 in.          |                     |
| Drive spline to rotor backlash | STD                             | 0.541 – 0.790 mm        | 0.0213 – 0.0311 in.                                                                                              |                     |                     |
|                                | Limit                           | 1.00 mm                 | 0.0394 in.                                                                                                       |                     |                     |
|                                | Oil Pump<br>(11, 13B,<br>13B-T) | Rotor body clearance    | STD                                                                                                              | 0.144 – 0.220 mm    | 0.0057 – 0.0087 in. |
|                                |                                 |                         | Limit                                                                                                            | 0.40 mm             | 0.0157 in.          |
| Rotor side clearance           |                                 | STD                     | 0.035 – 0.090 mm                                                                                                 | 0.0014 – 0.0035 in. |                     |
|                                |                                 | Limit                   | 0.15 mm                                                                                                          | 0.0059 in.          |                     |
| Rotor tip clearance            | STD                             | 0.110 – 0.240 mm        | 0.0043 – 0.0094 in.                                                                                              |                     |                     |
|                                | Limit                           | 0.30 mm                 | 0.0118 in.                                                                                                       |                     |                     |
| Drive spline to rotor backlash | STD                             | 0.541 – 0.790 mm        | 0.0213 – 0.0311 in.                                                                                              |                     |                     |
|                                | Limit                           | 1.00 mm                 | 0.0394 in.                                                                                                       |                     |                     |

## Torque Specifications

| Part tightened                           |                 | kg-cm | ft-lb | N-m |
|------------------------------------------|-----------------|-------|-------|-----|
| Engine drain plug                        |                 | 350   | 25    | 34  |
| Plug of oil pump relief valve            |                 | 500   | 36    | 49  |
| Timing gear case x Cylinder block        | 12 mm bolt head | 185   | 13    | 18  |
|                                          | 14 mm bolt head | 375   | 27    | 37  |
| Oil pipe x Timing gear case (Union bolt) |                 | 110   | 8     | 11  |
| Oil pipe x Injection pump                |                 | 110   | 8     | 11  |
| Oil pipe x Timing gear case (Nut)        |                 | 185   | 13    | 18  |
| Oil pipe x Cylinder block                |                 | 450   | 33    | 44  |
| Oil strainer x Timing gear case          |                 | 185   | 13    | 18  |
| Oil strainer x Cylinder block            |                 | 185   | 13    | 18  |
| Oil pan x Timing gear case               |                 | 185   | 13    | 18  |
| Oil pan x Cylinder block                 |                 | 185   | 13    | 18  |
| Oil pan x Rear oil seal retainer         |                 | 130   | 9     | 13  |
| Oil cooler x Oil cooler case             |                 | 185   | 13    | 18  |
| Oil cooler case x Cylinder block         |                 | 185   | 13    | 18  |
| Oil filter bracket x Cylinder block      |                 | 375   | 27    | 37  |
| Plug of oil cooler relief valve          |                 | 500   | 36    | 49  |
| Plug of oil filter relief valve          |                 | 500   | 36    | 49  |
| Oil nozzle check valve x Cylinder block  |                 | 350   | 25    | 34  |

**A-22 SERVICE SPECIFICATIONS — Starting System, Charging System**

**STARTING SYSTEM**

|                    |                                |                                    |                                                                        |                      |
|--------------------|--------------------------------|------------------------------------|------------------------------------------------------------------------|----------------------|
| Pre-heating system | Light lighting time            |                                    | Approx. 2 seconds<br>15 – 19.5 seconds<br><br>20 seconds<br>14 seconds |                      |
|                    | 3B (Super glow type)           | at 20°C (68°F)                     |                                                                        |                      |
|                    | B, 3B (Fixed delay type)       |                                    |                                                                        |                      |
|                    | 11B, 13B, 13B-T                | at water temp, sensor disconnected |                                                                        |                      |
|                    | 12V type                       |                                    |                                                                        |                      |
|                    | 24V type                       |                                    |                                                                        |                      |
| Starter            | Rated voltage and output power |                                    | 12 V 2.5 kw                                                            | 24 V 4.5 kw          |
|                    | No-load characteristic         |                                    | 180 A or less at 11 V                                                  | 90 A or less at 23 V |
|                    | Ampere                         | 3,500 rpm or more                  | ---                                                                    | ---                  |
|                    | rpm                            | 20.5 mm 0.807 in.                  | ---                                                                    | ---                  |
|                    | Brush length                   | STD 13.0 mm 0.512 in.              | ---                                                                    | ---                  |
|                    | Limit                          | 3.2 – 4.0 kg                       | ---                                                                    | ---                  |
|                    | Spring installed load          | STD (7.1 – 8.8 lb, 31 – 39 N)      | ---                                                                    | ---                  |
|                    | Commutator                     |                                    |                                                                        |                      |
|                    | Outer diameter                 | STD 36 mm 1.42 in.                 | ---                                                                    | ---                  |
|                    | Limit                          | 35 mm 1.38 in.                     | ---                                                                    | ---                  |
|                    | Undercut depth                 | STD 0.7 mm 0.028 in.               | ---                                                                    | ---                  |
|                    | Limit                          | 0.2 mm 0.008 in.                   | ---                                                                    | ---                  |
|                    | Circle runout                  | Limit 0.05 mm 0.0020 in.           | ---                                                                    | ---                  |

**CHARGING SYSTEM**

|                                  |                                   |                    |                   |
|----------------------------------|-----------------------------------|--------------------|-------------------|
| Battery specific gravity         |                                   | See page A-2       |                   |
| Drive belt tension or deflection |                                   | See page A-2       |                   |
| Alternator                       | Rated output                      | 12 V 40 A          |                   |
|                                  |                                   | 12 V 45 A          |                   |
|                                  |                                   | 12 V 50 A          |                   |
|                                  |                                   | 12 V 55 A          |                   |
|                                  |                                   | 24 V 20 A          |                   |
|                                  |                                   | 24 V 25 A          |                   |
|                                  |                                   | 24 V 30 A          |                   |
|                                  |                                   | 24 V 55 A          |                   |
|                                  | Rotor coil resistance             | 12V type           | 3.9 – 4.1 Ω       |
|                                  |                                   | 24V type           | 18.8 – 19.2 Ω     |
|                                  | w/ IC regulator                   | 12V type           | 2.8 – 3.0 Ω       |
|                                  |                                   | 24V type           | 8.8 – 9.2 Ω       |
|                                  | Slip ring diameter                | STD 32.3 – 32.5 mm | 1.272 – 1.280 in. |
|                                  | Brush exposed length              | Limit 32.1 mm      | 1.264 in.         |
|                                  |                                   | STD 20.0 mm        | 0.787 in.         |
|                                  | Limit                             | 5.5 mm             | 0.217 in.         |
| Alternator regulator             | Regulating voltage at 25°C (77°F) | 12V type           | 13.8 – 14.8 V     |
|                                  |                                   | 24V type           | 27.0 – 29.0 V     |
|                                  | w/ IC regulator                   | 12V type           | 13.8 – 14.4 V     |
|                                  |                                   | 24V type           | 27.9 – 28.5 V     |