

ZEXEL Ass'y No.	104700-9122
Bosch Ass'y No.	F 01G 09W 0DG
Bosch Typecode	
Engine Type	4D56TC
Manufacturer	HYUNDAI
Edition date	22.04.09

**1 Adjustment conditions**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
	Test oil		ISO4113orSAEJ967d				
		1404 Test oil					
P	Test oil temperature	degC	45	45	50		
	Nozzle		105780-0060				
	Bosch type code		NP-DN0SD1510				
	Nozzle holder		105780-2150				
P	Opening pressure	MPa	13	13	13.3		
P	Opening pressure	kgf/cm2	133	133	136		
	Injection pipe		157805-7320				
P	Injection pipe	mm	2-6-450				
		Inside diameter - outside diameter - length (mm)					
	Joint assembly		157641-4720				
	Tube assembly		157641-4020				
P	Transfer pump pressure	kPa	20	20	20		
P	Transfer pump pressure	kgf/cm2	0.2	0.2	0.2		
	Direction of rotation (viewed from drive side)		R				
		Right					

**2 Adjustment specification****2.1 Compensation resistor, compensation voltage comparison**

Name	Comp. resistor/voltage																																												
	<table><tr><th rowspan="2">A</th><th>B</th><th>C(<math>\Delta U_{\alpha \text{ soll}}</math>)</th></tr><tr><th>k<math>\Omega</math></th><th>V</th></tr><tr><td>1</td><td>0.18</td><td>0.075</td></tr><tr><td>2</td><td>0.30</td><td>0.063</td></tr><tr><td>3</td><td>0.43</td><td>0.051</td></tr><tr><td>4</td><td>0.62</td><td>0.038</td></tr><tr><td>5</td><td>0.82</td><td>0.028</td></tr><tr><td>6</td><td>1.10</td><td>0.014</td></tr><tr><td>7</td><td>1.50</td><td>0</td></tr><tr><td>8</td><td>2.00</td><td>-0.014</td></tr><tr><td>9</td><td>2.70</td><td>-0.028</td></tr><tr><td>10</td><td>3.90</td><td>-0.038</td></tr><tr><td>11</td><td>5.60</td><td>-0.051</td></tr><tr><td>12</td><td>8.20</td><td>-0.063</td></tr><tr><td>13</td><td>15.00</td><td>-0.075</td></tr></table>	A	B	C( $\Delta U_{\alpha \text{ soll}}$ )	k $\Omega$	V	1	0.18	0.075	2	0.30	0.063	3	0.43	0.051	4	0.62	0.038	5	0.82	0.028	6	1.10	0.014	7	1.50	0	8	2.00	-0.014	9	2.70	-0.028	10	3.90	-0.038	11	5.60	-0.051	12	8.20	-0.063	13	15.00	-0.075
A	B		C( $\Delta U_{\alpha \text{ soll}}$ )																																										
	k $\Omega$	V																																											
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	Compensation resistance/compensation voltage comparison A = Compensation resistor number B= Compensation resistance C = Compensation voltage delta U alpha soll																																												

**2.2 Pump chamber pressure**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
S	Pump chamber pressure	kPa	598	569	627		
S	Pump chamber pressure	kgf/cm2	6.1	5.8	6.4		
P	Basic		*				
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Pump chamber pressure	kPa	294	294			
C	Pump chamber pressure	kgf/cm2	3	3			

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Pump chamber pressure	kPa	598	559	637		
C	Pump chamber pressure	kgf/cm2	6.1	5.7	6.5		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Pump chamber pressure	kPa	735	686	784		
C	Pump chamber pressure	kgf/cm2	7.5	7	8		

**2.3 Timer stroke**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
S	Timer stroke	mm	7.7	7.5	7.9		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	1.8	0.3	3.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	350	350	350		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	5.2	3.1	7.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	7.7	7.4	8		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	70	70	70		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	4	1.9	6.1		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	9.75	9.3	10.2		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.7	2.7	2.7		
C	Timer stroke	mm	0	0	0		

**2.4 TPS output**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.7	2.7	2.7		
S	Vtps	V	0.51	0.382	0.638		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.7	2.7	2.7		
C	Vtps	V	0.51	0.382	0.638		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		

P	U alpha soll	V	2.7	2.7	2.7		
C	Vtps	V	1.925	1.702	2.148		

**2.5 Overflow**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Overflow quantity	cm3/min	550	420	680		

**2.6 Fuel injection quantities**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1250	1250	1250		
P	U alpha soll + dU alpha soll	V	2.73	2.73	2.73		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	63.3	62.8	63.8		
S	Difference in delivery	mm3/st.	3.5		3.5		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	375	375	375		
P	U alpha soll + dU alpha soll	V	1.81	1.81	1.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	7.3	4.3	10.3		
S	Difference in delivery	mm3/st.	2.5		2.5		
P	Basic		*				
	Remarks						

Confirmation of difference in delivery

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2300	2300	2300		
P	U alpha soll + dU alpha soll	V	1.81	1.81	1.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	19.4	16.9	21.9		
S	Difference in delivery	mm3/st.	5.5		5.5		
P	Basic		*				
	Remarks						

Confirmation of difference in delivery

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	U alpha soll + dU alpha soll	V	2.9	2.9	2.9		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	50.3	40.3	60.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	375	375	375		
P	U alpha soll + dU alpha soll	V	1.81	1.81	1.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	7.3	4.3	10.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	500	500	500		
P	U alpha soll + dU alpha soll	V	2.59	2.59	2.59		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	51.8	49.3	54.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	750	750	750		
P	U alpha soll + dU alpha soll	V	2.71	2.71	2.71		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	60.2	57.7	62.7		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1250	1250	1250		
P	U alpha soll + dU alpha soll	V	2.73	2.73	2.73		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	63.3	62.3	64.3		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1900	1900	1900		
P	U alpha soll + dU alpha soll	V	2.56	2.56	2.56		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	53.2	50.7	55.7		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2300	2300	2300		
P	U alpha soll + dU alpha soll	V	1.81	1.81	1.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm <sup>3</sup> /st.	19.4	16.9	21.9		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2450	2450	2450		
P	U alpha soll + dU alpha soll	V	1	1	1		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm <sup>3</sup> /st.	3		3		

**2.7 Magnet valve OFF**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1900	1900	1900		
P	U alpha soll + dU alpha soll	V	2.56	2.56	2.56		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	cm <sup>3</sup> /min	0	0	0		

**2.8 Confirming NP sensor output**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	200	200	200		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.7	2.7	2.7		
C	Speed output	r/min	N+8				

N=Measure the actual speed.

**2.9 Checking fuel temperature sensor**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1250	1250	1250		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.73	2.73	2.73		
C	Temperature output	degC	T+5				

Measure T = actual output temperature

**2.10 Magnet**

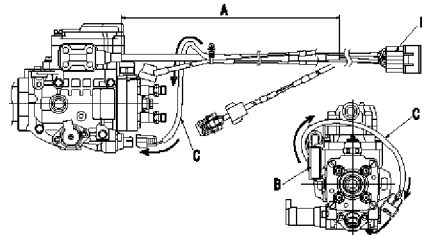
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
C	Max. applied voltage	V	8	8	8		
P	Test voltage	V	13	12	14		

**3 Assembly dimension**

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
S	K dimension	mm	3.3	3.2	3.4		
S	KF dimension	mm	5.9	5.8	6		
S	Pre-stroke	mm	0.1	0.08	0.12		

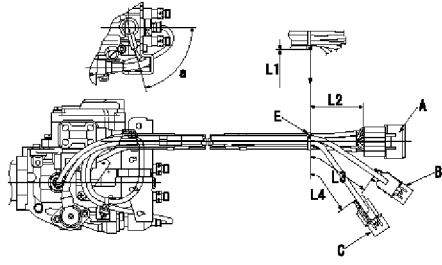
**4 Attachments' specification****4.1 Attachment specification 1**

Name	HARNESS & CONNECTOR
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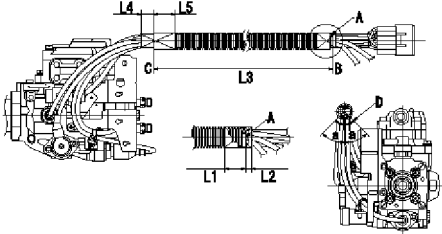
**T.C.V. connector assembly specification**

- (1) Ensure the GE cable is not twisted at section A.
- (2) Refer to diagram for direction of connector B.
- (3) Route the TCV harness C in the direction indicated by the arrows in the figure and install the connector.

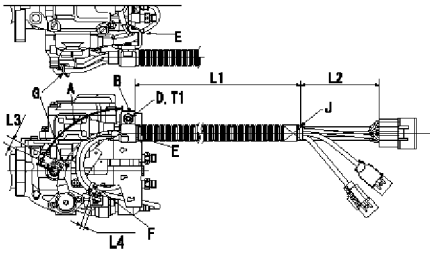
**4.2 Attachment specification 2**

Name	HARNESS & CONNECTOR
a=(75deg) L1=Max.2mm L2=110+-10mm L3=80+-10mm L4=70+-10mm	
	<b>Harness position specification</b> (1)Where the connector side's harness is pulled out, position the protective tube at the connector side so that lead wire exposure is the minimum. (2)Fix the harness using clips to the dimensions shown in the figure. (3)Cut the binder leaving no more than L1 excess. A = GE, TCV, Q adjustment B=NP,FCV C=TPS E = binder

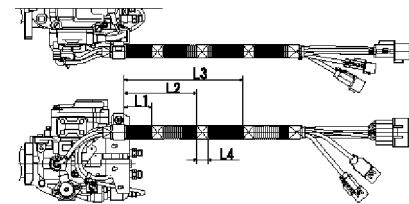
**4.3 Attachment specification 3**

Name	HARNESS & CONNECTOR
L1=Max.25mm L2=Max.10mm L3=325+-10mm L4=(20mm) L5=(30mm) a=45deg	
	<b>Corrugated tube assembly specification</b> (1)Where the pump sensor side and connector side harness come out, attach protective tube to the sensor side and the connector side (except for the FCV grommet position) so that the lead wires are not exposed or visible. (2)Align the end of the corrugated tube with clip A and fix it using black vinyl tape (L1, L2). (3)Confirm that the dimension to the end of the corrugated tube C is L3, and fix it using black vinyl tape (L4, L5). (4)Refer to the illustration for the position of the corrugated tube slit. A = binder B = outside edge of binder C = end of corrugated tube D = position of corrugated tube's slit

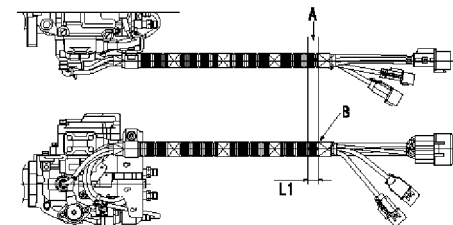
**4.4 Attachment specification 4**

Name	HARNESS & CONNECTOR
L1=300+-10mm L2=(110mm) L3=27~37mm L4=5~15mm T1=9.8~13.7N-m(1.0~1.4kgf-m)	 <p>Harness fixing specification</p> <p>(1)At the clip position J at dimension L2 from the rear end of the connector, and the dimension L1 from the metal end of the clip B, fix using the socket head bolt and the spring washer.</p> <p>(2)Adjust the length of dimension L1 within the tolerance so that the TPS and Np harness at A is not excessively loose, then fix using the clip.</p> <p>(3)Clip the GE cable and the FCV harness using clip E, the GE cable and the FCV-TCV harness using clip F, and the TPS-NP harness using clip G.</p> <p>B = clip            D = socket head bolt            E = binder            F = binder            G=Binder            J = clip position</p>

**4.5 Attachment specification 5**

Name	HARNESS & CONNECTOR
L1=55+-10mm L2=125+-10mm L3=195+-10mm L4=(20mm)	 <p>Vinyl tape assembly specification</p> <p>Wrap with black vinyl tape (at 3 positions) from the end of the clip's metal portion at the positions shown in the figure (dimensions indicated).</p>

**4.6 Attachment specification 6**

Name	HARNESS & CONNECTOR
L1=20+-5mm	 <p>Marking application specification</p> <p>(1)Ensure the corrugated tube is not twisted and then mark the position A shown in the figure.</p> <p>(2)3 Mark at the two locations indicated in the figure ( viewed from the side of the pump and the top of the pump). The markings must be the dimensions shown and approx. 5 mm wide.</p> <p>(3)2 Use indelible paint for steel.</p> <p>A = white marking            B = End of tape binding</p>