

# Workshop Manual

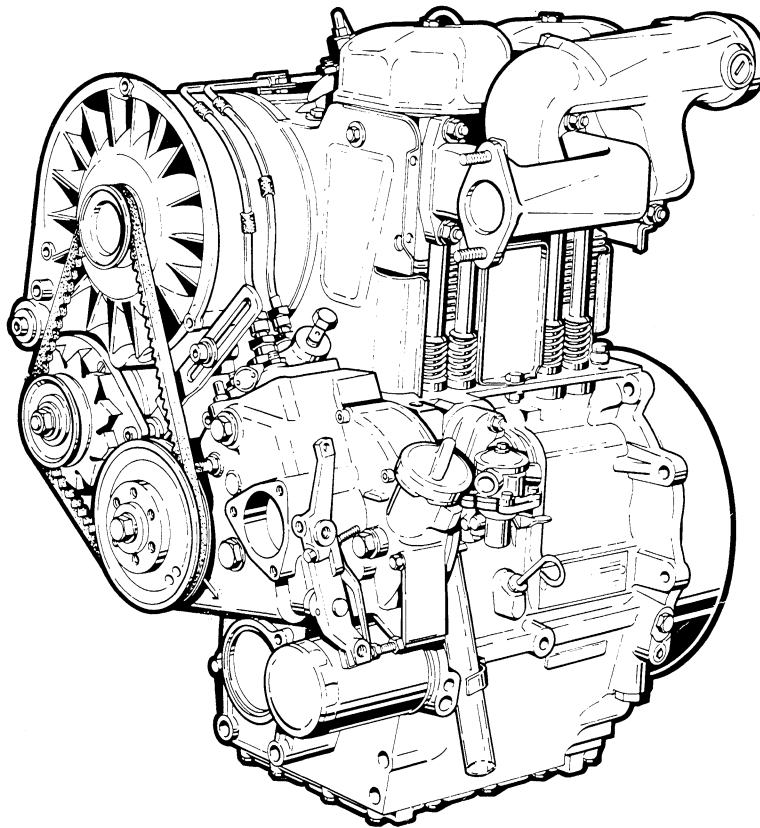


**DEUTZ**

291 1921

01/1987

## FL 511/W



**WORKSHOP MANUAL**  
**for**  
**Air-cooled DEUTZ DIESEL Engines**

**FL 511/W**

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## FOREWORD

This Workshop Manual informs our customers and Service partners about repair and adjustment work on the DEUTZ diesel engine. It is presumed that this work will be carried out by qualified personnel.

This Manual has been made up in a manner which ensures quick visual comprehension of the contents. This is achieved by illustrations and graphic symbols as substitute for the respective text. This layout permits universal use, because the illustrations and symbols are also largely understood by those being unable to read and write.




























Aspects of operation and maintenance are not dealt with in this Manual; they are contained in the Engine Operation Manual.

This Workshop Manual is not regularly updated. Any engineering changes having been introduced in the meantime will be considered in the next issue. Therefore, please refer to the Technical Circulars where engineering changes are announced when appropriate.

### General:

- This Workshop Manual has been prepared using our best knowledge and experience, taking into account safety and environmental aspects.
- It has to be ensured that everyone concerned with repair or adjustment work on the engine has this Workshop Manual available, reads it and understands it.
- It has to be ensured that all equipment, hand and special tools required for proper execution of repair work are in good condition.
- Failure to comply with this Workshop Manual may result in malfunction of the engine, short lifetime of components, personal injury or damage to property and environment for which we take no responsibility.
- Engine components such as springs, clips, flexible retaining rings, electric equipment, pipes, etc. involve a risk of damage or personal injury if handled in an improper way. It is therefore essential that no one attempts to do any work on the engine unless he has the necessary experience of the various tools, materials and methods.
- To ensure best efficiency, reliability and lifetime of the engine and its components, only original spare parts may be used for the repair.

# Key to Symbols

	<b>Disassembly</b> of assembly groups		<b>Guard against personal injury</b> Indication of hazard
	<b>Reassemble</b> to form assembly group		<b>Guard against material damage</b> Damage to parts
	<b>Remove</b> obstructing parts		<b>Prop up – Support – Hold</b>
	<b>Reinstall – Remount</b> parts which had obstructed disassembly		<b>Oil</b>
	<b>Attention! Important notice!</b>		<b>Grease</b>
	<b>Check – Adjust</b> e. g. torque, dimensions, pressures, etc.		<b>Mark</b> before disassembly, observe marks when reassembling
	<b>Special tool</b>		<b>Balance</b> Eliminate any imbalance
	<b>Note direction of installation</b>		<b>Filling – Topping up – Refilling</b> e. g. oil, cooling water, etc.
	<b>Visual inspection</b>		<b>Drain off</b> e. g. oil, cooling water, etc.
	<b>Possibly still serviceable</b> Renew if necessary		<b>Loosen – Release</b> e. g. loosening a clamping device
	<b>Renew at each reassembly</b>		<b>Tighten – Clamp</b> e. g. tightening a clamping device
	<b>Unlock – Lock</b> e. g. split pin, locking plate, etc.		<b>Vent</b>
	<b>Lock – Adhere</b> e. g. with liquid sealant		<b>Machining process</b>
			<b>See Technical Data</b> (For inst. 67 as indication of the line)

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1. SPECIFICATION DATA

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## General engine data

Designation of type		F1L 511	F1L 511 W	F2L 511	F2L 511 W
<b>1</b>	Total piston displacement cm <sup>3</sup>	825		1650	
<b>2</b>	Working cycle	Four-stroke diesel			
<b>3</b>	Combustion system	Direct injection W = 2-stage combustion system			
<b>4</b>	Bore mm	100			
<b>5</b>	Stroke mm	105			
<b>6</b>	Weight of engine according to VDMA kg	116		155	
<b>7</b>	Direction of rotation	When facing flywheel left counterclockwise			
<b>8</b>	Rated speed max. 1/min	3000			
<b>9</b>	Minimum idle speed 1/min	950 <sup>+50</sup>			
<b>10</b>	Compression ratio	17 : 1 FL 511 W = 19 : 1			
<b>11</b>	Compression pressure bar	29 - 31			
<b>12</b>	Firing order	—————		2 - 1	
<b>13</b>	Dimensions of engine with oil bath air cleaner and fuel filter				
<b>14</b>	Overall length mm	459,5		571	
<b>15</b>	Overall width mm	525		525	
<b>16</b>	Overall height mm	694		731	

## Fuel injection system

	Designation of type	F1L 511	F1L 511 W	F2L 511	F2L 511 W
17	<u>Fuel injection pump</u> Make	Bosch			
18	Pressure for testing tightness of relief valve (drop to 140 bar in a minute permiss)  bar	150			
19	Minimum pressure that must be attained with the injection pump element (with about 5 rotations of crankshaft) bar	300			
20	<u>Governor</u> Make	Deutz			
21	<u>Injection nozzle</u> Bosch	DLLA 149 S 774 FL 511 W = DNOSD 165			
22	Opening pressure (checking injector for re-use)  bar	$175^{+8}$ FL 511 W = $115^{+8}$			
23	Opening pressure (new condition)  bar	$180^{+8}$ FL 511 W = $120^{+8}$			
24	<u>Commencement of del. before TDC in °crankshaft rota.</u>				
25	Engines without advance unit degree /1/min	$24^{\circ}$ FL 511 W = $20^{\circ}$			
26	Engines with advance unit degree/1/min	_____			




## Fuel injection system

	Designation of type	F1L 511	F1L 511 W	F2L 511	F2L 511 W
<b>27</b>	Advance unit degree	_____			
<b>28</b>	Dimension of Injection Pump mm	82,6 <sup>+0,1</sup>			
<b>29</b>	Distance between the governor head and the crankcase mm	84,7 - 85,7			
<b>30</b>	Diameter of balls for the governor's thrust bearing mm	8			
<b>31</b>	No. of balls	19			
<b>32</b>	Speed adjusting shaft Axial clearance mm	0,2 - 1,1			


The commencement of injection expressed in degrees of crank angle ( $^{\circ}Kw$ ) can be translated into a length "L" in mm marked on the V-belt pulley (flywheel) as follows

$$L = \frac{d \cdot 3,14 \cdot ^{\circ}Kw}{360^{\circ}}$$

## Cylinder unit

	Designation of type	FIL 511	FIL 511 W	F2L 511	F2L 511 W
		<b>33</b>	<u>Cylinder head</u>		
<b>34</b>	Valve guide Outside diameter mm			+ 0,056 15,0 + 0,045	
<b>35</b>	Number of oversizes			2	
<b>36</b>	Each oversize mm			+ 0,056 0,25 + 0,045	
<b>37</b>	Bore in cylinder head mm			+ 0,011 15,0 0	
<b>38</b>	Number of oversizes			2	
<b>39</b>	Each oversize mm			+ 0,011 0,25 0	
<b>40</b>	Valve guide (pressed in) Inside diameter mm			+ 0,015 8,0 0	
<b>41</b>	Valve stem Diameter Inlet mm			0 7,96 - 0,015	
<b>42</b>	Valve stem Diameter Exhaust mm			0 7,94 - 0,02	
<b>43</b>	Valve stem clearance Inlet normal mm			0,04 - 0,07	
<b>44</b>	Inlet Limit value mm			0,15	
<b>45</b>	Exhaust normal mm			0,06 - 0,095	
<b>46</b>	Exhaust Limit value mm			0,2	
<b>47</b>	<u>Valve seating ring</u> Inlet outside diameter, nominal mm			0 45,66 - 0,02	
<b>48</b>	Number of oversizes			3	
<b>49</b>	Each oversize mm			0 0,1 - 0,02	
<b>50</b>	Exhaust outside diameter, nominal mm			0 40,16 - 0,02	
<b>51</b>	Number of oversizes			3	
<b>52</b>	Each oversize mm			0 0,1 - 0,02	

## Cylinder unit

	Designation of type	F1L 511	F1L 511 W	F2L 511	F2L 511 W
		<b>53</b>	Bore in cylinder head Inlet mm		
<b>54</b>	Exhaust mm			$+0,025$ $40,0$ $0$	
<b>55</b>	Valve tulip $\varnothing$ Inlet mm			$\pm 0,1$ $43,0$	
<b>56</b>	Valve tulip $\varnothing$ Exhaust mm			$\pm 0,1$ $37,0$	
<b>57</b>	Valve seat width Inlet mm			$+0,6$ $1,5$ $0$	
<b>58</b>	Exhaust mm			$+0,6$ $1,5$ $0$	
<b>59</b>	Seat angle - degree Inlet			$45^\circ$	
<b>60</b>	Exhaust degree			$45^\circ$	
<b>61</b>	Rim thickness Inlet mm			$0$ $1,0 - 0,2$	
<b>62</b>	Exhaust mm			$0$ $1,8 - 0,2$	
<b>63</b>	Wear limit Inlet mm			$0,5$	
<b>64</b>	Exhaust mm			$0,7$	
<b>65</b>	Distance valve disc/ Cylinder head sealing surface mm			$5,9$	
<b>66</b>	Limit value mm			$5,2$	
<b>67</b>	Valve clearance when engine is cold Inlet mm			$0,15$	
<b>68</b>	Exhaust mm			$0,15$	
<b>69</b>	After repairs to cylinder unit Inlet mm			$0,15$	
<b>70</b>	Exhaust mm			$0,15$	
<b>71</b>	Clearance between valve rockers and the cams of the decompression gear Coarse adjustment mm			_____	

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