

ZAR7



Plus (Double) Planetary Gears

for Windows

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ZAR7 - Plus Planetary Gears - test.zr7

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Plus Planet 0
Ravigneaux gear set Borg-Warner Model 8
S: Sun 1
Pi: Inner Planet 2
Pe: Outer Planet 3
H: Ring Wheel 4

	S	Pi	Pe	H
z	28	18	18	-47
d	11.5000	6.5000	6.5000	-4.5000
d _{ext}	32.00	28.00	28.00	30.00
d _{int}	36.00	32.00	32.00	-134.00
d _{ext}	32.890	28.918	28.918	-141.134
d _{int}	32.823	30.070	30.070	-125.919
d _{ext}	41.890	37.718	37.718	-132.134
d _{int}	38.00	16.00	16.00	-47.00

	S	Pi	Pe	H
Sup. MPa	1500	1500	1500	1500
Stp. PE MPa	800	800	800	800
Stp. SH MPa	1.29	1.17	1.17	1.17
Stp. SH _{int} MPa	1.33	1.11	1.11	1.11
Stp. SH _{ext} MPa	1.63	1.63	1.63	1.63
SP-SPI	3.53	2.14	2.14	2.14
SP-PIPe		2.14	2.14	4.47

Calculation Base

Difference between simple (minus) planetary gears and plus planetary gears are planet gear pairs instead of planet gears. This makes stationary ratio positive, speed directions are inverse compared with simple planetary gear. ZAR7 calculates dimensions and strength of plus planetary gears. To calculate tooth meshing and strength of the involute gear wheels, plus planetary gear set is separated into three gear pairs: sun wheel (S) with inner planet wheel (Pi), inner planet wheel (Pi) with outer planet wheel (Pe), outer planet wheel (Pe) with hollow wheel (H). Dimensions are calculated according to DIN 3960, deviations according to ISO 1328 or DIN 3961, tooth thickness tolerances according to DIN 3967, and strength according to ISO 6336.

Pre-Dimension

In Pre-Dimension, you enter input speed, output speed, and power. ZAR7 calculates and suggests dimensions of a plus planetary gear.

Gear Dimensions

Pressure angle, helix angle, normal module or normal pitch, number of teeth, face width, profile shift and center distance can be modified and optimized in a dialogue window. Reference profile can be standard tool according to ISO 53 (DIN 867), or you can define a profile by input of tooth height coefficients and fillet radius. Even chamfer and protuberance profiles can be calculated. ZAR7 calculates tooth thickness, clearance, span width and dimensions over/between pins and balls from tooth quality and tolerance zone. Diagrams show specific sliding along the tooth contact line.

Strength Calculation

Load-bearing capacity with safety factors SF for tooth root fracture and SH for pitting according to ISO 6336 for each gear pair: sun wheel (S) with inner planet wheel (Pi), inner planet wheel (Pi) with outer planet wheel (Pe), outer planet wheel (Pe) with hollow wheel (H). If safety factors less than 1.0, ZAR7 calculates time until tooth root fracture or pitting.

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CALCULATION METHOD: ISO 6336

	MPa	2xH
Sigma-PG = Sigma-PE * Yb1 * Yb2 * Yb3 * Yb4 * Yb5	MPa	332 347
Sigma-PG = F1 (db) * YF * YS * Yb1 * Yb2 * Yb3 * Yb4 * Yb5	MPa	188 153
Sigma-P = Sigma-PG * KA * Kv * KPs * KPa	MPa	237 190
SF = Sigma-PG / Sigma-P	SF	2.302 4.469

	MPa	2xH
Sigma-HE = ZH * ZE * Zepsilon * Zbeta * Zalpha * Zbeta * Zalpha	MPa	785
Sigma-HE = Sigma-HM * ZH * Zepsilon * Zbeta * Zalpha * Zbeta * Zalpha	MPa	1402 1402
Sigma-HE = Sigma-HM * ZH * Zepsilon * Zbeta * Zalpha * Zbeta * Zalpha	MPa	981
Sigma-HL = ZHL * Zepsilon * Zbeta * Zalpha * Zbeta * Zalpha	MPa	287 1 287
SHL_Z = Sigma-HE1.2 / Sigma-HL.2	SH	1.423 1.423

	MPa	2xH
d	mm	28.00
d _{ext}	mm	32.00
d _{int}	mm	-134.00
d _{ext}	mm	32.89
d _{int}	mm	-125.92
d _{ext}	mm	41.89
d _{int}	mm	16.00

	MPa	2xH
Sup. MPa	1500	1500
Stp. PE MPa	800	800
Stp. SH MPa	1.29	1.17
Stp. SH _{int} MPa	1.33	1.11
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