

ZEXEL Ass'y No.	104700-9162
Bosch Ass'y No.	9 460 614 826
Bosch Typecode	
Engine Type	4D56TCI
Manufacturer	HYUNDAI
Edition date	11.05.09

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>A</th><th>B</th><th>C($\Delta U_{\alpha \text{ soll}}$)</th></tr><tr><td></td><th>kΩ</th><th>V</th></tr><tr><td>1</td><td>0.18</td><td>0.058</td></tr><tr><td>2</td><td>0.30</td><td>0.046</td></tr><tr><td>3</td><td>0.43</td><td>0.037</td></tr><tr><td>4</td><td>0.62</td><td>0.028</td></tr><tr><td>5</td><td>0.82</td><td>0.019</td></tr><tr><td>6</td><td>1.10</td><td>0.010</td></tr><tr><td>7</td><td>1.50</td><td>0</td></tr><tr><td>8</td><td>2.00</td><td>-0.010</td></tr><tr><td>9</td><td>2.70</td><td>-0.019</td></tr><tr><td>10</td><td>3.90</td><td>-0.028</td></tr><tr><td>11</td><td>5.00</td><td>-0.037</td></tr><tr><td>12</td><td>8.20</td><td>-0.046</td></tr><tr><td>13</td><td>15.00</td><td>-0.058</td></tr></table>	A	B	C($\Delta U_{\alpha \text{ soll}}$)		k Ω	V	1	0.18	0.058	2	0.30	0.046	3	0.43	0.037	4	0.62	0.028	5	0.82	0.019	6	1.10	0.010	7	1.50	0	8	2.00	-0.010	9	2.70	-0.019	10	3.90	-0.028	11	5.00	-0.037	12	8.20	-0.046	13	15.00	-0.058
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	<p>Compensation resistance/compensation voltage comparison</p> <p>A = Compensation resistor number</p> <p>B= Compensation resistance</p> <p>C = Compensation voltage delta U alpha soll</p>																																													

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	2.86	2.86	2.86		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	72	71.5	72.5		
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	2	2	2		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	14.8	11.8	17.8		
S	Difference in delivery	mm3/st.	2.5		2.5		
P	Basic		*				
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2575	2575	2575		
P	U alpha soll + dU alpha soll	V	1.96	1.96	1.96		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	20.3	17.8	22.8		
S	Difference in delivery	mm3/st.	5.5		5.5		
P	Basic		*				
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	3.31	3.31	3.31		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	67.9	57.9	77.9		
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	2	2	2		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	14.8	11.8	17.8		
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	2.74	2.74	2.74		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	51.2	48.7	53.7		
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	2.83	2.83	2.83		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	63.1	60.6	65.6		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	U alpha soll + dU alpha soll	V	2.87	2.87	2.87		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	70.4	67.9	72.9		
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	2.86	2.86	2.86		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	72	71	73		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1500	1500	1500		
P	U alpha soll + dU alpha soll	V	2.82	2.82	2.82		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	68.6	66.1	71.1		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1750	1750	1750		
P	U alpha soll + dU alpha soll	V	2.8	2.8	2.8		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	65.5	63	68		
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	2.77	2.77	2.77		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	63.8	61.3	66.3		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2575	2575	2575		
P	U alpha soll + dU alpha soll	V	1.96	1.96	1.96		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	20.3	17.8	22.8		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2575	2575	2575		
P	U alpha soll + dU alpha soll	V	1	1	1		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/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	2.77	2.77	2.77		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	cm3/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

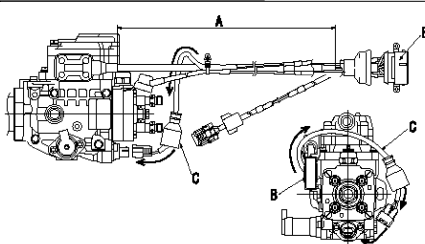
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
C	Max. applied voltage	V	8	8	8		
P	Test voltage	V	13	12	14		

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	5.8	5.7	5.9		
S	Pre-stroke	mm	0.1	0.08	0.12		

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

Name HARNESS & CONNECTOR



T.C.V. connector assembly specification

(1) Ensure the GE cable is not twisted at section A.

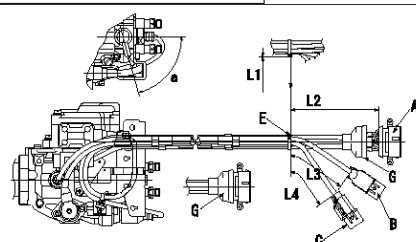
(2) Refer to diagram for direction of connector B.

(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=240+-10mm
 L3=185+11-9mm
 L4=185+11-9mm



Harness position specification

(1) Ensure each dimension is as shown in the diagram and fix the harness using the binders.

(2) Cut the binder leaving no more than L1 excess.

(3) Attach cover G to the GE, FCV, TCV and Q adjustment connectors.

(4) After completing all of the procedures, ensure no lead wires are exposed after routing the harness.

A = GE, FCV, TCV, Q adjustment

B=NP

C=TPS

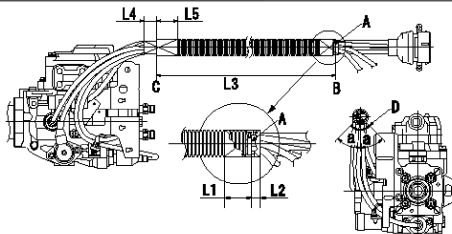
E = binder

G=Cover

4.3 Attachment specification 3

Name	HARNESS & CONNECTOR
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L1=Max.25mm
 L2=Max.10mm
 L3=345+-10mm
 L4=(20mm)
 L5=(30mm)
 a=45deg

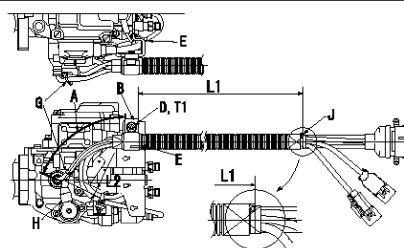
**Corrugated tube assembly specification**

- (1) Align the end of the corrugated tube with clip A and fix it using black vinyl tape (L1, L2).
 - (2) Confirm that the dimension to the end of the corrugated tube C is L3, and fix it using black vinyl tape (L4, L5).
 - (3) 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
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L1=320+-10mm
 L2=5~15mm
 T1=9.8~13.7N-m(1.0~1.4kgf-m)

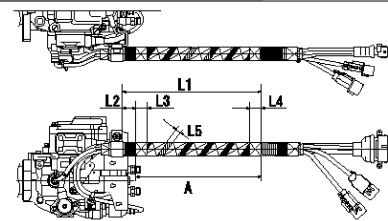
**Harness fixing specification**

- (1) Make the clearance between the clip J and the clip (B with metal end face) L1.
 - (2) Fix clip B using socket head bolt D. At this time, adjust to within the tolerance L1 so that the TP S and NP harnesses in section A do not have excessive slack.
 - (3) Clip the GE cable and the FCV harness using clip E, and the TPS-NP harness using clip G.
 - (4) Attach the binder G after ensuring that the TPS cover H is not loose.
- B = clip
 D = socket head bolt
 E = binder
 G = Binder
 H = TPS cover
 J = binder

4.5 Attachment specification 5

Name	HARNESS & CONNECTOR
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L1=250+-10mm
 L2=25+-10mm
 L3=(20mm)
 L4=(20mm)
 L5=(10mm)

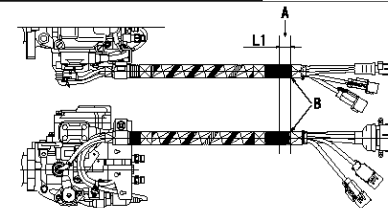
**Vinyl tape assembly specification**

Wrap with vinyl tape at position A in the figure.

4.6 Attachment specification 6

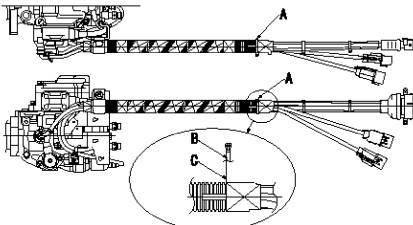
Name	HARNESS & CONNECTOR
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L1=20+-5mm

**Marking application specification**

- (1) Ensure the corrugated tube is not twisted and then mark the position A shown in the figure.
 - (2) 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.
 - (3) Use indelible paint for steel.
- A = white marking
 B = End of tape binding

4.7 Attachment specification 7

Name	HARNESS & CONNECTOR
	
	<p>Binder union specification</p> <p>(1) After wrapping with tape, align the end with the end of the binder and attach the binder.</p> <p>(2) Cut the binder leaving no more than 2mm excess.</p> <p>A = binder</p> <p>B = end of binder</p> <p>C = end of tape binding</p>