



REPAIR INSTRUCTION

Issued by ROBERT BOSCH (AUSTRALIA) PTY. LTD.
A.B.N. 48 004 315 628
Incorporated in
Victoria

File: DISM
Section: K - NHA
Bulletin No: 0008
Page: 1 of 25
Date: Sept. 2003
Supersedes: 0001, Nov 1999

Subject : Two-spring Nozzle Holder Assembly Testing and Repair

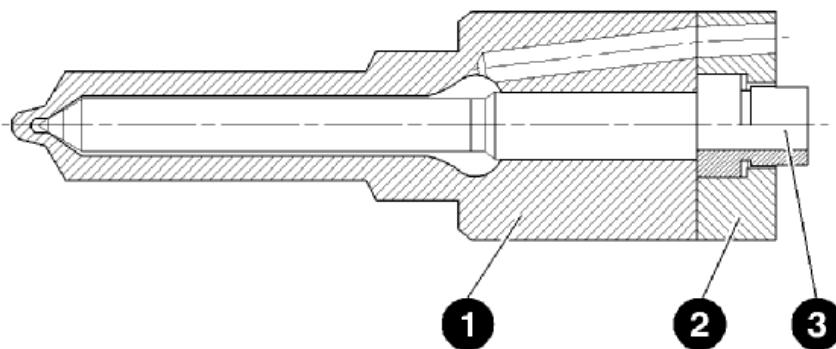
This bulletin addresses the repair / test procedure and spare parts requirements to ensure correct servicing of the two-spring injector assembly.

The procedure must be followed to achieve the specified design operation of the injector assembly.

The use of closer tolerances (plunger lift to port closing and plunger stroke) on nozzle replacement means that opening pressure setting is not required for pressure stage 2.
Closer tolerances are achieved by way of a nozzle kit comprising:

- 1 = Nozzle
- 2 = Adapter plate
- 3 = Stop sleeve

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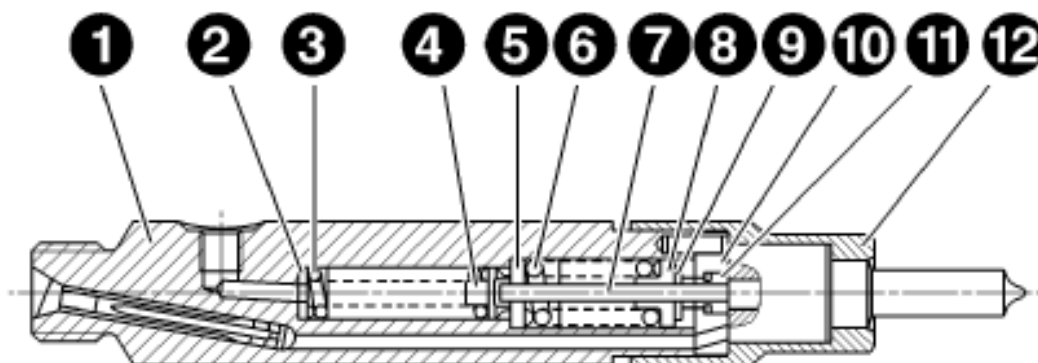
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Design of two-spring nozzle holder

- 1 = Holding element
- 2 = Shim
- 3 = Pressure spring
Opening pressure 1
- 4 = Pressure pin
- 5 = Guide disk
- 6 = Pressure spring
Opening pressure 2
- 7 = Pressure pin
- 8 = Spring seat
- 9 = Shim
- 10 = Adapter plate
- 11 = Stop sleeve
- 12 = Nozzle retaining nut

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1. Special features

Two-spring holder repairs are only to be performed following completion of warranty period and only in combination with nozzle tester EPS100 and an extractor. Extraction is required to stop oil mist escaping into the ambient atmosphere.

In terms of

- * Measurement accuracy
- * Dead space
- * Pressure gauge quality,

Nozzle tester EFEP 60H (0 681 200 502) is no longer suitable for checking and adjusting all nozzle-holder assemblies.

Warranty inspections using EFEP 60H are not permitted and invalidate warranty claims.

2. Tools required:

Nozzle tester EPS 100	0 684 200 704	
Extractor EPS 738 (220V)	0 684 200 702	
(110V)	0 684 200 703	
Test adapter	1 683 391 194	
Torque wrench	comm. avail.	
Micrometer	(meas. range 20...50 mm)	comm. avail.
Nozzle cleaner	0 986 611 140	

Note:

Never use steel brush for cleaning nozzle cone as this would damage injection orifices.

Use commercially available ultrasonic cleaner.



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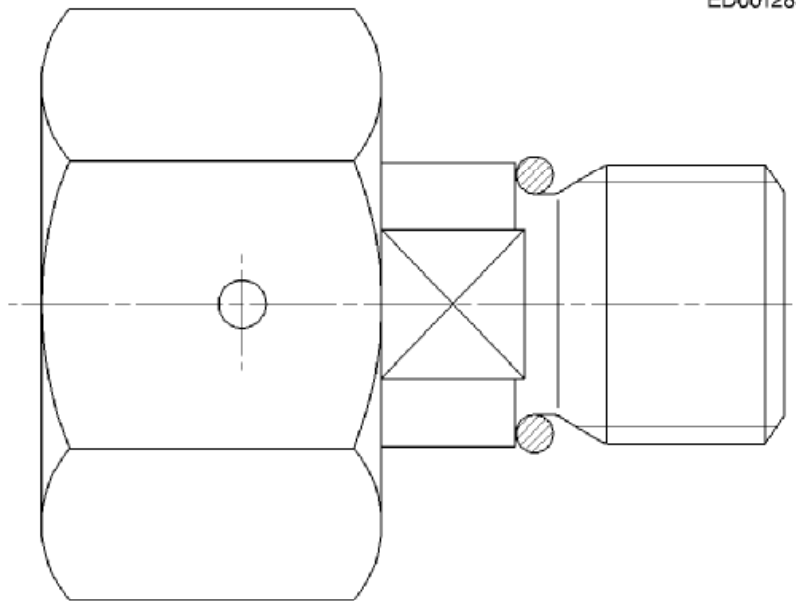
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Note on test adapter 1 683 391 194:

The test adapter consists of a union nut and a thrust member. It is used for Opel nozzle-and-holder assembly (VP44) with no inlet connector.

Union nut fixes thrust member in position on nozzle-and-holder assembly and provides a seal. Fuel injection tubing is connected to thrust member.

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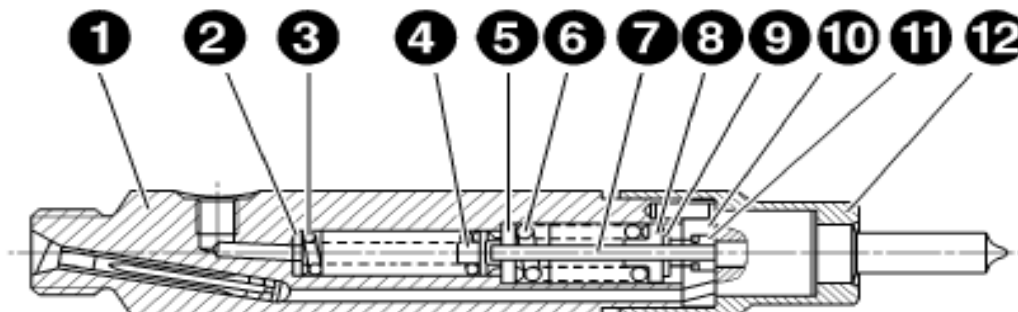
3. Opening pressure setting procedure

Opening pressure 1 is set by way of pressure pin (7). The following selection ranges are available:

Selection range	2 433 101 996	:	28.19...29.50 mm
Selection range	2 433 101 997	:	33.80...34.80 mm
Selection range	2 433 101 998	:	43.80...44.78 mm

7 = Pressure pin

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Clean nozzle-holder assembly before dismantling.

Use appropriate test tubing to connect nozzle-and-holder assembly to nozzle tester EPS100.

Check and assess following functions of nozzle-holder assembly.

- * Opening pressure
- * Leakage
- * Spray pattern



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Note:

If necessary, make use of appropriate test adapter (e.g. Opel nozzle-and-holder assembly) for test purposes.

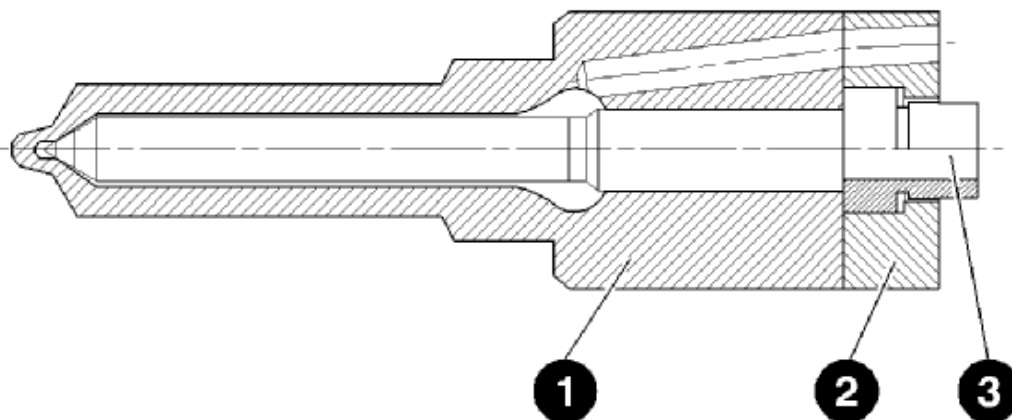
- * Dismantle nozzle-and-holder assembly.
- * Remove thermal protection disk if fitted.
- * Unfasten and unscrew nozzle retaining nut.
- * Remove nozzle, adapter plate and stop sleeve.
- * Pull out pressure pin.

If possible, avoid removing shim and pressure spring of 2nd pressure stage from holding element.

Pressure spring or component replacement is not permitted. Pressure stage 2 components must be re-used and fitted in correct position.

- 1 = Nozzle
- 2 = Adapter plate
- 3 = Stop sleeve

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Repairs are not to be performed in the event of internal rusting in spring chamber (critical for nozzle-holder assembly with circular peening). Replace entire nozzle-and-holder assembly.

Clean holding element.

Ensure cleanliness when fitting nozzle-holder assembly.

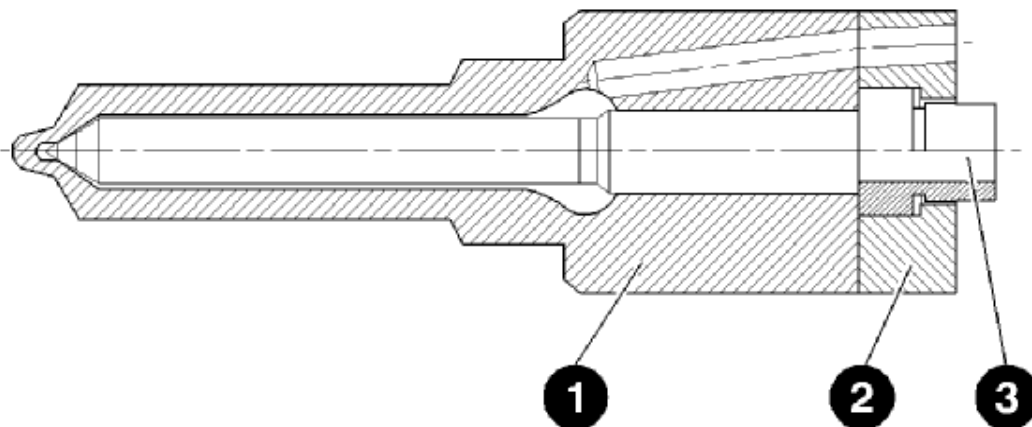
Re-insert pressure pin.

Fit nozzle kit

- 1 = Nozzle
- 2 = Adapter plate
- 3 = Stop sleeve

When fitting nozzle kit, make sure fitted pins of holder are inserted in correct position in the pin hole in nozzle.

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Fit nozzle retaining nut and tighten to specified torque.

Nozzle-and-holder assemblies:

Type KBAL ..P..	30...40 Nm
Type KDAL ..P..	30...40 Nm
Type KBEL ..P..	40...50 Nm
Type KDEL ..P..	40...50 Nm

Measure stage 1 nozzle opening pressure. If opening pressure is outside tolerance, dismantle nozzle-holder assembly and adjust opening pressure.

Procedure for opening pressure adjustment:

- * Remove nozzle retaining nut.
- * Remove nozzle kit.
- * Remove pressure pin.
- * Use micrometer to measure pressure pin length.
- * Select pressure pin as per selection range.

(Pressure stage: 0.02 mm = 4...6 bar)

- * Assemble nozzle-holder assembly.
- * Replace damaged nozzle retaining nuts.
- * Tighten nozzle retaining nut to specified torque.

Nozzle-and-holder assemblies:

Type KBAL ..P..	30...40 Nm
Type KDAL ..P..	30...40 Nm
Type KBEL ..P..	40...50 Nm
Type KDEL ..P..	40...50 Nm



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Check opening pressure as per setting table. Adjustment procedure is complete if opening pressure is within tolerance.

Check adjusted nozzle-and-holder assembly for

- * Leakage
- * Spray pattern
- * Chatter

Detach nozzle-holder assembly from EPS 100 Injector Tester. Fit thermal protection disk if applicable.

Note:

When installing Opel nozzle-holder assemblies with VP44, watch out for leakage at cross member and fuel injection tubing connection. Always replace sealing ring at nozzle-holder assembly.



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4. Nozzle kit table

Nozzle kits comprise:

Adapter plate, stop sleeve and intermediate plate

Nozzle kits	Application					
2 437 010 077	0432193746	0432193747				
2 437 010 076	0432193732	0432193733	0432193794	0432193811	0432193823	0432193824
2 437 010 083	0432193838	0432193840				
2 437 010 059	0432193662	0432193663	0432193695	0432193696		
2 437 010 102	0432193634					
2 437 010 080	0432193639	0432193640	0432193758	0432193790		
2 437 010 087	0432193631	0432193835				
2 437 010 111	0432193594	0432193595				
2 437 010 071	0432193599	0432193600				
2 437 010 063	0432193686	0432193797				
2 437 010 093	0432193541	0432193655				
2 437 010 078	0432193753					
2 437 010 108	0432193611					
2 437 010 057	0432191528					
2 437 010 055	0432133835	0432133836				
2 437 010 085	0432193819					
2 437 010 129	0432133801					
2 437 010 130	0432133794	0432133795				
2 437 010 123	0432193564					
2 437 010 064	0432193687					
2 437 010 101	0432193633					
2 437 010 118	0432193569					
2 437 010 091	0432193666					
2 437 010 082	0432193786	0432193807				
2 437 010 062	0432193682	0432193683				
2 437 010 081	0432193766					
2 437 010 117	0432133804	0432133805				
2 437 010 075	0432193731					
2 437 010 092	0432133824	0432133825				
2 437 010 074	0432193728					
2 437 010 090	0432193879					
2 437 010 094	0432193650					
2 437 010 070	0432193701					
2 437 010 106	0432193615	0432193616				
2 437 010 113	0432193583					
2 437 010 084	0432193785	0432193809	0432193858	0432193859		
2 437 010 112	0432133817	0432133818				
2 437 010 095	0432193643					
2 437 010 065	0432193688					
2 437 010 088	0432193866					
2 437 010 068	0432193691					
2 437 010 138	0432193525					



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2 437 010 128	0432133800				
2 437 010 126	0432193552	0432193553			
2 437 010 119	0432193570				
2 437 010 135	0432193532				
2 437 010 060	0432193669	0432193670			
2 437 010 051	0432131692				
2 437 010 050	0432131691				
2 437 010 056	0432133869				
2 437 010 099	0432131684				
2 437 010 121	0432193565				
2 437 010 086	0432193836				
2 437 010 066	0432193689				
2 437 010 073	0432193716	0432193717			
2 437 010 107	0432193625	0432193626			
2 437 010 131	0432191398				
2 437 010 098	0432191495				
2 437 010 052	0432131724				
2 437 010 053	0432131744				
2 437 010 072	0432193709	0432193710			
2 437 010 079	0432193755				
2 437 010 132	0432131652				
2 437 010 136	0432193527				
2 437 010 089	0432193877	0432193878			
2 437 010 116	0432191465				
2 437 010 054	0432131807				
2 437 010 141	0432193512				
2 437 010 067	0432193690				
2 437 010 104	0432193628				
2 437 010 114	0432193582				
2 437 010 127	0432193549				
2 437 010 110	0432193604	0432193605			
2 437 010 142	0432193513				
2 437 010 137	0432131644				
2 437 010 103	0432131683				
2 437 010 125	0432193556				
2 437 010 097	0432193636				
2 437 010 133	0432133790				
2 437 010 134	0432133791				
2 437 010 140	0432193702				
2 437 010 143	0432193510	0432193511			



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5. Selection ranges (pressure setting pins) for opening pressure setting

Select. range 2 433 101 996	Pressure pin length (mm)
2433101579	28.20
2433101577	28.22
2433101575	28.24
2433101573	28.26
2433101571	28.28
2433101569	28.30
2433101567	28.32
2433101565	28.34
2433101563	28.36
2433101561	28.38
2433101559	28.40
2433101557	28.42
2433101555	28.44
2433101553	28.46
2433101551	28.48
2433101301	28.50
2433101302	28.51
2433101303	28.52
2433101304	28.53
2433101305	28.54
2433101306	28.55
2433101307	28.56
2433101308	28.57
2433101309	28.58
2433101310	28.59
2433101311	28.60
2433101312	28.61
2433101313	28.62
2433101314	28.63
2433101315	28.64
2433101316	28.65
2433101317	28.66
2433101318	28.67
2433101319	28.68
2433101320	28.69
2433101321	28.70
2433101322	28.71
2433101323	28.72
2433101324	28.73
2433101325	28.74
2433101326	28.75
2433101327	28.76
2433101328	28.77
2433101329	28.78
2433101330	28.79

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2433101331	28.80
2433101332	28.81
2433101333	28.82
2433101334	28.83
2433101335	28.84
2433101336	28.85
2433101337	28.86
2433101338	28.87
2433101339	28.88
2433101340	28.89
2433101341	28.90
2433101342	28.91
2433101343	28.92
2433101344	28.93
2433101345	28.94
2433101346	28.95
2433101347	28.96
2433101348	28.97
2433101349	28.98
2433101350	28.99
2433101351	29.00
2433101352	29.01
2433101353	29.02
2433101354	29.03
2433101355	29.04
2433101356	29.05
2433101357	29.06
2433101358	29.07
2433101359	29.08
2433101360	29.09
2433101361	29.10
2433101362	29.11
2433101363	29.12
2433101364	29.13
2433101365	29.14
2433101366	29.15
2433101367	29.16
2433101368	29.17
2433101369	29.18
2433101370	29.19
2433101371	29.20
2433101372	29.21
2433101373	29.22
2433101374	29.23
2433101375	29.24
2433101376	29.25
2433101377	29.26
2433101378	29.27
2433101379	29.28
2433101380	29.29
2433101381	29.30



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2433101382	29.31
2433101383	29.32
2433101384	29.33
2433101385	29.34
2433101386	29.35
2433101387	29.36
2433101388	29.37
2433101389	29.38
2433101390	29.39
2433101391	29.40
2433101392	29.41
2433101393	29.42
2433101394	29.43
2433101395	29.44
2433101397	29.46
2433101399	29.48
2433101400	29.49
2433101401	29.50

Select. range 2 433 101 997	Pressure pin length (mm)
2433101200	33.80
2433101202	33.82
2433101204	33.84
2433101206	33.86
2433101208	33.88
2433101210	33.90
2433101212	33.92
2433101214	33.94
2433101216	33.96
2433101218	33.98
2433101220	34.00
2433101222	34.02
2433101224	34.04
2433101226	34.06
2433101228	34.08
2433101230	34.10
2433101232	34.12
2433101234	34.14
2433101236	34.16
2433101238	34.18
2433101240	34.20
2433101242	34.22
2433101244	34.24
2433101246	34.26
2433101248	34.28
2433101250	34.30
2433101252	34.32
2433101254	34.34
2433101256	34.36



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2433101258	34.38
2433101260	34.40
2433101262	34.42
2433101264	34.44
2433101266	34.46
2433101268	34.48
2433101270	34.50
2433101274	34.54
2433101276	34.56
2433101282	34.62
2433101286	34.66
2433101288	34.68
2433101296	34.76
2433101298	34.78

Select. range 2 433 101 998	Pressure pin length (mm)
2433101102	43.82
2433101106	43.86
2433101108	43.88
2433101110	43.90
2433101112	43.92
2433101114	43.94
2433101116	43.96
2433101118	43.98
2433101120	44.00
2433101122	44.02
2433101124	44.04
2433101126	44.06
2433101128	44.08
2433101130	44.10
2433101132	44.12
2433101134	44.14
2433101136	44.16
2433101138	44.18
2433101140	44.20
2433101142	44.22
2433101144	44.24
2433101146	44.26
2433101148	44.28
2433101150	44.30
2433101154	44.34
2433101156	44.36
2433101158	44.38
2433101160	44.40
2433101162	44.42
2433101164	44.44
2433101166	44.46
2433101168	44.48
2433101170	44.50



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2433101172	44.52
2433101174	44.54
2433101180	44.60
2433101186	44.66
2433101188	44.68
2433101192	44.72
2433101194	44.74
2433101196	44.76

6. Opening pressure settings

Nozzle-and-holder assembly	Opening pressure (bar)
0 432 131 624	291...301
0 432 131 644	181...193
0 432 131 652	181...193
0 432 131 683	216...228
0 432 131 684	291...301
0 432 131 691	291...301
0 432 131 692	291...301
0 432 131 724	291...301
0 432 131 744	291...301
0 432 131 807	301...311
0 432 133 783	231...243
0 432 133 784	231...243
0 432 133 785	231...243
0 432 133 786	231...243
0 432 133 790	221...233
0 432 133 791	221...233
0 432 133 792	231...243
0 432 133 793	231...243
0 432 133 794	231...243
0 432 133 795	231...243
0 432 133 800	221...233
0 432 133 801	221...233
0 432 133 802	231...243
0 432 133 803	231...243
0 432 133 804	231...243
0 432 133 805	231...243
0 432 133 815	231...243
0 432 133 816	231...243
0 432 133 817	231...243
0 432 133 818	231...243
0 432 133 822	231...243
0 432 133 823	231...243
0 432 133 824	231...243
0 432 133 825	231...243
0 432 133 833	221...233
0 432 133 834	221...233



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0 432 133 835	221...233
0 432 133 836	221...233
0 432 133 869	201...209
0 432 191 398	210...222
0 432 191 401	210...222
0 432 191 464	271...281
0 432 191 465	271...281
0 432 191 494	271...281
0 432 191 495	271...281
0 432 191 527	204...216
0 432 191 528	204...216
0 432 193 508	221...231
0 432 193 509	221...231
0 432 193 510	221...231
0 432 193 511	221...231
0 432 193 512	221...233
0 432 193 513	211...223
0 432 193 514	211...223
0 432 193 525	221...233
0 432 193 526	241...253
0 432 193 527	241...253
0 432 193 532	201...211
0 432 193 541	241...253
0 432 193 542	221...231
0 432 193 543	221...231
0 432 193 544	191...201
0 432 193 545	191...201
0 432 193 549	191...203
0 432 193 550	221...231
0 432 193 551	221...231
0 432 193 552	221...231
0 432 193 553	221...231
0 432 193 555	211...223
0 432 193 556	211...223
0 432 193 563	206...216
0 432 193 564	206...216
0 432 193 565	221...231
0 432 193 566	221...231
0 432 193 569	221...233
0 432 193 570	221...233
0 432 193 571	211...223
0 432 193 573	221...231
0 432 193 574	221...231
0 432 193 575	191...201
0 432 193 576	191...201
0 432 193 577	191...201
0 432 193 578	191...201
0 432 193 579	221...231
0 432 193 580	221...231
0 432 193 582	231...241
0 432 193 583	231...241



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0 432 193 584	221...231
0 432 193 585	221...231
0 432 193 592	221...231
0 432 193 593	221...231
0 432 193 594	221...231
0 432 193 595	221...231
0 432 193 597	221...231
0 432 193 598	221...231
0 432 193 599	221...231
0 432 193 600	221...231
0 432 193 601	211...223
0 432 193 602	221...231
0 432 193 603	221...231
0 432 193 604	221...231
0 432 193 605	221...231
0 432 193 608	221...231
0 432 193 609	221...231
0 432 193 610	191...201
0 432 193 611	191...201
0 432 193 613	191...201
0 432 193 614	191...201
0 432 193 615	191...201
0 432 193 616	191...201
0 432 193 617	191...201
0 432 193 618	191...201
0 432 193 619	221...231
0 432 193 620	221...231
0 432 193 621	191...201
0 432 193 622	191...201
0 432 193 623	191...201
0 432 193 624	191...201
0 432 193 625	191...201
0 432 193 626	191...201
0 432 193 627	211...223
0 432 193 628	211...223
0 432 193 631	226...236
0 432 193 632	241...253
0 432 193 633	221...233
0 432 193 634	221...233
0 432 193 636	226...236
0 432 193 637	191...201
0 432 193 638	191...201
0 432 193 639	191...201
0 432 193 640	191...201
0 432 193 643	201...211
0 432 193 644	201...211
0 432 193 650	181...193
0 432 193 655	201...213
0 432 193 662	221...231
0 432 193 663	221...231
0 432 193 666	181...193



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0 432 193 669	221...231
0 432 193 670	221...231
0 432 193 680	191...201
0 432 193 681	191...201
0 432 193 682	191...201
0 432 193 683	191...201
0 432 193 686	181...193
0 432 193 687	181...193
0 432 193 688	181...193
0 432 193 689	241...253
0 432 193 690	261...273
0 432 193 691	221...231
0 432 193 693	221...231
0 432 193 694	221...231
0 432 193 695	221...231
0 432 193 696	221...231
0 432 193 700	201...211
0 432 193 701	201...211
0 432 193 702	221...231
0 432 193 703	221...231
0 432 193 704	221...231
0 432 193 705	221...231
0 432 193 707	191...201
0 432 193 708	191...201
0 432 193 709	191...201
0 432 193 710	191...201
0 432 193 716	191...201
0 432 193 717	191...201
0 432 193 728	201...213
0 432 193 731	221...231
0 432 193 732	191...201
0 432 193 733	191...201
0 432 193 734	191...201
0 432 193 735	191...201
0 432 193 744	191...201
0 432 193 745	191...201
0 432 193 746	191...201
0 432 193 747	191...201
0 432 193 753	201...211
0 432 193 754	201...211
0 432 193 755	221...231
0 432 193 758	191...203
0 432 193 766	201...211
0 432 193 768	191...201
0 432 193 769	191...201
0 432 193 771	191...201
0 432 193 784	191...201
0 432 193 785	191...201
0 432 193 786	191...201
0 432 193 787	191...201
0 432 193 788	191...201



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0 432 193 790	191...201
0 432 193 794	191...201
0 432 193 795	191...201
0 432 193 797	181...193
0 432 193 806	191...201
0 432 193 807	191...201
0 432 193 808	191...201
0 432 193 809	191...201
0 432 193 810	191...201
0 432 193 811	191...201
0 432 193 819	201...211
0 432 193 820	201...211
0 432 193 823	191...201
0 432 193 824	191...201
0 432 193 829	191...201
0 432 193 830	191...201
0 432 193 834	201...211
0 432 193 835	201...211
0 432 193 836	201...211
0 432 193 837	191...201
0 432 193 838	191...201
0 432 193 839	191...201
0 432 193 840	191...201
0 432 193 856	191...201
0 432 193 857	191...201
0 432 193 858	191...201
0 432 193 859	191...201
0 432 193 866	201...211
0 432 193 877	181...189
0 432 193 878	181...189
0 432 193 879	201...209
0 432 193 880	181...189
0 432 193 881	181...189

7. Nozzle retaining nuts

Nozzle retaining nut	Application
2 433 349 100	0 432 191 465 0 432 191 495
2 433 349 302	0 432 193 604 0 432 193 605 0 432 193 615 0 432 193 616 0 432 193 682 0 432 193 683 0 432 193 716 0 432 193 717



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2 433 349 304

0 432 133 869
0 432 193 552
0 432 193 553
0 432 193 564
0 432 193 594
0 432 193 595
0 432 193 611
0 432 193 643
0 432 193 662
0 432 193 663
0 432 193 669
0 432 193 670
0 432 193 695
0 632 193 696
0 432 193 702
0 432 193 709
0 432 193 710
0 432 193 728
0 432 193 732
0 432 193 733
0 432 193 746
0 432 193 747
0 432 193 753
0 432 193 755
0 432 193 785
0 432 193 786
0 432 193 794
0 432 193 807
0 432 193 809
0 432 193 811
0 432 193 823
0 432 193 824
0 432 193 838
0 432 193 840
0 432 193 858
0 432 193 859

2 433 349 304

0 432 193 866
0 432 193 877
0 432 193 878
0 432 193 879

2 433 349 324

0 432 133 790
0 432 133 791
0 432 133 800
0 432 133 801

2 433 349 452

0 432 131 644
0 432 131 652
0 432 131 683



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0 432 131 684
0 432 131 691
0 432 131 692
0 432 131 724
0 432 131 744
0 432 131 807

2 433 349 465

0 432 193 513
0 432 193 527
0 432 193 532
0 432 193 556
0 432 193 565
0 432 193 582
0 432 193 583
0 432 193 626
0 432 193 625
0 432 193 628
0 432 193 631
0 432 193 636
0 432 193 639
0 432 193 640
0 432 193 698
0 432 193 690
0 432 193 691
0 432 193 701
0 432 193 731
0 432 193 758
0 432 193 766
0 432 193 790
0 432 193 819
0 432 193 835
0 432 193 836

2 433 349 466

0 432 133 794
0 432 133 795
0 432 133 804
0 432 133 805
0 432 133 817
0 432 133 818
0 432 133 824
0 432 133 825
0 432 133 835
0 432 133 836
0 432 191 398
0 432 191 528
0 432 193 512
0 432 193 525
0 432 193 541
0 432 193 549
0 432 193 569



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	0 432 103 570
	0 432 193 634
	0 432 193 650
	0 432 193 655
	0 432 193 686
	0 432 193 687
	0 432 193 688
	0 432 193 797
2 433 349 479	0 432 193 510
	0 432 193 511
	0 432 193 599
	0 432 193 600
2 433 349 483	0 432 193 666
2 433 314 042	0 432 131 644
	0 432 131 652
	0 432 131 683
	0 432 131 684
	0 432 131 691
	0 432 131 692
	0 432 131 724
	0 432 131 744
	0 432 131 807
2 433 314 053	0 432 191 465
	0 432 191 495
2 433 349 100	0 432 133 869
	0 432 193 552
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2 433 349 249

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0 432 193 688
0 432 193 797

2 433 349 257

0 432 193 666

2 433 349 267

0 432 133 790
0 432 133 791
0 432 133 800
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2 433 349 418

0 432 193 513
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0 432 193 639
0 432 193 640
0 432 193 689
0 432 193 690
0 432 193 691
0 432 193 701
0 432 193 731

2 433 349 418

0 432 193 758
0 432 193 766
0 432 193 790
0 432 193 819
0 432 193 835
0 432 193 836