

3. TECHNICAL APPENDIX

Instructions for crimping our cable lugs and connectors

Following we give some information about suitable tools and the realization of the crimping process when working with our cable lugs and connectors. **Please notice, that it is absolutely necessary to pay attention to the fact that cable connector, tool and die set are well suited to each other. Only under this condition it is possible to guarantee optimal solderless crimped connections. Therefore we recommend to work only with the suitable druseidt tools.**

To take notice of the various kinds of applications and the number of crimping operations we offer tools in a different price- and performance level. Generally we recommend only to work with ratchet assisted tools, especially when working in the industrial field. So it is possible to guarantee a constant crimping force and optimal crimping performance all over the time. Also we recommend to inspect the tools every year (by permanent working shorter periods after agreement).

With pleasure we'll check and repair your tools in our company. Please notice that it's not allowed to make any changes on our tools. It is not possible to give any form of guarantee by improper handling, incorrect repairing or changed tools. All cable lugs, connectors and tools are constructed for the crimping of stranded copper- and aluminium-conductors. By working with massive single wire conductors or cables made out of other materials it is necessary to consult our company. Our company offers a wide range of cable connectors. Based on this fact it is not possible to write down crimping instructions for all of the different kinds of conductors described in this catalogue. Therefore please be so kind and contact us in case of doubt. With pleasure our employees assist your company to find an optimal crimping solution for your application.

Direction for crimping cable lugs and connectors

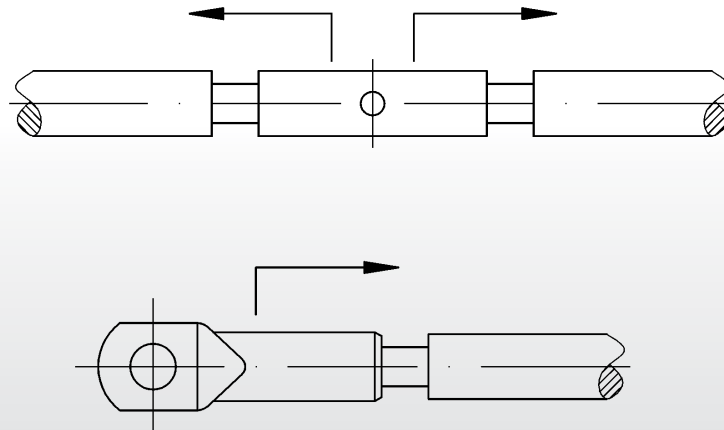
A general instruction is that cable lugs or connectors and the used cable must have the same cross-section. By working with fine stranded cables with a bigger outer-Ø it is necessary to work with cable lugs for fine stranded cables (described in this catalogue on pages 35-39) or cable lugs with a bigger cross-section as the cable. To work with cable lugs with a smaller cross-section as the cable is not allowed.

To guarantee an optimal filling of the crimp sleeve it is necessary that the difference of the inner-Ø of the sleeve and the outer-Ø of the stripped cable is not to much. You get an optimal crimping performance when the inner-Ø of the sleeve and the outer-Ø of the cable is nearly the same. The dimension of the cable lugs and connectors are described in our catalogue. Please compare these dimensions with the outer-Ø of your stripped cable.

Crimping procedure by working with tubular cable lugs and connectors:

- cutting of the cable (right angled to the conductor).
- stripping of the cable. Stripping length = length of the crimp sleeve + ca. 10 %, caused of the sleeve stretching when crimping.
- before starting the crimping process it is necessary to clean the stripped cable ends and make it free of dirt and oxides. Sector shaped cables must be rounded with special dies.
- insertion of the cable. By working with cable lugs up to the end of the crimping sleeve, by working with connectors up to the centre of the connector.
- checking up that cable lug or connector, tool and die set are the right ones.
- take also notice of the instructions for use of the crimping tool.
- realizing of the crimping process. Beginning from the flange of the cable lug in the direction to the conductor or by working with connectors from the connector-centre in the direction to the conductor (acc. to the following drawing). Number of crimpings in dependence of the crimping width and length of the crimping sleeves (please take also notice of the instructions on page 203).

Crimping direction by realizing the crimping process:



Number of crimpings

When working with tubular cable lugs and connectors the number of crimpings are in dependence of the used tool and the crimping width of the die sets. Such information are given in our tables and the description in this catalogue.

The recommend min. number of crimpings are contained in the following tables. When working with butt connectors it is necessary to double it. When crimping cable lugs please pay attention to our instructions on page 202 too.

cross-section mm ²	number x crimping width				
	druseidt standard design	druseidt Euro-design	druseidt design for fine stranded cables	copper DIN-design 46235 / 46267/1	aluminium DIN-design 46239 / 46267/2
10	1 x 5 mm	1 x 5 mm	1 x 5 mm	1 x 5 mm	-
	1 x 7 mm	1 x 7 mm	1 x 7 mm	1 x 7 mm	-
16	1 x 5 mm	2 x 5 mm	2 x 5 mm	2 x 5 mm	3 x 5 mm
	1 x 7 mm	1 x 7 mm	1 x 10 mm	1 x 14 mm	2 x 7 mm
					1 x 12 mm
25	2 x 5 mm	2 x 5 mm	2 x 5 mm	2 x 5 mm	4 x 5 mm
	1 x 10 mm	1 x 12 mm	1 x 12 mm	2 x 7 mm	3 x 7 mm
				1 x 14 mm	2 x 12 mm
35	2 x 5 mm	2 x 5 mm	2 x 5 mm	2 x 5 mm	5 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	2 x 7 mm	4 x 7 mm
	1 x 12 mm	1 x 12 mm	1 x 14 mm	1 x 12 mm	2 x 12 mm
50	2 x 5 mm	2 x 5 mm	2 x 5 mm	3 x 5 mm	5 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	2 x 7 mm	4 x 7 mm
	1 x 12 mm	1 x 12 mm	1 x 14 mm	1 x 12 mm	2 x 12 mm
70	2 x 5 mm	2 x 5 mm	3 x 5 mm	3 x 5 mm	7 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	2 x 7 mm	5 x 7 mm
	1 x 14 mm	1 x 14 mm	1 x 14 mm	1 x 12 mm	3 x 12 mm
95	3 x 5 mm	3 x 5 mm	3 x 5 mm	4 x 5 mm	7 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	3 x 7 mm	5 x 7 mm
	1 x 14 mm	1 x 14 mm	1 x 14 mm	2 x 12 mm	3 x 12 mm
120	3 x 5 mm	3 x 5 mm	3 x 5 mm	4 x 5 mm	7 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	2 x 7 mm	5 x 7 mm
	1 x 14 mm	1 x 14 mm	1 x 14 mm	2 x 12 mm	3 x 12 mm
150	3 x 5 mm	3 x 5 mm	3 x 5 mm	4 x 5 mm	7 x 5 mm
	2 x 7 mm	2 x 7 mm	2 x 7 mm	3 x 7 mm	5 x 7 mm
	1 x 14 mm	1 x 14 mm	1 x 14 mm	2 x 14 mm	3 x 12 mm
185	3 x 5 mm	3 x 5 mm	4 x 5 mm	4 x 5 mm	7 x 5 mm
	2 x 7 mm	2 x 7 mm	3 x 7 mm	3 x 7 mm	5 x 7 mm
	1 x 14 mm	1 x 14 mm	2 x 14 mm	2 x 14 mm	3 x 12 mm
240	4 x 5 mm	4 x 5 mm	5 x 5 mm	5 x 5 mm	8 x 5 mm
	3 x 7 mm	3 x 7 mm	4 x 7 mm	4 x 7 mm	6 x 7 mm
	2 x 14 mm	2 x 14 mm	2 x 14 mm	2 x 14 mm	3 x 12 mm
300	4 x 5 mm	4 x 5 mm	-	5 x 5 mm	8 x 5 mm
	3 x 7 mm	3 x 7 mm	-	4 x 7 mm	6 x 7 mm
	2 x 14 mm	2 x 14 mm	-	2 x 14 mm	3 x 12 mm
400	2 x 14 mm	2 x 14 mm	-	3 x 17 mm	3 x 17 mm
500	3 x 14 mm	3 x 14 mm	-	3 x 17 mm	4 x 17 mm
630	3 x 14 mm	3 x 14 mm	-	3 x 17 mm	4 x 17 mm
800	-	-	-	3 x 25 mm	4 x 25 mm
1000	-	-	-	3 x 25 mm	4 x 25 mm

Maximum allowable current load of cable lugs and connectors in conjunction with insulated leadings and conductors

The current load of cable lugs and connectors depends on the regulations of the VDE 0298 part 4 where the allowable current load of leadings and cables are regulated. Following a summary of some most used situations.

- Group 1:** Leadings up to a nominal voltage 1 kV and heat resistant leadings acc. to VDE 0298 part 4 table 11 column 2. Air-cooled single wire leadings, rubber-insulated, PVC-insulated, heat resistant.
- Group 2:** Leadings up to a nominal voltage of 1 kV and heat resistant leadings acc. to VDE 0298 part 4 column 5. Multi-conductor leadings (but not for household appliance and hand-hold units) layed on or of free areas, rubber insulated, PVC-insulated, heat resistant.

The information about current load apply by an ambient temperature of +30° C in dependence of the laying system of the cables.

- Group 3:** Leadings with a nominal voltage of 0,6/1 kV acc. to VDE 0298 part 4, column 7. Rubber insulated leadings 0,6/1 kV and 1,8/3 kV in special design (air cooled laying).
- Group 4:** Leadings with a nominal voltage of 0,6/1 kV acc. to VDE 0298, part 4 column 4. Multi conductor leadings rubber tube insulated and trailing cables up to 6/10 kV layed on or of free areas.

nominal cross-section mm ²	current load for copper cables in ampere			
	Group 1	Group 2	Group 3	Group 4
0,75	15	12	-	-
1	19	15	-	-
1,5	24	18	30	-
2,5	32	26	41	30
4	42	34	55	41
6	54	44	70	53
10	73	61	98	74
16	98	82	132	99
25	129	108	176	131
35	158	135	218	162
50	198	168	276	202
70	245	207	347	250
95	292	250	416	301
120	344	292	488	352
150	391	335	566	404
185	448	382	644	461
240	528	453	775	-
300	608	523	898	-
400	726	-	-	-
500	830	-	-	-

Remark: Design of the leadings resp. all values deviates from VDE 0298 part 4 dated August 2003 and are only valid under the conditions of the VDE-regulations.

Tightening torques for screws

acc. to DIN EN 61238/DIN VDE 0220 part 2 for screws 8.8

thread M	tightening torque Nm
5	5
6	9
8	22
10	44

thread M	tightening torque Nm
12	75
14	120
16	190
20	380

Tightening force for leadings and cables

The tightening force is the identified value to pull out a leading or cable out of the crimped connector. The values deliver information about the mechanical stress of crimping connections. In dependence of the different cable lugs and connectors we have different regulations about the minimum tightening forces for crimping connections.

To pass the test acc. to the different norms and regulations it is necessary that the electrical conductor cannot pulled out inside of 60 seconds when testing with 100 % of the tightening force. Following a summary of such values under consideration of the different norms.

	Values for crimping copper connectors up to 10 mm ² DIN EN 61238-1, 3/2004 (VDE 0220 part 100) except cable end sleeves			Values for crimping aluminium connectors up to 16 mm ² DIN EN 61238-1, 03/2004 (VDE 0220 part 100)		
	100%	130%	150%	100%	130%	150%
10 mm ²	600 N	780 N	900 N	-	-	-
16 mm ²	960 N	1248 N	1440 N	640 N	832 N	960 N
25 mm ²	1500 N	1950 N	2250 N	1000 N	1300 N	1500 N
35 mm ²	2100 N	2730 N	3150 N	1400 N	1820 N	2100 N
50 mm ²	3000 N	3900 N	4500 N	2000 N	2600 N	3000 N
70 mm ²	4200 N	5460 N	6300 N	2800 N	3640 N	4200 N
95 mm ²	5700 N	7410 N	8550 N	3800 N	4940 N	5700 N
120 mm ²	7200 N	9360 N	10800 N	4800 N	6240 N	7200 N
150 mm ²	9000 N	11700 N	13500 N	6000 N	7800 N	9000 N
185 mm ²	11100 N	14430 N	16550 N	7400 N	9620 N	11100 N
240 mm ²	14400 N	18720 N	21600 N	9600 N	12480 N	14400 N
300 mm ²	18000 N	23400 N	27000 N	12000 N	15600 N	18000 N
400 mm ²	24000 N*			16000 N	20800 N	24000 N
500 mm ²	30000 N*			20000 N	26000 N	30000 N
625 mm ²	37500 N*			25000 N*		
800 mm ²	48000 N*			32000 N*		
1000 mm ²	60000 N*			40000 N*		

* VDE 0220 part 100: maximum value is limited up to 20000 N

cross-section	Values for crimp connections up to 10 mm ² EN 60352 part 2, 10/2002 except cable end sleeves			Values for connections with tabs and receptacles in combination with copper conductors DIN EN 61210 (VDE 0613 part 6), 06/2011		
	100%	130%	150%	100%		
0,2 mm ²	-	-	-	28 N		
0,34 mm ²	-	-	-	40 N		
0,5 mm ²	60 N	78 N	90 N	56 N		
0,75 mm ²	85 N	111 N	128 N	84 N		
1 mm ²	108 N	140 N	162 N	108 N		
1,5 mm ²	150 N	195 N	225 N	150 N		
2,5 mm ²	230 N	299 N	345 N	230 N		
4 mm ²	310 M	403 N	465 N	310 N		
6 mm ²	360 N	468 N	540 N	360 N		
10 mm ²	380 N	494 N	570 N	-		

cross-section	Values for cable end sleeves		cross-section	Values for cable end sleeves	
	EN 60947-1 (VDE 0660 part 100) release 04/2008	EN 60999-1 release 12/2000		EN 60947-1 (VDE 0660 part 100) release 04/2008	EN 60999-2 release 4/2004
0,2 mm ²	10 N	10 N	50 mm ²	236 N	236 N
0,34 mm ²	15 N	15 N	70 mm ²	285 N	285 N
0,5 mm ²	20 N	20 N	95 mm ²	351 N	351 N
0,75 mm ²	30 N	30 N	120 mm ²	427 N	427 N
1 mm ²	35 N	35 N	150 mm ²	427 N	427 N
1,5 mm ²	40 N	40 N	185 mm ²	503 N	503 N
2,5 mm ²	50 N	50 N	240 mm ²	578 N	578 N
4 mm ²	60 N	60 N			
6 mm ²	80 N	80 N			
10 mm ²	90 N	90 N			
16 mm ²	100 N	100 N			
25 mm ²	135 N	135 N			
35 mm ²	190 N	190 N			

Temperature resistance of cable lugs and connectors

copper cable lugs without insulation	up to + 120° C
uninsulated cable end sleeves	up to + 120° C
cable lugs and connectors with PA-insulation	up to + 105° C
cable lugs and connectors with PC-insulation	up to + 100° C
cable lugs and connectors with PVC-insulation	up to + 70° C
cable lugs and connectors with shrinking insulation	up to + 95° C
insulated cable end sleeves	up to + 105° C

cable lugs and connectors out of nickel	up to + 500° C
cable lugs and connectors out of stainless steel	up to + 400° C
uninsulated tabs and receptacles, brass, uncoated	up to + 90° C
uninsulated tabs and receptacles, brass, tin plated	up to + 100° C
uninsulated tabs and receptacles, brass, silver plated	up to + 110° C
uninsulated tabs and receptacles, brass, nickel plated	up to + 250° C

Conductor cross-section comparison

AWG	30	29	28	27	26	25	24	23	22	21	20	19
cross-section mm ²	0,0503	0,0646	0,0804	0,102	0,128	0,163	0,205	0,259	0,325	0,412	0,519	0,653
comparable metrical cross-section	0,05	-	-	0,1	0,14	-	0,2	0,25	-	-	0,5	-

AWG	18	17	16	15	14	13	12	11	10	9	8	7
cross-section mm ²	0,823	1,04	1,31	1,65	2,08	2,63	3,31	4,15	5,27	6,62	8,35	10,6
comparable metrical cross-section	0,75	1	-	1,5	-	2,5	-	-	-	6	-	10

AWG	6	5	4	3	2	1	0	2/0	3/0	4/0	5/0	6/0
cross-section mm ²	13,3	16,8	21,2	26,7	33,6	42,4	53,4	67,5	85,0	107,2	135,1	170,3
comparable metrical cross-section	-	16	-	25	35	-	50	70	95	120	150	185

Inspection and repair of crimping tools

In dependence of the frequency of use and the environmental influences crimping tools are subject of abrasion. Therefore we recommend to inspect the tools every year (by permanent working shorter periods after agreement). With pleasure we'll check and repair your tools in our company. Please notice that tools delivered by druseidt may not be changed in any way.

In particular it is not allowed to make diameter holes etc. Please use our tools only in accordance with our description and the regulations. Repairs of tools may only be executed by our service-department. With pleasure our employees assist your company in repairing and inspecting tools as well as in finding optimal crimping solutions.

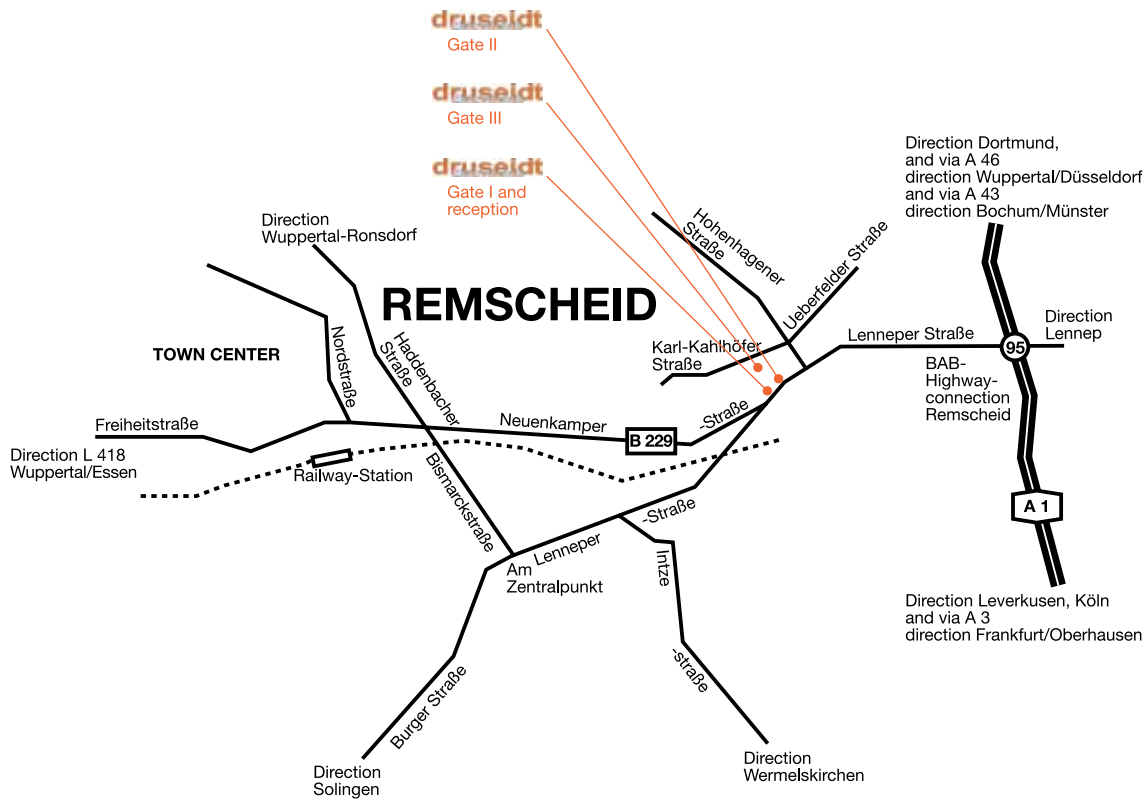
Numerical Index

Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page		
02004	51	02273	64	03090	102	03230	42	03456	37	03831/S-45	47	03929	44	04660 vz	81
02004 bl	51	02274	64	03091	102	03230/S	42	03458	37	03832	45	03941	48	04686	81
02006	51	02275	64	03092	102	03231	42	03460	37	03832/S-45	47	03942	48	04707 vz	81
02006 bl	51	02276	64	03093	102	03231/S	42	03462	37	03833	45	03943	48	04710 vz	81
02070	57	02277	64	03094	102	03232	42	03464	37	03833/S-45	47	03944	48	04711 vz	81
02071	57	02278	64	03095	102	03232/S	42	03466	37	03834	45	03945	48	04721 vz	82
02072	57	02279	64	03097	102	03233	42	03468	37	03834/S-45	47	03946	48	04722	82
02073	57	02280	64	03100	102	03233/S	42	03470	37	03835	45	03947	48	04790 vz	80
02074	57	02281	64	03108	102	03234	43	03472	37	03836	45	03948	48	04792 vz	80
02075	57	02282	64	03109	102	03234/S	43	03474	37	03836/S-45	47	03949	48	04794 vz	80
02076	57	02283	64	03110	102	03235	43	03476	37	03837	45	03950	48	04801 vz	80
02077	57	02284	64	03111	102	03235/S	43	03480	37	03837/S-45	47	03951	48	04802 vz	80
02078	57	02285	64	03112	102	03236	43	03482	37	03838	45	03952	48	04804 vz	80
02079	57	02286	64	03113	102	03236/S	43	03484	37	03838/S-45	47	03953	48	04850 vz	82
02080	57	02287	64	03114	102	03237	43	03486	37	03839	45	03954	48	04870	78
02100	34	02578	88	03116	102	03237/S	43	03490	37	03839/S-45	47	03955	48	04870 vz	78
02101	34	02580	88	03117	102	03238	43	03492	37	03840	45	03956	48	04872	78
02102	34	02581	88	03118	102	03238/S	43	03494	37	03841	45	03960	39	04875	78
02105	34	02583	88	03119	102	03239	43	03496	37	03842	46	03961	39	04875 vz	78
02106	34	02584	88	03120	102	03239/S	43	03497	37	03842/S-45	47	03962	39	04877	78
02107	34	02585	88	03121	102	03240	43	03498	37	03843	46	03963	39	04878	78
02110	34	02586	88	03122	102	03240/S	43	03499	37	03843/S-45	47	03964	39	04878 vz	78
02111	34	02587	88	03136-	103	03241	43	03500	37	03844	46	03965	39	04880	78
02112	34	02588	88	03136+	103	03241/S	43	03501	37	03844/S-45	47	03966	39	04883	78
02113	34	02589	88	03137-	103	03242	43	03502	37	03845	46	03967	39	04883 vz	78
02115	34	02670	60	03137+	103	03242/S	43	03575	88	03845/S-45	47	03968	39	04885	78
02116	34	02671	60	03147	100	03243	43	03576	88	03846	46	03969	39	04886	78
02117	34	02672	60	03148	100	03243/S	43	03696	83	03847	46	03970	39	04886 vz	78
02118	34	02675	60	03165	48	03244	43	03697	83	03848	46	03971	39	04888	78
02121	34	02676	60	03166	48	03244/S	43	03699	83	03849	46	03972	39	04888 vz	78
02122	34	02677	60	03167	48	03245	43	03703	83	03850	46	03973	39	04890	78
02123	34	02678	60	03168	48	03245/S	43	03707	83	03850/S-45	47	03974	39	04890 vz	78
02124	34	02679	60	03169	48	03246	43	03708	83	03851	46	03975	39	04892	78
02127	34	02680	60	03170	48	03246/S	43	03709	83	03851/S-45	47	03976	39	04892 vz	78
02128	34	02696	60	03171	48	03247	43	03710	83	03852	46	03977	39	04894	78
02129	34	02697	60	03172	48	03247/S	43	03711	83	03852/S-45	47	03978	39	04894 vz	78
02132	34	02698	60	03173	48	03248	43	03715	83	03853	46	03979	39	04896	78
02133	34	02700	90	03196	42	03248/S	43	03716	83	03854	46	03980	39	04896 vz	78
02134	34	02701	90	03196/S	42	03249	43	03717	83	03855	46	03981	39	04940	78
02137	34	02702	90	03197	42	03249/S	43	03718	83	03856	46	03982	39	04940 vz	78
02138	34	02703	90	03197/S	42	03250	43	03719	83	03856/S-45	47	03983	39	04945	78
02139	34	02704	90	03198	42	03250/S	43	03720	83	03857	46	03984	39	04945 vz	78
02150	54	02705	90	03198/S	42	03251	43	03721	83	03857/S-45	47	03985	39	04947	78
02151	54	02706	90	03199	42	03251/S	43	03722	83	03858	46	03986	39	04947 vz	78
02152	54	02707	90	03199/S	42	03252	43	03750	84	03858/S-45	47	03990	53	04980 vz	79
02153	54	02708	90	03200	42	03252/S	43	03751	84	03859	46	03990/vz	53	04982 vz	79
02154	54	02709	90	03200/S	42	03253	43	03752	84	03859/S-45	47	03991	53	05103	152
02155	54	02710	90	03201	42	03253/S	43	03753	84	03860	46	03991/vz	53	05103	158
02156	54	02715	90	03201/S	42	03254	43	03754	84	03861	46	03992	53	05116/N	154
02157	54	02716	90	03202	42	03254/S	43	03755	84	03861/S-45	47	03992/vz	53	05122	148
02158	54	02717	90	03202/S	42	03331	27	03756	84	03862	46	04058	82	05124	148
02159	54	03203	42	03332	27	03757	84	03757	84	03862/S-45	47	04058 vz	82	05125	148
02160	54	03203/S	42	03333	27	03764	84	03764	84	03863	46	04060	82	05126	158
02161	54	03204	42	03336	27	03765	84	03765	84	03863/S-45	47	04060 vz	82	05140	149
02162	54	03204/S	42	03337	27	03775	85	03775	85	03864	46	04063	82	05141	149
02163	54	03205	42	03338	27	03776	85	03776	85	03864/S-45	47	04063 vz	82	05144	149
02164	54	03205/S	42	03339	27	03777	85	03777	85	03865	46	04070	82	05145	74
02165	54	03206	42	03341	27	03778	85	03778	85	03865/S-45	47	04070 vz	82	05146	74
02166	54	03206/S	42	03342	27	03779	85	03779	85	03866	46	04072	82	05147	74
02167	54	03207	42	03343	27	03780	85	03780	85	03866/S-45	47	04072 vz	82	05148	74
02168	54	03207/S	42	03344	27	03781	85	03781	85	03867	46	04074	82	05149	74
02169	54	03208	42	03346	27	03783	85	03783	85	03867/S-45	47	04074 vz	82	05150	74
02170	54	03208/S	42	03347	27	03785	85	03785	85	03868	46	04076 vz	82	05151	74
02171	54	03209	42	03348	27	03786	85	03786	85	03868/S-45	47	04080 vz	82	05160	153
02172	54	03209/S	42	03349	27	03787	85	03787	85	03869	46	04083 vz	82	05161	153
02173	54	03210	42	03351	27	03788	85	03788	85	03869/S-45	47	04085 vz	82	05162	153
02174	54	03210/S	42	03352	27	03789	85	03789	85	03870	46	04245 vz	76	05163	153
02175	54	03211	42	03353	27	03790	85	03790	85	03871	46	04285	77	05164	153
02176	54	03211/S	42	03354	27	03791	85	03791	85	03872	46	04285 vz	77	05165	153
02177	54	03212	42	03355	27	03800	38	03800	38	03873	46	04287	77	05166	153
02178	54	03212/S	42	03356	27	03801	38	03801	38	03874	46	04287 vz	77	05167	153
02179	54	03213	42	03357	27	03802	38	03802	38	03875	46	04292 vz	77	05168	153
02180	54	03213/S	42	03358	27	03803	38	03803	38	03876	46	04296 vz	77	05169	153
02181	54	03214	42	03360	27	03804	38	03804	38	03877	46	04300 vz	76	05170	153
02220	89	03214/S	42	03361	27	03805	38	03805	38	03878	46	04305 vz	76	05171	153
02221	89	03215	42	03362	27	03806	38	03806	38	03881/S-45	47	04332 vz	77	05172	153
02222	89	03215/S	42	03365	27	03807	38	03807	38	03900	44	04340 vz	77	05173	153
02223	89	03216	42	03366	27	03808	38	03808	38	03901	44	04347 vz	76	05174	153
02224	89	03216/S	42	03367	27	03809	38	03809	38	03902	44	04351 vz	76	05175	153
02225	89	03217	42	03369	27	03810	38	03810	38	03903	44	04356 vz	76	05176	153
02226	89	03217/S	42	03370	27	03815	45	03815	45	03904	44	04358 vz	76	05177	144
02227	89	03218	42	03372	27	03816	45	03816	45	03905	44	04360	76	05178	154
02228	89	03218/S	42	03373	27	03817	45	03817	45	03906	44	04360 vz	76	05179	144
02229	89	03219	42	03410	37	03818	45	03818	45	03907	44	04361	76	05180	152
02250	64	03219/S	42	03412											

Numerical Index

Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page	Part-No.	page
05212	143	05629/1	119	10130	30	10258	57	10532	91	10864	38	12193	168
05213	143	05629/2	119	10132	30	10259	57	10533	91	10866	38	12194	168
05214	143	06100	94	10133	30	10260	57	10535	90	10867	38	12195	168
05215	143	06102	94	10134	30	10300	50	10536	90	10868	38	12196	168
05216	143	06103	94	10135	30	10300 bl	50	10537	90	10869	38	12197	168
05217	143	06105	94	10136	30	10302	50	10538	90	10871	38	12198	168
05218	143	06106	94	10137	30	10302 bl	50	10539	90	10872	38	12199	168
05219	143	06109	94	10138	31	10304	50	10541	90	10873	38	12200	168
05222	137	06110	94	10139	31	10304 bl	50	10544	91	10874	38	12270	115
05224	137	06111	94	10140	30	10306	50	10545	89	10875	38	12271	115
05226	137	06112	94	10141	31	10306 bl	50	10546	89	10876	38	12272	115
05228	137	06113	94	10143	31	10308	50	10547	89	10877	38	12273	115
05229	137	06114	94	10144	31	10308 bl	50	10548	89	10878	38	12274	115
05253	188	06114/8	94	10145	31	10310	50	10549	89	10880	38	12275	115
05254	188	06115	94	10145	43	10310 bl	50	10550	89	10881	38	12276	115
05256	193	06116	94	10146	31	10312	50	10551	89	10882	38	12277	115
05258	189	06117	94	10147	31	10312 bl	50	10552	89	10905	63	12279	116
05259	189	06120	94	10148	31	10314	50	10555	91	10906	63	12280	116
05260	189	06121	94	10149	31	10314 bl	50	10556	91	10907	63	12281	116
05262	189	06122	94	10149	43	10316	50	10557	91	10910	63	12282	116
05265	190	06125	94	10150	31	10316 bl	50	10558	91	10911	63	12283	116
05266	191	06126	94	10150	43	10318	50	10560	91	10912	63	12284	116
05267	190	06129	94	10151	31	10318 bl	50	10561	91	10915	63	12286	116
05267	191	06130	94	10151	43	10320	51	10562	91	10916	63	12287	116
05268	190	06131	94	10152	31	10320 bl	51	10565	89	10917	63	12288	116
05268	191	06135	93	10152	43	10345	100	10566	89	10920	63	12289	116
05269	190	06138	93	10153	31	10346	100	10568	89	10921	63	12290	116
05269	191	06139	93	10153	43	10347	100	10569	89	10922	63	12291	116
05270	189	06140	93	10154	31	10348	100	10571	89	10925	63	12292	116
05272	189	06143	93	10154	43	10350	100	10572	89	10926	63	12294	116
05274	189	06144	93	10155	31	10351	100	10585	103	10930	63	12295	116
05275	189	06147	93	10155	43	10352	100	10585/6	103	10931	63	12296	116
05300	145	06148	93	10156	30	10353	100	10585/7.3	103	10932	63	12297	116
05301	145	06149	93	10158	30	10356	100	10586	103	10936	63	12298	116
05320	146	06150	93	10159	30	10357	100	10586/13	103	10937	63	12299	116
05321	146	06151	93	10160	30	10400	32	10587	103	10938	63	12300	116
05322	146	06152	93	10162	30	10400	45	10587/14	103	10940	63	12302	116
05400	132	06153	93	10163	30	10402	32	10595	103	10941	63	12303	110
05402	133	06156	93	10164	30	10402	45	10595/6	103	10942	63	12304	110
05403	133	06157	93	10165	30	10404	32	10595/7.3	103	10943	63	12305	110
05404	136	06158	93	10166	31	10404	45	10596	103	10945	63	12306	110
05405	136	06161	93	10167	31	10406	32	10596/13	103	10946	63	12307	110
05406	136	06162	93	10168	31	10406	45	10597	103	10947	63	12308	110
05407	136	06165	93	10169	31	10408	32	10597/14	103	10948	63	12309	110
05408	132	06166	93	10170	31	10408	45	10600	103	11000	21	12314	110
05412	132	06167	93	10171	31	10410	32	10601	103	11001	21	12315	110
05419	132	06170	93	10172	31	10410	45	10685	103	11004	21	12316	110
05460	115	06171	93	10173	31	10412	32	10685/6	103	11005	21	12317	110
05490	117	06174	93	10174	31	10412	45	10685/7.3	103	11008	21	12322	110
05491	117	06175	93	10174	43	10414	32	10686	103	11009	21	12324	197
05492	117	06176	93	10175	31	10414	45	10686/13	103	11020	20	12325	197
05493	117	06178	93	10175	43	10416	32	10687	103	11021	20	12326	197
05494	117	06179	93	10176	31	10416	45	10687/14	103	11022	20	12327	197
05495	117	06182	93	10176	43	10418	32	10695	103	11025	122	12328	197
05500	116	06183	93	10177	31	10418	45	10695/6	103	11026	122	12329	197
05501	116	06184	93	10177	43	10420	32	10695/7.3	103	11027	122	12330	197
05502	116	06185	93	10178	31	10420	45	10696	103	11028	122	12331	197
05503	116	06186	93	10178	43	10422	32	10696/13	103	11029	122	12341	167
05504	116	06187	93	10190	31	10422	45	10697	103	11030	122	12342	167
05505	116	10005	20	10190	43	10424	32	10697/14	103	11031	122	12343	167
05530	117	10015	20	10210	51	10424	45	10700	36	11032	122	12344	167
05531	117	10021.01.02	15	10210 vz	51	10426	32	10700/S	36	11033	122	12345	167
05532	117	10022.01	17	10211	51	10426	45	10702	36	11034	122	12346	167
05533	117	10024.01	17	10211 vz	51	10428	32	10702/S	36	11040	20	12347	167
05534	117	10025	122	10212	51	10428	45	10704	36	11041	20	12348	167
05535	117	10026	122	10212 vz	51	10430	32	10704/S	36	11042	20	12349	167
05540	117	10027	122	10212/35	51	10432	32	10706	36	11100	135	12350	167
05541	117	10028	122	10212/35 vz	51	10434	32	10706/S	36	11101	135	12351	167
05542	117	10029	122	10213	51	10436	32	10707	36	11102	135	12352	168
05543	117	10030	122	10213 vz	51	10438	32	10707/S	36	11103	135	12353	168
05544	117	10031	122	10213/35	51	10438/S-45	33	10708	36	11104	135	12354	168
05545	117	10032	122	10213/35 vz	51	10440	32	10708/S	36	11105	135	12355	168
05550	116	10033	122	10214	51	10441	32	10710	36	11106	135	12356	168
05551	116	10034	122	10214 vz	51	10442	32	10710/S	36	11107	135	12357	168
05552	116	10045	122	10215	51	10443	32	10711	36	11110	135	12358	168
05553	116	10046	122	10215 vz	51	10444	32	10711/S	36	11111	135	12359	168
05554	116	10047	122	10216	51	10445	32	10712	36	11112	135	12360	168
05555	116	10048	122	10216 vz	51	10446	33	10712/S	36	11260	128	12361	168
05570	117	10049	122	10217	51	10452	64	10713	36	11261	128	12362	168
05571	117	10050	122	10217 vz	51	10453	64	10713/S	36	11262	128	12363	168
05572	117	10051	122	10218	51	10480	72	10714	36	11264	128	12364	168
05573	117	10052	122	10218 vz	51	10481	72	10714/S	36	11265	128	12365	168
05574	117	10053	122	10219	51	10482	72	10715	36	11266	128	12366	168
05575	117	10054	122	10219 vz	51	10483	72	10715/S	36	11268	128	12367	168
05580	117	10061	122	10220	51	10484	72	10716	36	11720 vz	77	12368	168
05581	117	10062	122	10220 vz	51	10485	72	10838	32	11725 vz	77	12369	168
05582	117	10063	122	10221	51	10486	72	10840	32	11915	81	12370	160
05583	117	10064	122	10221 vz	51	10487	72	10841	32	11990	86	12370/50	160
05584	117	10065	122	10222	51	10488	72	10842	32	11991	86	12371	160
05585	117	10071	122	10222 vz	51	10490	72	10843	32	11992	86	12372	159
05620	118	10072	122	10223	51	10491	73	10844	32	11993	86	12372/50	159
05621	118	10073	122	10223 vz	51	10492	73	10845	32	11994	86	12373	159
05622	118	10074	122	10240	57	10493	73	10846	33	11995	86	12374	159
05623	118	10080	24	10241	57	10494	73	10850	38	11996	86	12375	159
05624	118	10085	24	10242	57	10495	73						

Space for notes



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