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Design and Fabrication of Screw Jack using Worm Gear

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Abstract: *In this we are going to see about the modelling and construction of screw jack using worm and spur gear arrangement. There are wide application in paper making machinery, foundries, missile bases, and a whole host of applications where precision adjustment is required. In most such worm gear jacks, the worm gear is made of a relatively soft material such as aluminium bronze, the lifting screw may be of a heat treated hardened steel .Different strength theories of failure for the screwed shaft are taken into account, according to the type of material used. The assembly consist of components such as ball bearings, circular shafts, spur gear, worm gear etc…*

Keywords: *Design, fabrication, worm gear screw jack.*

1. INTRODUCTION

A screw jack is a type of jack, i.e., a mechanical device used to lift heavy loads or apply large forces, which is operated by a lead-screw. The virtues of using a screw as a machine, e.g., for pumping water, was firstly demonstrated by Archimedes in 200 BC, but it was the famous Leonardo da Vinci in the late 1400's who firstly designed a worm gear screw jack (WGSJ). Leonardo's design of WGSJ is still accepted nowadays: by using a threaded worm gear, supported on bearings, that rotates by turning a worm shaft, the lead-screw is driven to move the load.

In our design we are using components such as worm gear, spur gear, ball bearings, circular shaft, bolt and nut arrangement which acts as lifter, and handle for manual operation and DC motor for automatic operation. The Dc motor is attached to the assembly by using temporary fasteners like bolted joints if required.

There are wide application in paper making machinery, foundries, missile bases, and a whole host of applications where precision adjustment is required. In most such worm gear jacks, the worm gear is made of a relatively soft material such as aluminium bronze, the lifting screw may be of a heat treated hardened steel.

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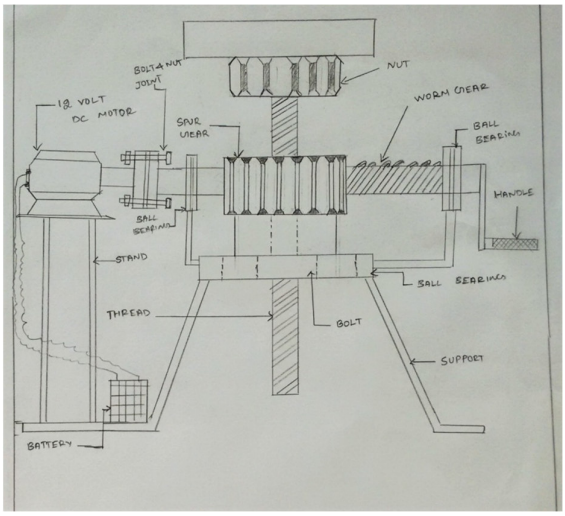
2. Pictorial Representation



3. Methodolgy

In this initially the bolt is welded into the ball bearing, then one end of the circular shaft is welded to the top of ball bearing and other end is welded to the spur gear, it forms the main assembly. Worm gear is made to mate with the spur gear it is done by using ball bearing support.

Other end of the worm gear is extended to certain level for the purpose of connecting motor for automatic operation of the jack and a handle is attached to the other end of the worm gear for manual operation. Now the nut is connected to the bolt through the spur gear.

4. Spur Gear Selection

For a required centre distance and gear ratio a suitable pair of spur gears can be selected used and assessed by the following procedure.

Select numbers of teeth in gears and module (pitch).

$$\text{Gear Ratio } i = \frac{Z_2 \text{ (Teeth driven gear)}}{Z_1 \text{ (Teeth driving gear)}}$$

$$\text{Shaft centre distance in mm} = \frac{\text{sum gear teeth X pitch}}{(Z_1 + Z_2)\,P}$$

From this initial selection each gear can be assessed for strength and wear using the following formulae. The least of the four calculated powers is the capacity of the gear set. The capacity required is determined by multiplying actual power by a service factor relative to driver and driven equipment, refer page c2. If calculated power is below required capacity increase pitch or face width of gears, adjust teeth sizes accordingly, and reassess drive. If calculated power is substantially in excess of required capacity a lower Module could be considered.

$$\text{Strength capacity } Ps = \frac{Xb \times Sb \times Ys \times F \times N \times Z \times P^{1.1}}{19{,}100 \times 10^3} \text{ kw}$$

$$\text{Wear capacity } Pw = \frac{Xc \times Sc \times Yz \times F \times N \times Z \times P^{0.8}}{10{,}000 \times 10^3} \text{ kw}$$

Where:- F = Face width mm
N = Gear shaft speed r.p.m.
P = Gear pitch, Module No.
Sb = Bending stress for gear material (see below)
Sc = Surface stress for gear material (see below)
Xb = Speed factor for strength - see table 1
Xc = Speed factor for wear - see table 2
Ys = Strength factor - see table 3
Yz = Zone factor - see table 4

Factors Sb and Sc Gears

Gear Type	Sb N/mm²	Sc N/mm²
Steel Gears and racks	130	9.65
Cast Gears	52	9.30

Table 1 Speed factor for Strength Xb (for 26000 hour rating)

Daily Hours	Gear Shaft rpm															
	0.1	1	5	10	40	100	150	200	400	800	600	1000	1500	2000	3000	5000	10000
24	0.784	0.640	0.566	0.518	0.435	0.375	0.349	0.330	0.294	0.286	0.274	0.246	0.223	0.211	0.189	0.163	0.122
12	0.865	0.700	0.623	0.568	0.475	0.420	0.384	0.362	0.321	0.310	0.300	0.268	0.245	0.231	0.198	0.167	0.134
6	0.970	0.775	0.685	0.628	0.526	0.460	0.426	0.410	0.357	0.342	0.331	0.297	0.272	0.263	0.221	0.186	0.147
3	1.080	0.864	0.750	0.690	0.580	0.517	0.474	0.448	0.401	0.380	0.368	0.328	0.301	0.288	0.245	0.207	0.164
1	1.250	1.031	0.880	0.800	0.678	0.596	0.552	0.525	0.465	0.445	0.437	0.385	0.349	0.328	0.286	0.240	0.192

Table 2 Combined Speeed Factor for Wear Xc (for 26000 hour rating)

Daily Hours	Gear Shaft rpm															
	0.1	1	5	10	40	100	150	200	400	800	600	1000	1500	2000	3000	5000	10000
24	1.149	0.780	0.564	0.488	0.377	0.320	0.297	0.282	0.250	0.240	0.233	0.209	0.192	0.180	0.157	0.132	0.106
12	1.448	0.908	0.718	0.625	0.478	0.408	0.372	0.355	0.317	0.304	0.294	0.262	0.240	0.226	0.196	0.165	0.122
6	1.830	1.258	0.901	0.790	0.607	0.514	0.474	0.455	0.404	0.382	0.370	0.334	0.307	0.287	0.250	0.211	0.167
3	2.295	1.570	1.168	0.980	0.762	0.647	0.607	0.575	0.508	0.488	0.472	0.425	0.391	0.369	0.328	0.269	0.219
1	3.370	2.280	1.663	1.440	1.218	0.929	0.882	0.825	0.728	0.700	0.675	0.610	0.551	0.520	0.425	0.390	0.304

Table 3 Strength Factor Ys

No. Teeth		Number Teeth Mating Gear																			
	Rack	127	100	80	70	60	50	40	35	30	28	26	24	22	20	19	18	17	16	15	14	13	12
12	.658	.625	.618	.614	.610	.605	.600	.597	.596	.593	.592	.591	.590	.588	.585	.584	.581	.578	.575	.573	.571	.567	.562
13	.679	.644	.638	.632	.628	.623	.616	.612	.610	.606	.605	.604	.602	.600	.597	.597	.595	.590	.587	.584	.578	.575	.570
14	.700	.662	.655	.650	.645	.640	.632	.626	.623	.620	.619	.617	.614	.611	.608	.606	.604	.600	.597	.592	.588	.583	.576
15	.714	.678	.670	.664	.659	.653	.646	.638	.635	.631	.629	.626	.624	.620	.617	.615	.613	.609	.606	.598	.593	.587	.580
16	.729	.690	.684	.676	.672	.665	.657	.650	.647	.639	.637	.634	.630	.626	.621	.617	.615	.610	.606	.601	.596	.593	.590
17	.740	.702	.696	.687	.682	.675	.665	.657	.653	.647	.643	.639	.634	.630	.624	.620	.616	.613	.609	.604	.598	.592	.584
18	.750	.710	.704	.697	.691	.683	.672	.665	.660	.654	.650	.645	.642	.637	.632	.625	.622	.618	.614	.610	.605	.600	.593	.584
19	.760	.720	.713	.705	.700	.692	.680	.672	.664	.662	.656	.647	.643	.638	.633	.623	.629	.619	.615	.610	.605	.600	.593	.584
20	.770	.728	.720	.713	.707	.698	.686	.677	.665	.662	.646	.642	.638	.628	.626	.622	.619	.614	.610	.605	.600	.586	.579
22	.786	.740	.732	.726	.714	.709	.696	.674	.660	.647	.644	.640	.635	.630	.624	.621	.617	.613	.608	.604	.598	.590	.581
24	.800	.752	.741	.726	.728	.718	.700	.687	.648	.641	.637	.634	.629	.625	.626	.617	.613	.610	.606	.600	.593	.586	.577
26	.813	.762	.753	.742	.735	.725	.699	.671	.645	.633	.630	.627	.623	.619	.614	.612	.609	.605	.601	.596	.589	.581	.572
28	.828	.772	.763	.750	.743	.732	.711	.675	.647	.625	.622	.620	.616	.613	.609	.607	.603	.600	.594	.588	.582	.575	.566
30	.838	.782	.772	.759	.750	.738	.716	.677	.649	.623	.615	.611	.609	.605	.602	.600	.596	.591	.587	.582	.576	.569	.560
35	.862	.800	.789	.775	.765	.751	.727	.686	.654	.622	.613	.608	.602	.598	.594	.591	.587	.582	.578	.574	.568	.562	.548
40	.876	.820	.803	.788	.776	.761	.736	.693	.660	.642	.619	.607	.594	.585	.574	.569	.565	.562	.559	.555	.550	.544	.535
50	.900	.842	.822	.806	.794	.776	.752	.705	.675	.644	.633	.620	.604	.593	.582	.575	.568	.568	.557	.544	.538	.528	.517
60	.913	.856	.833	.815	.802	.783	.758	.716	.688	.654	.642	.630	.615	.600	.590	.583	.574	.567	.559	.549	.542	.533	.523
70	.923	.868	.839	.820	.806	.788	.762	.723	.696	.664	.650	.638	.624	.611	.596	.589	.582	.574	.566	.556	.547	.539	.529
80	.928	.880	.839	.821	.808	.791	.765	.728	.703	.673	.656	.645	.632	.618	.602	.596	.588	.581	.573	.562	.553	.543	.533
100	.931	.890	.840	.822	.809	.793	.767	.734	.710	.683	.669	.661	.641	.628	.613	.604	.596	.589	.580	.571	.561	.550	.541
127	.930	.900	.836	.820	.808	.789	.770	.738	.716	.693	.680	.676	.650	.638	.624	.616	.608	.598	.590	.580	.570	.560	.550
Rack	–	.839	.820	.808	.800	.780	.767	.755	.742	.728	.721	.714	.705	.696	.684	.677	.669	.661	.652	.642	.632	.620	.606

Number of Teeth on Gear being Designed

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Table 4 Zone Factor Y_z (Note: factor same for both gears in gearset)

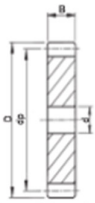
No. Teeth	Number Teeth Mating Gear																					
	Rack	127	100	80	70	60	50	40	35	30	28	26	24	22	20	19	18	17	16	15	14	13	12
12	1.47	1.35	1.34	1.32	1.30	1.28	1.26	1.25	1.25	1.24	1.23	1.22	1.21	1.20	1.19	1.18	1.16	1.14	1.12	1.10	1.07	1.04	1.01
13	1.65	1.47	1.46	1.44	1.42	1.39	1.36	1.34	1.32	1.31	1.29	1.28	1.26	1.25	1.23	1.20	1.18	1.16	1.14	1.12	1.09	1.06	1.04
14	1.75	1.61	1.59	1.55	1.53	1.49	1.45	1.42	1.40	1.38	1.37	1.36	1.34	1.32	1.29	1.28	1.25	1.23	1.21	1.18	1.15	1.09	1.07
15	1.90	1.72	1.69	1.64	1.61	1.58	1.53	1.48	1.46	1.43	1.42	1.41	1.39	1.37	1.34	1.31	1.29	1.27	1.24	1.21	1.18	1.12	1.10
16	2.08	1.84	1.80	1.75	1.72	1.67	1.62	1.55	1.53	1.49	1.48	1.46	1.45	1.42	1.39	1.36	1.33	1.30	1.28	1.24	1.21	1.14	1.12
17	2.20	1.97	1.92	1.86	1.81	1.75	1.68	1.61	1.59	1.55	1.54	1.52	1.49	1.47	1.43	1.41	1.38	1.35	1.30	1.27	1.23	1.16	1.14
18	2.30	2.06	2.01	1.94	1.89	1.83	1.75	1.66	1.63	1.60	1.58	1.56	1.53	1.50	1.46	1.44	1.41	1.38	1.33	1.29	1.25	1.18	1.16
19	2.42	2.16	2.10	2.04	1.98	1.92	1.82	1.71	1.68	1.64	1.62	1.60	1.57	1.54	1.50	1.47	1.44	1.41	1.36	1.31	1.28	1.20	1.18
20	2.55	2.26	2.20	2.12	2.07	2.00	1.89	1.75	1.72	1.68	1.66	1.63	1.60	1.56	1.53	1.50	1.46	1.43	1.39	1.34	1.29	1.23	1.19
22	2.78	2.42	2.35	2.28	2.22	2.13	2.00	1.88	1.82	1.75	1.73	1.70	1.66	1.62	1.56	1.54	1.50	1.47	1.42	1.37	1.32	1.25	1.20
24	3.00	2.59	2.50	2.42	2.34	2.25	2.13	1.98	1.90	1.83	1.79	1.75	1.71	1.66	1.60	1.57	1.53	1.49	1.45	1.39	1.34	1.26	1.21
26	3.20	2.74	2.64	2.53	2.44	2.36	2.23	2.06	1.96	1.88	1.84	1.80	1.75	1.70	1.63	1.60	1.56	1.52	1.46	1.41	1.36	1.28	1.22
28	3.45	2.89	2.79	2.66	2.56	2.46	2.33	2.15	2.04	1.94	1.90	1.84	1.79	1.73	1.66	1.62	1.58	1.54	1.48	1.42	1.37	1.29	1.23
30	3.70	3.03	2.90	2.76	2.67	2.54	2.40	2.30	2.11	1.98	1.94	1.88	1.83	1.75	1.68	1.64	1.60	1.55	1.49	1.43	1.38	1.31	1.24
35	4.30	3.44	3.35	3.00	2.89	2.77	2.60	2.40	2.27	2.11	2.04	1.96	1.90	1.82	1.72	1.68	1.63	1.59	1.53	1.46	1.40	1.32	1.25
40	4.65	3.64	3.50	3.27	3.11	2.93	2.76	2.53	2.40	2.30	2.15	2.06	1.98	1.88	1.75	1.71	1.66	1.61	1.55	1.48	1.42	1.34	1.25
50	5.50	4.07	3.84	3.65	3.50	3.28	3.00	2.76	2.60	2.40	2.33	2.23	2.13	2.00	1.89	1.82	1.75	1.68	1.62	1.53	1.45	1.35	1.26
60	6.50	4.51	4.21	3.89	3.75	3.57	3.28	2.93	2.77	2.54	2.46	2.36	2.25	2.13	2.00	1.92	1.83	1.75	1.67	1.58	1.49	1.39	1.28
70	7.50	4.99	4.67	4.25	3.97	3.75	3.50	3.11	2.89	2.67	2.56	2.44	2.34	2.22	2.07	1.98	1.89	1.81	1.72	1.61	1.53	1.42	1.30
80	8.40	5.31	5.00	4.57	4.25	3.89	3.65	3.27	3.00	2.76	2.66	2.53	2.42	2.28	2.12	2.04	1.94	1.86	1.75	1.64	1.55	1.44	1.32
100	9.70	5.92	5.51	5.00	4.67	4.21	3.84	3.50	3.25	2.90	2.79	2.64	2.50	2.35	2.20	2.10	2.01	1.92	1.80	1.69	1.59	1.46	1.34
127	–	6.89	5.92	5.31	4.99	4.51	4.07	3.64	3.44	3.03	2.89	2.74	2.59	2.42	2.26	2.16	2.06	1.97	1.84	1.72	1.61	1.47	1.35
Rack	–	–	9.70	8.40	7.50	6.50	5.50	4.65	4.30	3.70	3.45	3.20	3.00	2.78	2.55	2.42	2.30	2.20	2.08	1.90	1.75	1.65	1.47

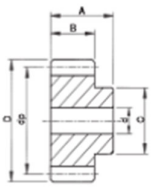
Dimensions tables for Spur Gears 1.0 and 1.5 Mod.

All gears machined from medium carbon, induction hardening steels.

Gear Widths

Pitch	A	B
1 Mod	25	15
1.5 Mod	30	17





1.0 Mod Spur Gears

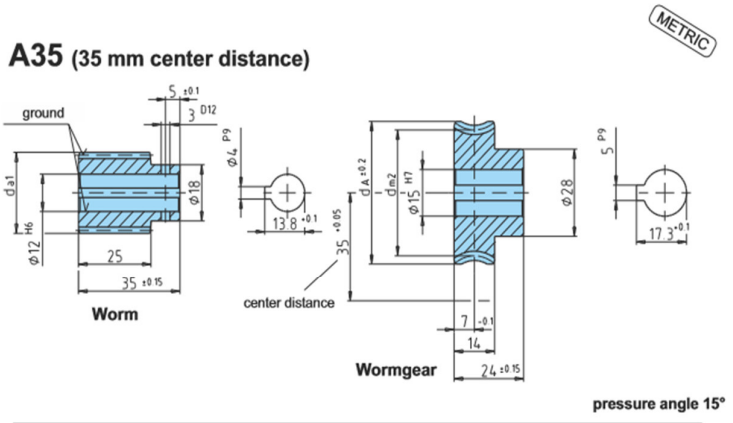
Suffix of Cat. No. indicates gear type

Gear Type 'A' *Gear Type 'B'*

Cat. No.	No. Teeth	Pitch Dia. dp	Min Bore d	Max. Bore	Hub ∅ C	Outside Dia. D	Weight kg
S10128	12	12	–	6	9	14	.012
S10138	13	13	–	7	10	15	.016
S10148	14	14	–	7	10	16	.020
S10158	15	15	–	8	12	17	.025
S10168	16	16	–	8	13	18	.030
S10179	17	17	8	9	14	19	.033
S10188	18	18	8	10	15	20	.038
S10198	19	19	8	10	15	21	.045
S10208	20	20	8	11	16	22	.055
S10218	21	21	8	11	16	23	.058
S10228	22	22	8	12	18	24	.060
S10238	23	23	8	12	18	25	.065
S10248	24	24	8	13	20	26	.070
S10258	25	25	8	13	20	27	.075
S10268	26	26	8	13	20	28	.085
S10278	27	27	8	13	20	29	.090
S10288	28	28	8	13	20	30	.096
S10298	29	29	8	13	20	31	.100
S10308	30	30	8	13	20	32	.105
S10318	31	31	10	16	25	33	.110
S10328	32	32	10	16	25	34	.120
S10338	33	33	10	16	25	35	.130
S10348	34	34	10	16	25	36	.135
S10358	35	35	10	16	25	37	.140
S10368	36	36	10	16	25	38	.150
S10378	37	37	10	16	25	39	.155
S10388	38	38	10	16	25	40	.160
S10398	39	39	10	16	25	41	.170
S10408	40	40	10	16	25	42	.180
S10418	41	41	10	20	30	43	.190
S10428	42	42	10	20	30	44	.200
S10438	43	43	10	20	30	45	.210
S10448	44	44	10	20	30	46	.220
S10458	45	45	10	20	30	47	.230
S10468	46	46	10	20	30	48	.240
S10478	47	47	10	20	30	49	.250

Cat. No.	No. Teeth	Pitch Dia. dp	Min Bore d	Max. Bore	Hub ∅ C	Outside Dia. D	Weight kg
S10488	48	48	10	20	30	50	.026
S10498	49	49	10	20	30	51	.027
S10508	50	50	12	20	30	52	.028
S10518	51	51	12	27	40	53	.031
S10528	52	52	12	27	40	54	.032
S10538	53	53	12	27	40	55	.034
S10548	54	54	12	27	40	56	.035
S10558	55	55	12	27	40	57	.036
S10568	56	56	12	27	40	58	.037
S10578	57	57	12	27	40	59	.038
S10588	58	58	12	27	40	60	.039
S10598	59	59	12	27	40	61	.040
S10608	60	60	12	27	40	62	.041
S10618	61	61	12	34	50	63	.047
S10628	62	62	12	34	50	64	.048
S10638	63	63	12	34	50	65	.049
S10648	64	64	12	34	50	66	.050
S10658	65	65	12	34	50	67	.051
S10668	66	66	12	34	50	68	.052
S10678	67	67	12	34	50	69	.053
S10688	68	68	12	34	50	70	.054
S10698	69	69	12	34	50	71	.055
S10708	70	70	12	34	50	72	.056
S1072A	72	72	12	45	–	74	.063
S1075A	75	75	12	46	–	77	.066
S1076A	76	76	12	46	–	78	.052
S1080A	80	80	12	50	–	82	.055
S1085A	85	85	12	54	–	87	.059
S1090A	90	90	12	57	–	92	.070
S1095A	95	95	12	60	–	97	.080
S10100A	100	100	12	63	–	102	.090
S10110A	110	110	12	68	–	113	1.12
S10114A	114	114	12	70	–	116	1.20
S10120A	120	120	12	74	–	122	1.25
S10127A	127	127	12	80	–	129	1.49

5. Worm Gear Selection



i = gear ratio
□ = lead angle
m = module
z_1 = number of threads
d_{m1} = pitch diameter (worm)
d_{a1} = tip diameter (worm)
z_2 = No. of teeth
d_{m2} = pitch diameter (worm gear)
d_A = max. diameter (worm gear)
T_2 = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

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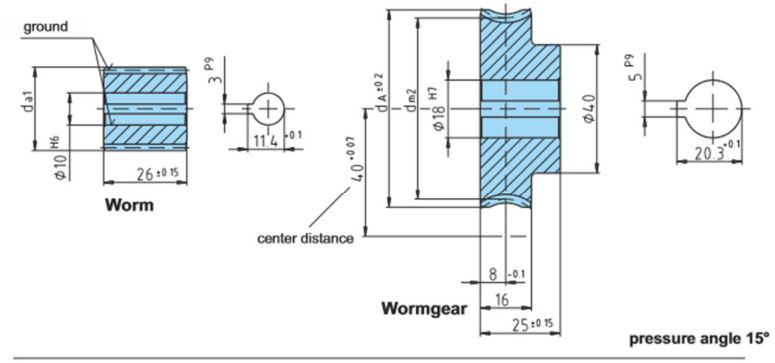
Catalog				worm			wormgear			T_2 [Nm] Bronze		No.
	i	γ_m	m	z_1	d_{m1}	d_{a1}	z_2	d_{m2}	d_A	MG	MO	SO
A35U3*	2.78:1	31°01'	1.5	9	26.2	29.2	25	43.8	46.76	6.6	8.2	10.2
A35U5	5:1	22°52'	1.75	5	22.52	26.02	25	47.48	53	15.3	18.4	22.9
A35U7	7.25:1	13°47'	1.5	4	25.18	28.18	29	44.82	50	14.7	17.6	22
A35U8	8:1	14°25'	1.9	3	22.89	26.69	24	47.11	53	16.7	20	25
A35U10	10:1	10°43'	1.5	3	24.2	27.2	30	45.8	51	16	19.2	24
A35U11	11:1	10°32'	1.4	3	22.98	25.78	33	47.02	52	16.7	20	25
A35U12	12:1	9°11'	1.9	2	23.8	27.6	24	46.2	52	16.1	19.3	24
A35U15	15:1	7°	1.5	2	24.62	27.62	30	45.38	50	15.3	18.4	22.9
A35U20	20:1	5°33'	1.15	2	23.78	26.08	40	46.22	50.5	14.8	17.8	22.2
A35U25	25:1	4°9'	0.9	2	24.87	26.67	50	45.13	49	12.9	15.5	19.3
A35U30	30:1	3°27'	1.5	1	24.92	27.92	30	45.08	50	15	18	22.5
A35U35	35:1	3°51'	1.4	1	20.85	23.65	35	49.15	53	17.1	20.5	25.6
A35U40	40:1	2°45'	1.15	1	23.91	26.21	40	46.09	50.5	14.7	17.6	22
A35U50	50:1	2°4'	0.9	1	24.93	26.73	50	45.07	49	12.9	15.5	19.3
A35U58	58:1	2°21'	0.85	1	20.65	22.35	58	49.35	53	14.5	17.4	21.7
A35U90	90:1	1°9'	0.5	1	25	26	90	45	49	9.1	10.9	13.6

METRIC

A40 (40 mm center distance)



i = gear ratio
γ_m = lead angle
m = module
z_1 = number of threads
d_{m1} = pitch diameter (worm)
d_{a1} = tip diameter (worm)
z_2 = No. of teeth
d_{m2} = pitch diameter (worm gear)
d_A = max. diameter (worm gear)
T_2 = output torque
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

Catalog				worm			wormgear			T_2 [Nm] Bronze		No.
	i	γ_m	m	z_1	d_{m1}	d_{a1}	z_2	d_{m2}	d_A	MG	MO	SO
A40U7	6.75:1	21°19'	2	4	22	26	27	58	64	29.5	35.4	44.2
A40U8	8:1	16°35'	2.25	3	23.64	28.14	24	56.36	62.5	27.5	33	41.2
A40U10	10:1	16°1'	1.9	3	20.66	24.46	30	59.34	65	29.5	35.4	44.2
A40U12	12:1	10°21'	1.5	3	25.05	28.05	36	54.95	60	25.2	30.2	37.8
A40U15	15:1	9°53'	1.9	2	22.14	25.94	30	57.86	64	28	33.6	42
A40U20	20:1	8°59'	1.5	2	19.2	22.2	40	60.8	66	28.9	34.6	43.3
A40U25	25:1	5°58'	1.15	2	22.15	24.45	50	57.85	62	24.4	29.2	36.6
A40U28	28:1	4°47'	2	1	24	28	28	56	61.5	28.4	34	42.6
A40U30	30:1	5°50'	2	1	19.68	23.68	30	60.32	66	30.1	36.1	45.1
A40U35	35:1	5°26'	1.75	1	18.48	21.98	35	61.52	67	31	37.2	46.5
A40U36	36:1	3°19	1.5	1	25.91	28.91	36	54.09	59	23.9	28.6	35.8
A40U40	40:1	4°20'	1.5	1	19.83	22.83	40	60.17	65	28.3	33.9	42.4
A40U50	50:1	4°8'	1.25	1	17.3	19.8	50	62.7	68	27	32.4	40.5
A40U56	56:1	2°23'	1	1	24	26	56	56	59	21.9	26.2	32.8
A40U60	60:1	1°59'	0.9	1	25.92	27.72	60	54.08	57.5	19.3	23.1	28.9
A40U70	70:1	3°3'	0.9	1	16.91	18.71	70	63.09	67	24.1	28.9	36.1
A40U75	75:1	1°48'	0.75	1	23.75	25.25	75	56.26	60	18.8	22.5	28.2
A40U80	80:1	2°10'	0.75	1	19.9	21.4	80	60.1	64	20.1	24.1	30.1
A40U90	90:1	2°22'	0.7	1	16.95	18.35	90	63.05	67	19.1	22.9	28.6

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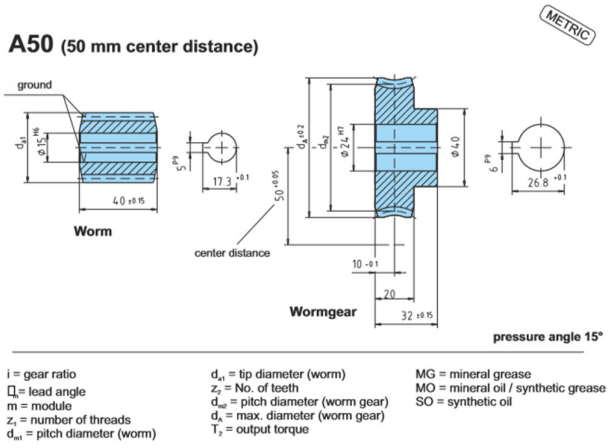

Catalog				worm			wormgear			T_2[Nm] Bronze		No.
	i	γ	m	z_1	d_{m1}	d_{a1}	z_2	d_{m2}	d_A	MG	MO	SO
A50U4	4.25:1	25°51'	3.5	4	32.1	39.1	17	67.9	77	34	40.8	51
A50U6	6:1	19°17'	3.5	3	31.8	38.8	18	68.2	77	52	62.4	78
A50U9	8.66:1	13°52'	2.5	3	31.29	36.29	26	68.71	77	64.3	77.1	96.4
A50U12	12:1	10°23'	2.75	2	30.5	36	24	69.5	77	66.4	79.6	99.6
A50U14	13.5:1	9°38'	2.5	2	29.9	34.9	27	70.1	77	62.8	75.4	94.2
A50U19	19:1	6°17'	3.5	1	32	39	19	68	77	78.2	93.8	117.3
A50U23	23:1	5°38'	3	1	30.58	36.58	23	69.42	77	71.1	85.3	106.6
A50U27	27:1	4°40'	2.5	1	30.73	35.73	27	69.27	77	64.5	77.4	96.7
A50U35	35:1	3°51'	2	1	29.78	33.78	35	70.22	77	56.7	68	85
A50U46	46:1	2°47'	1.5	1	30.85	33.85	46	69.15	74	50.6	60.7	75.9
A50U55	55:1	2°19'	1.25	1	30.9	33.4	55	69.1	74	46.2	55.4	69.3
A50U69	69:1	1°51'	1	1	30.9	32.9	69	69.1	74	41.4	49.6	62.8

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.

Conclusion

The mechanism which we have discussed above will be fabricated according to the load to be lifted and standard sizes of the gears will be selected from the above table.

References

1. Gallina, P., Vibration in Screw Jack Mechanisms: Experimental Results, Journal of Sound and Vibration, Vol. 282, Issues 3-5, pp. 1025–1041, 2005.
2. De Bona, F., Jacazio, G., Simulation of Mechanical Drives with Generalized Power Losses, Mathematical and Computer Modelling, Vol. 11, pp. 1178–1182, 1988.
3. Oledzki, A.A., Modelling and Simulation of Self-Locking Drives, Mechanism and Machine Theory, Vol. 30, Issue 6, pp. 929–942, 1995.
4. Nippon Gear, Co. Ltd., Catalog of Japanese Industrial Gear: Screw Jack, Tokyo, pp. 1–32, 2001.
5. Omori, S., Design of Intelligent Machines, 12th end., Fukuoka Institute of Technology, Fukuoka, pp. 1–121, 2009 (in Japanese).
6. Johnson, R.C., Optimum Design of Mechanical Elements, John Wiley and Sons, New York, pp. 1–301, 1961.
7. Polak, E., Computational Methods in Optimization: A Unified Approach, Academic Press, New York, pp. 1–329, 1971.
8. Wilde, D.J., Global Optimum Design, John Wiley and Sons, New York, pp.5–67, 1978.
9. Angeles, J., Zakhariev, E., Computational Methods in Mechanical Systems: Mechanism Analysis, Synthesis, and Optimization, Springer, pp. 1–425, 1998.
10. Japanese Industrial Standard Collection, Technical and Industrial Book Co., Tokyo, 2005 (in Japanese).
11. Rothberg, H.A., Mechanical Design and Systems Handbook, 2nd end., McGraw-Hill Book Co., New York, pp. 7–173, 1985.
12. Juvinall, R.C., Marshek, K.M., Fundamentals of Machine Component Design, 4th end., John Willey and Sons, New York, pp. 1–769, 2006.

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