ME တက်တဲ့ကျောင်းသားတွေဟာ Textbook/ Problem Solution စတာတွေကိုဆရာအကူအညီမပါဘဲမိမိ

ဘာသာဖတ်ပြီးနားလည်တာကိုအကျယ်တဝင့်ရေးသားဖေါ်ပြနိုင်လိုရင်းကိုအတိုချုပ်ရေးသားပြီး အဓိက အချက်တွေ၊ဖေါ်မြူလာတွေ၊လက်တွေ့ အသုံးချချက်တွေကိုကောက်နှုတ်နိုင်စွမ်းရှိရမယ်။

အဲဒီစွမ်းရည်ရအောင်လေ့ကျင့်နည်းတွေကိုအခုထဲ့သွင်းထားတဲ့လင့်တွေမှာပြထားတယ်။

Handbook of Engineering Calculations ဟာတကယ်လက်တွေ့ အင်ဂျင်နီယာဒီဇိုင်းပုစ္ဆာတွေ

ကိုဘယ်လိုဖြေရှင်းတွက်ချက်ရမယ်ဆိုတာနည်းလမ်းပေါင်းစုံပြထားတယ်။

အဲဒါကိုဘယ်လိုအကျယ်တဝင့်ရှင်းလင်းမယ်၊လိုအပ်တဲ့ Data တွေ၊ဇယားတွေ၊ဝေါဟာရတွေကို

အင်တာနက်ကဘယ်လိုရှာရမယ်ဆိုတာ Mechanical/ Civil/ Electricalနမူနာ၃ခုပြထားတယ်။

www.iqytechnicalcollege.com/MEquality.pdf

IQY ရဲ့ Master Diploma Course မှာစာမေးပွဲမထားဘဲကျောင်းသားတွေအဲဒီလိုအဖြေရှာ၊နားလည်

ချက်ကိုတင်ပြချက်တွေကိုသုံးသပ်အကဲဖြတ်တဲ့နည်းကိုသုံးပါတယ်။

အဲဒါဟာနက်နက်နဲနဲစဉ်းစားတွေးခေါ်ခြင်းအလေ့အကျင့်ကိုအင်ဂျင်နီယာပညာရေးမှာသုံးထားတဲ့အလေ့အ

ကျင့်ပြုနည်းနမူနာတစ်ခုဖြစ်ပါတယ်။

Critical Thinking Video

https://youtu.be/Cekuc04E2xM

The students who are attending Master of Engineering degree program need to possess the skills that they can read and understand the textbooks and problem solutions without assistance provided by teacher and write what understood, express the main points, highlight the key formulae and indicate the way to be utilize in the practice.

Handbook of Engineering Calculations contains the summarized advice on how to solve many practical design problems.

The students need to perform the expanded calculations based on the suggested guideline solution advice by collecting the required data, facts, tables extracts etc from internet.

The examples on how to perform such task is provided in three worked examples in mechanical, civil and electrical engineering.

Master Diploma course of IQY Technical College does not have the examination instead the evaluation and assessment on how the students find the solution and their understanding

It is one of the examples on applications of critical thinking exercises in engineering education.

BAE 701 Engineering Fundamental

Civil

www.mongroupsydney1.com/1.pdf

select one specialisation

Section 1-Civil Engineering (PDFFile Page 7)
Section 6- Water & Waste Water Engineering (PDF File Page 1041)
Section 7-Environmental Engineering (PDF File Page 1078) 2

For every topic, you need to write the short note on what you understand, formula, summary, outlines and at least 2 problems solution (Please note, each problem is solved in short form, you need to clearly reproduce them by step by step)

Section 1-Civil Engineering (PDFFile Page 7)

STRUCTURAL STEEL DESIGN

Steel Beams and Plate Girders

Notes

The notational system used conforms with that given, and it is augmented to include the following:

Aw = area of flange, in2 (cm2);

Aw = area of web, in2 (cm2);

bf = width of flange, in (mm);

d =depth of section, in (mm);

dw = depth of web, in (mm);

tf = thickness of flange, in (mm);

tw = thicknessof web, in (mm);

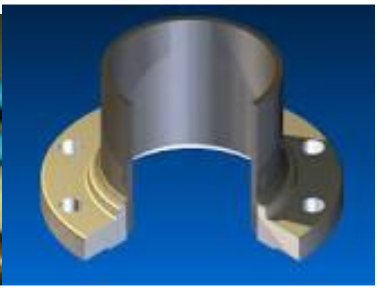
L′ = unbraced length of compression flange, in (mm);

fy = yield-point stress,

lb/in2 (kPa).

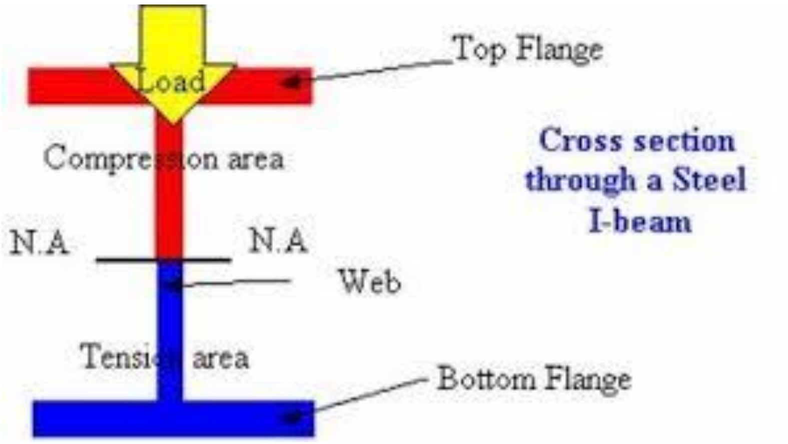
Flange?----- Internet search

A flange is an external or internal ridge, or rim, for strength, as the flange of an iron beam such as an I-beam or a T-beam; or for attachment to another object, as the flange on the end of a pipe



Web? Internet search

Images for area of web i beam



It is an example of every new technical term is described and appropriate internet research is performed so that you can understand the exact meaning.

Problem

A beam on a simple span of 30 ft (9.2 m) carries a uniform superimposed load of 1650 lb/lin ft(24,079.9 N/m). The compression flange is laterally supported along its entire length. Select the most economic section.

Calculation Procedure in the book

***1. Compute the maximum bending moment and the required section modulus*.** Assume that the beam weighs 50 lb/lin ft (729.7 N/m) and satisfies the requirements of a compact section as set forth in the *Specification*.

The maximum bending moment is $M = (1/8)wL2 = (1/8)(1700)(30)2(12) = 2,295,000$ in·lb

(259,289.1 N·m).

Referring to the *Specification* shows that the allowable bending stress is 24,000 lb/in2 (165,480.0 kPa). Then *S* = *M*/*f* = 2,295,000/24,000 = 95.6 in3 (1566.88 cm3).

***2. Select the most economic section*.** Refer to the AISC *Manual*, and select the most economic section. Use W18 × 55 = 98.2 in3 (1609.50 cm3); section compact. The disparity between the assumed and actual beam weight is negligible.

A second method for making this selection is shown below.

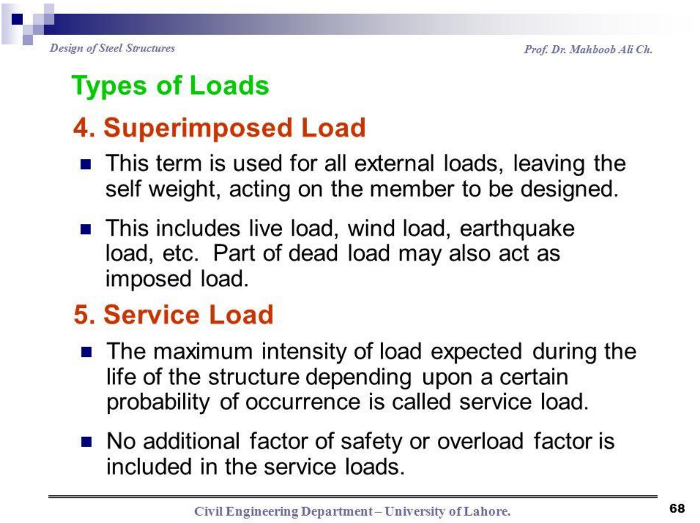
***3. Calculate the total load on the member*.** Thus, the total load = *W* = 30(1700) = 51,000 lb

(226,848.0 N).

***4. Select the most economic section*.** Refer to the tables of allowable uniform loads in the *Manual*, and select the most economic section. Thus, use W18 × 55; *W*allow = 52,000 lb (231,296.0 N). The capacity of the beam is therefore slightly greater than required.

Detailed explanation to be done (Worked Example)

Superimposed load-/ Maximum bending moment/ Section modulus -- Internet search



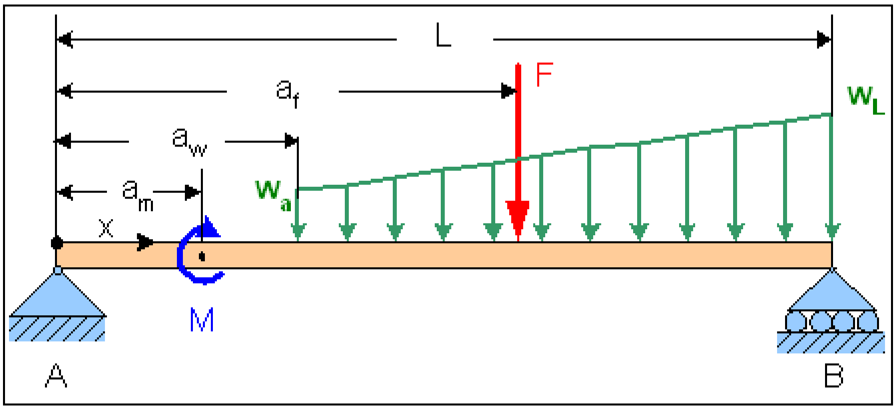
Types of Loads

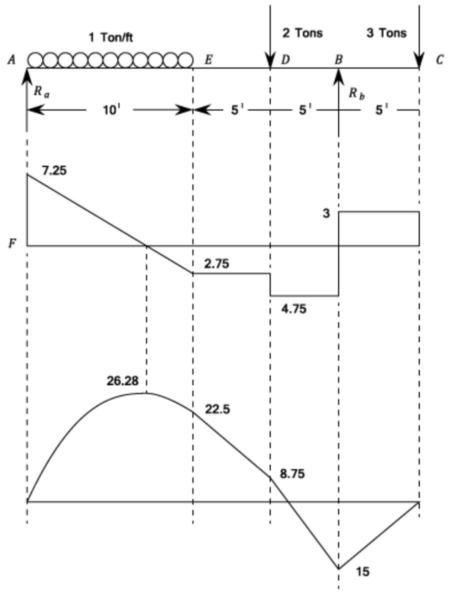
4. Superimposed Load

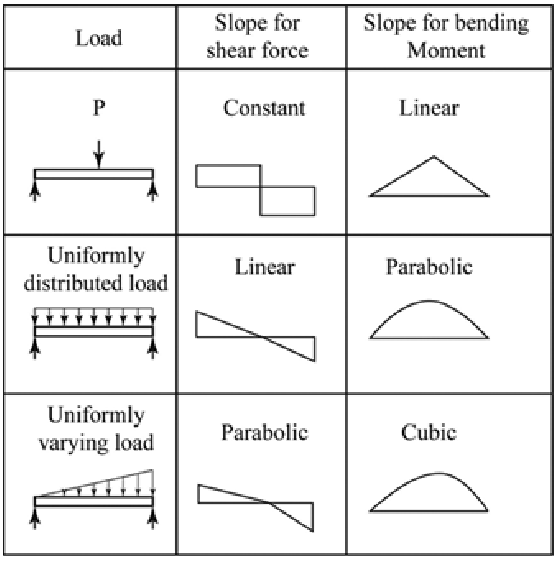
- This term is used for all external loads, leaving the self weight, acting on the member to be designed.
- This includes live load, wind load, earthquake load, etc. Part of dead load may also act as imposed load.

5. Service Load

- The maximum intensity of load expected during the life of the structure depending upon a certain probability of occurrence is called service load.
- No additional factor of safety or overload factor is included in the service loads.


L
a_f
F
w_L
a_w
w_a
a_m
x
M
A
B





Load	Slope for shear force	Slope for bending Moment
P	Constant	Linear
Uniformly distributed load	Linear	Parabolic
Uniformly varying load	Parabolic	Cubic

Figure-1 Slopes for various types of loads

Section modulus is a geometric property for a given cross-**section** used in the design of beams or flexural members. Other geometric properties used in design include area for tension and shear, radius of gyration for compression, and moment of inertia and polar moment of inertia for stiffness.

Calculating the section modulus

To calculate the section modulus, the following formula applies:

$Z = \frac{I}{y}$ where I = moment of inertia, y = distance from centroid to top or bottom edge of the rectangle $\left(\frac{d}{2}\right)$

For symmetrical sections the value of **Z** is the same above or below the centroid.

For asymmetrical sections, two values are found: **Z** max and **Z** min.

To calculate the value of **Z** for a simple symmetrical shape such as a rectangle:

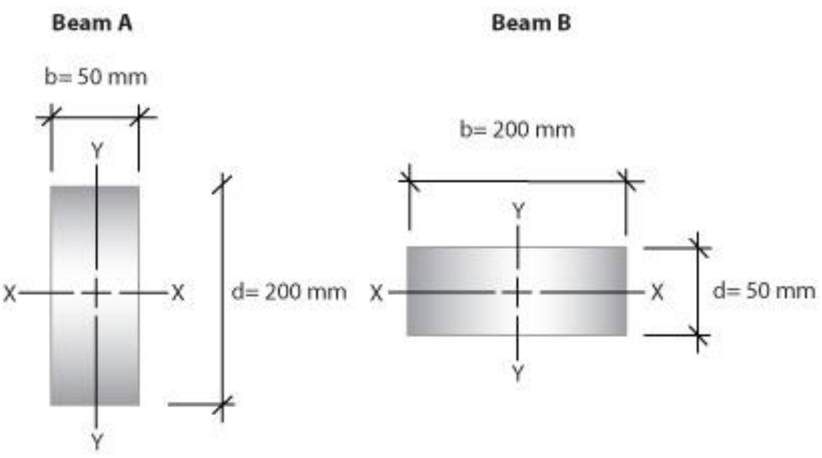
$Z_{xx} = \frac{Ixx}{y}$ where $I_{xx} = \frac{bd^3}{12}\ mm^4$

and y = $\frac{1}{2}$ depth or $\frac{d}{2}$ mm

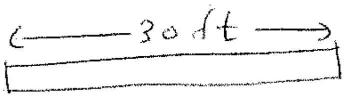
This gives the formula for **Z** as: $Z = \frac{bd^2}{6}\ mm^3$

Note: The standard form of writing the value of **Z** is to write it as a number x 10^3 mm^3, eg a value of 2,086 is written as 2.086 x 10^3.

Calculating Z



WORKED EXAMPLE FOR GIVEN PROBLEM AND SHORT SOLUTION PROCESS



Superimposed Load = 1650 lb / Lin ft

Take 1700

maximum bending moment = $m = \frac{wl^2}{8}$ ft-lb

$m = \frac{wl^2}{8} \times 12$ in-lb

$\therefore m = \frac{1700 \times 30^2 \times 12}{8} = 2295000$ in lb

1 in lb = 0.113 N-m (Internet search)

$\therefore$ 2295000 in lb $\Rightarrow$ 2295000 × 0.113

= 259289 N-m

Allowable bending stress (as per American Steel standard Specification) is 24000 lb / in²

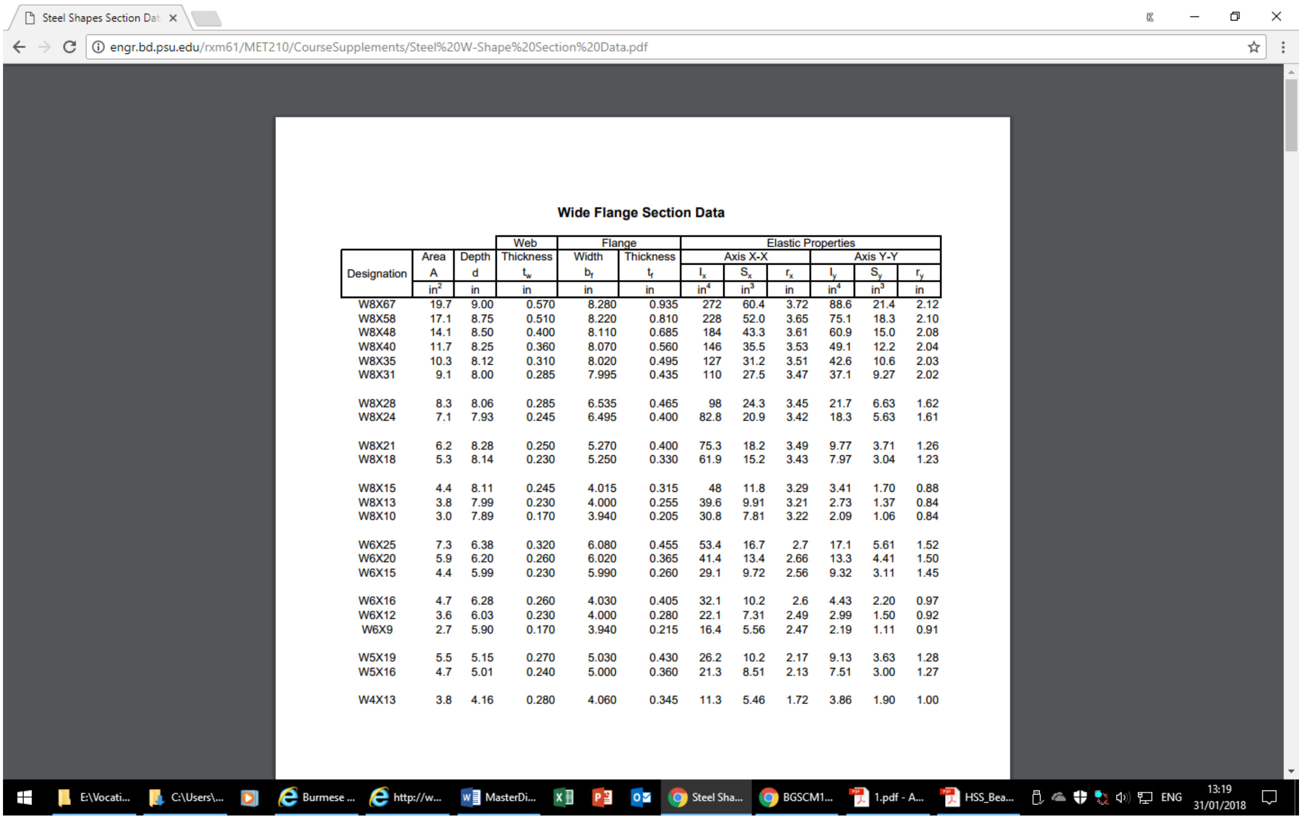
Index (S) = $\frac{\text{Bending moment}}{\text{maximum Bending Stress}}$

$S = \frac{m}{f} = \frac{2295000}{24000} = 95.6 \text{ in}^3$

(or) (1566.88 cm³)

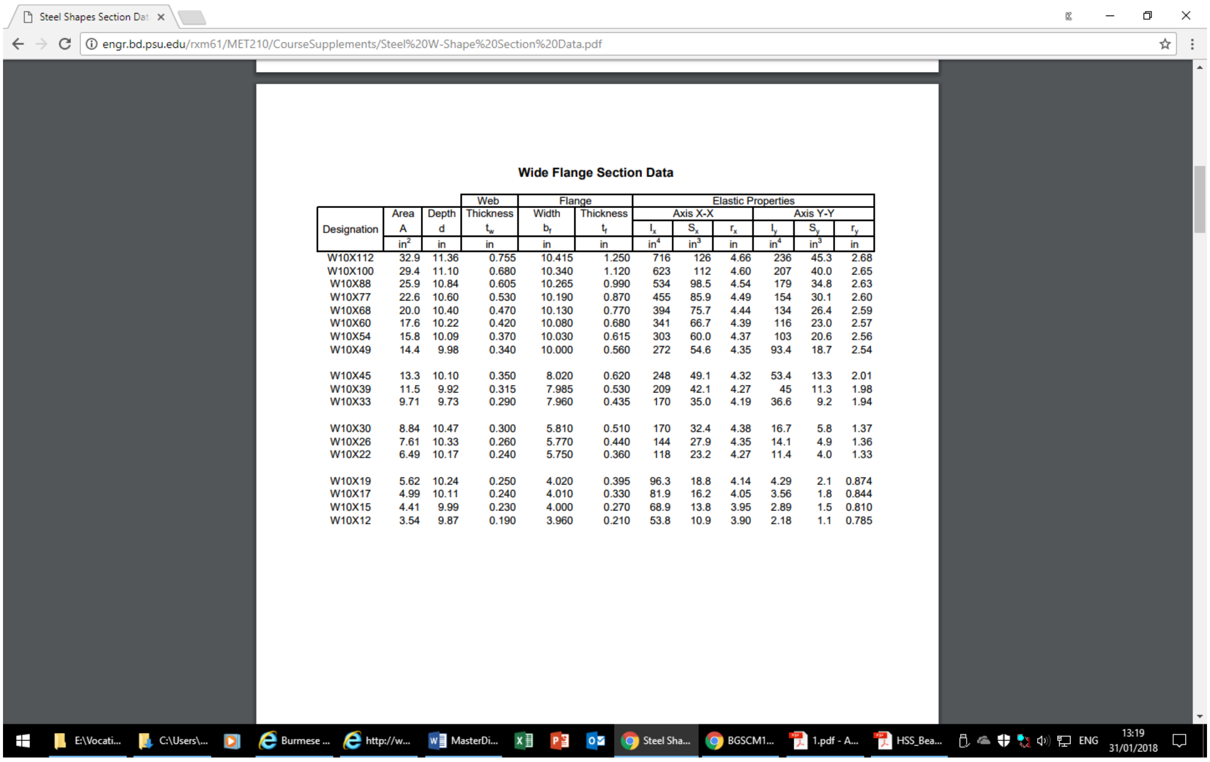
Steel shape section data

http://engr.bd.psu.edu/rxm61/MET210/CourseSupplements/Steel%20W-Shape%20Section%20Data.pdf



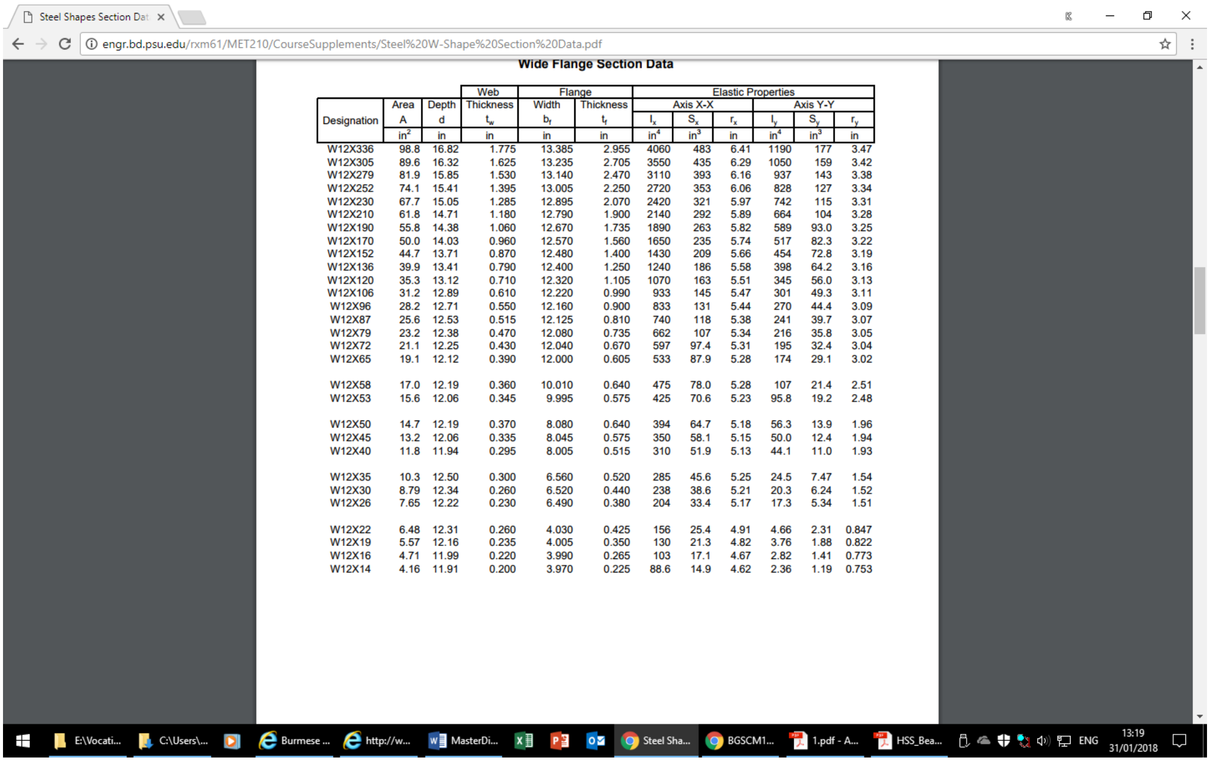
Wide Flange Section Data

			Web	Flange		Elastic Properties					
Designation	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W8X67	19.7	9.00	0.570	8.280	0.935	272	60.4	3.72	88.6	21.4	2.12
W8X58	17.1	8.75	0.510	8.220	0.810	228	52.0	3.65	75.1	18.3	2.10
W8X48	14.1	8.50	0.400	8.110	0.685	184	43.3	3.61	60.9	15.0	2.08
W8X40	11.7	8.25	0.360	8.070	0.560	146	35.5	3.53	49.1	12.2	2.04
W8X35	10.3	8.12	0.310	8.020	0.495	127	31.2	3.51	42.6	10.6	2.03
W8X31	9.1	8.00	0.285	7.995	0.435	110	27.5	3.47	37.1	9.27	2.02
W8X28	8.3	8.06	0.285	6.535	0.465	98	24.3	3.45	21.7	6.63	1.62
W8X24	7.1	7.93	0.245	6.495	0.400	82.8	20.9	3.42	18.3	5.63	1.61
W8X21	6.2	8.28	0.250	5.270	0.400	75.3	18.2	3.49	9.77	3.71	1.26
W8X18	5.3	8.14	0.230	5.250	0.330	61.9	15.2	3.43	7.97	3.04	1.23
W8X15	4.4	8.11	0.245	4.015	0.315	48	11.8	3.29	3.41	1.70	0.88
W8X13	3.8	7.99	0.230	4.000	0.255	39.6	9.91	3.21	2.73	1.37	0.84
W8X10	3.0	7.89	0.170	3.940	0.205	30.8	7.81	3.22	2.09	1.06	0.84
W6X25	7.3	6.38	0.320	6.080	0.455	53.4	16.7	2.7	17.1	5.61	1.52
W6X20	5.9	6.20	0.260	6.020	0.365	41.4	13.4	2.66	13.3	4.41	1.50
W6X15	4.4	5.99	0.230	5.990	0.260	29.1	9.72	2.56	9.32	3.11	1.45
W6X16	4.7	6.28	0.260	4.030	0.405	32.1	10.2	2.6	4.43	2.20	0.97
W6X12	3.6	6.03	0.230	4.000	0.280	22.1	7.31	2.49	2.99	1.50	0.92
W6X9	2.7	5.90	0.170	3.940	0.215	16.4	5.56	2.47	2.19	1.11	0.91
W5X19	5.5	5.15	0.270	5.030	0.430	26.2	10.2	2.17	9.13	3.63	1.28
W5X16	4.7	5.01	0.240	5.000	0.360	21.3	8.51	2.13	7.51	3.00	1.27
W4X13	3.8	4.16	0.280	4.060	0.345	11.3	5.46	1.72	3.86	1.90	1.00



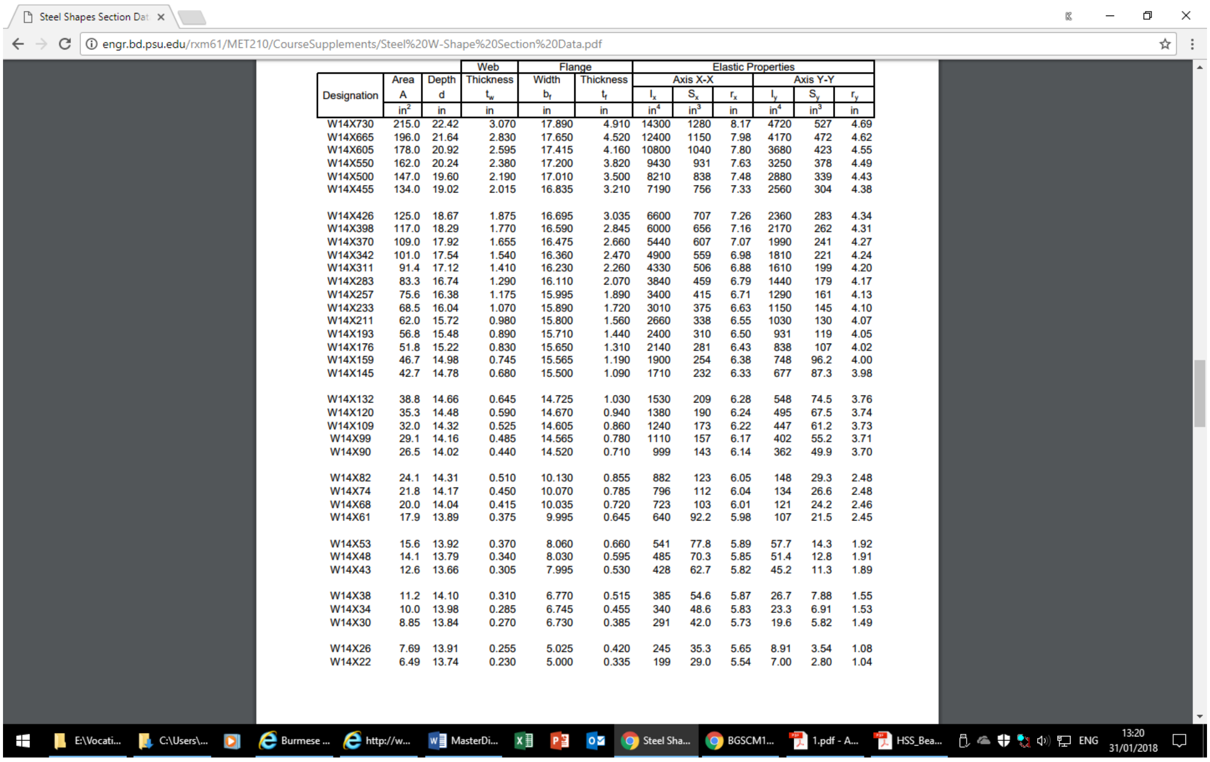
Wide Flange Section Data

			Web	Flange		Elastic Properties					
Designation	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W10X112	32.9	11.36	0.755	10.415	1.250	716	126	4.66	236	45.3	2.68
W10X100	29.4	11.10	0.680	10.340	1.120	623	112	4.60	207	40.0	2.65
W10X88	25.9	10.84	0.605	10.265	0.990	534	98.5	4.54	179	34.8	2.63
W10X77	22.6	10.60	0.530	10.190	0.870	455	85.9	4.49	154	30.1	2.60
W10X68	20.0	10.40	0.470	10.130	0.770	394	75.7	4.44	134	26.4	2.59
W10X60	17.6	10.22	0.420	10.080	0.680	341	66.7	4.39	116	23.0	2.57
W10X54	15.8	10.09	0.370	10.030	0.615	303	60.0	4.37	103	20.6	2.56
W10X49	14.4	9.98	0.340	10.000	0.560	272	54.6	4.35	93.4	18.7	2.54
W10X45	13.3	10.10	0.350	8.020	0.620	248	49.1	4.32	53.4	13.3	2.01
W10X39	11.5	9.92	0.315	7.985	0.530	209	42.1	4.27	45	11.3	1.98
W10X33	9.71	9.73	0.290	7.960	0.435	170	35.0	4.19	36.6	9.2	1.94
W10X30	8.84	10.47	0.300	5.810	0.510	170	32.4	4.38	16.7	5.8	1.37
W10X26	7.61	10.33	0.260	5.770	0.440	144	27.9	4.35	14.1	4.9	1.36
W10X22	6.49	10.17	0.240	5.750	0.360	118	23.2	4.27	11.4	4.0	1.33
W10X19	5.62	10.24	0.250	4.020	0.395	96.3	18.8	4.14	4.29	2.1	0.874
W10X17	4.99	10.11	0.240	4.010	0.330	81.9	16.2	4.05	3.56	1.8	0.844
W10X15	4.41	9.99	0.230	4.000	0.270	68.9	13.8	3.95	2.89	1.5	0.810
W10X12	3.54	9.87	0.190	3.960	0.210	53.8	10.9	3.90	2.18	1.1	0.785

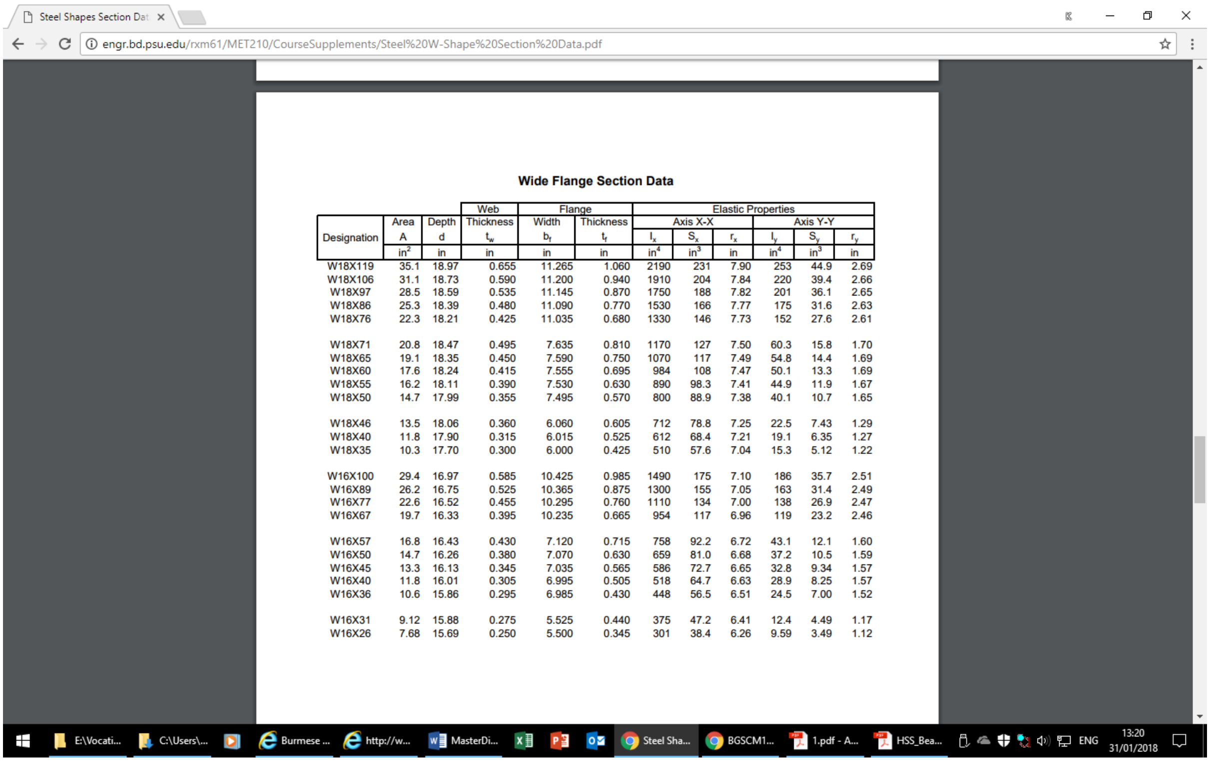


Wide Flange Section Data

			Web	Flange		Elastic Properties					
	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
Designation	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W12X336	98.8	16.82	1.775	13.385	2.955	4060	483	6.41	1190	177	3.47
W12X305	89.6	16.32	1.625	13.235	2.705	3550	435	6.29	1050	159	3.42
W12X279	81.9	15.85	1.530	13.140	2.470	3110	393	6.16	937	143	3.38
W12X252	74.1	15.41	1.395	13.005	2.250	2720	353	6.06	828	127	3.34
W12X230	67.7	15.05	1.285	12.895	2.070	2420	321	5.97	742	115	3.31
W12X210	61.8	14.71	1.180	12.790	1.900	2140	292	5.89	664	104	3.28
W12X190	55.8	14.38	1.060	12.670	1.735	1890	263	5.82	589	93.0	3.25
W12X170	50.0	14.03	0.960	12.570	1.560	1650	235	5.74	517	82.3	3.22
W12X152	44.7	13.71	0.870	12.480	1.400	1430	209	5.66	454	72.8	3.19
W12X136	39.9	13.41	0.790	12.400	1.250	1240	186	5.58	398	64.2	3.16
W12X120	35.3	13.12	0.710	12.320	1.105	1070	163	5.51	345	56.0	3.13
W12X106	31.2	12.89	0.610	12.220	0.990	933	145	5.47	301	49.3	3.11
W12X96	28.2	12.71	0.550	12.160	0.900	833	131	5.44	270	44.4	3.09
W12X87	25.6	12.53	0.515	12.125	0.810	740	118	5.38	241	39.7	3.07
W12X79	23.2	12.38	0.470	12.080	0.735	662	107	5.34	216	35.8	3.05
W12X72	21.1	12.25	0.430	12.040	0.670	597	97.4	5.31	195	32.4	3.04
W12X65	19.1	12.12	0.390	12.000	0.605	533	87.9	5.28	174	29.1	3.02
W12X58	17.0	12.19	0.360	10.010	0.640	475	78.0	5.28	107	21.4	2.51
W12X53	15.6	12.06	0.345	9.995	0.575	425	70.6	5.23	95.8	19.2	2.48
W12X50	14.7	12.19	0.370	8.080	0.640	394	64.7	5.18	56.3	13.9	1.96
W12X45	13.2	12.06	0.335	8.045	0.575	350	58.1	5.15	50.0	12.4	1.94
W12X40	11.8	11.94	0.295	8.005	0.515	310	51.9	5.13	44.1	11.0	1.93
W12X35	10.3	12.50	0.300	6.560	0.520	285	45.6	5.25	24.5	7.47	1.54
W12X30	8.79	12.34	0.260	6.520	0.440	238	38.6	5.21	20.3	6.24	1.52
W12X26	7.65	12.22	0.230	6.490	0.380	204	33.4	5.17	17.3	5.34	1.51
W12X22	6.48	12.31	0.260	4.030	0.425	156	25.4	4.91	4.66	2.31	0.847
W12X19	5.57	12.16	0.235	4.005	0.350	130	21.3	4.82	3.76	1.88	0.822
W12X16	4.71	11.99	0.220	3.990	0.265	103	17.1	4.67	2.82	1.41	0.773
W12X14	4.16	11.91	0.200	3.970	0.225	88.6	14.9	4.62	2.36	1.19	0.753



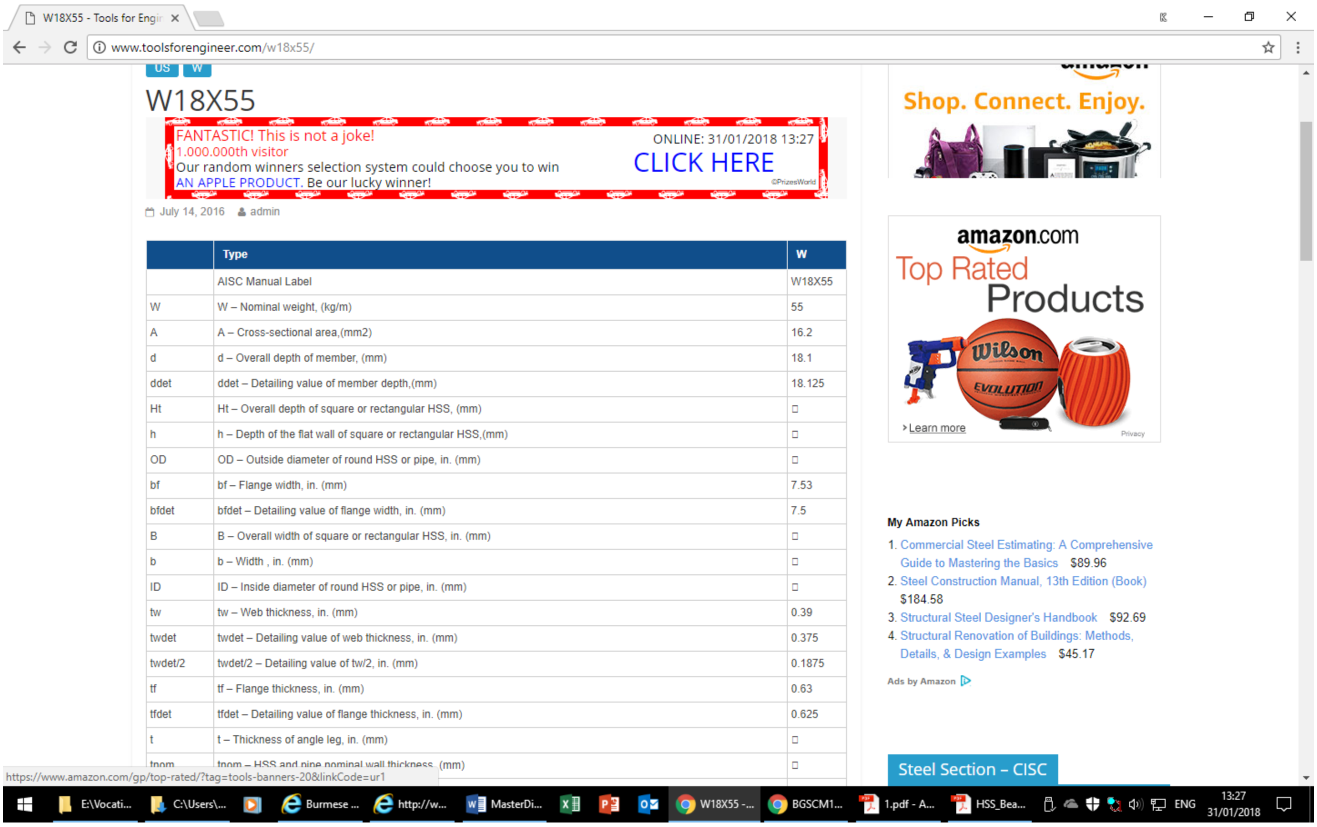
			Web	Flange		Elastic Properties					
	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
Designation	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W14X730	215.0	22.42	3.070	17.890	4.910	14300	1280	8.17	4720	527	4.69
W14X665	196.0	21.64	2.830	17.650	4.520	12400	1150	7.98	4170	472	4.62
W14X605	178.0	20.92	2.595	17.415	4.160	10800	1040	7.80	3680	423	4.55
W14X550	162.0	20.24	2.380	17.200	3.820	9430	931	7.63	3250	378	4.49
W14X500	147.0	19.60	2.190	17.010	3.500	8210	838	7.48	2880	339	4.43
W14X455	134.0	19.02	2.015	16.835	3.210	7190	756	7.33	2560	304	4.38
W14X426	125.0	18.67	1.875	16.695	3.035	6600	707	7.26	2360	283	4.34
W14X398	117.0	18.29	1.770	16.590	2.845	6000	656	7.16	2170	262	4.31
W14X370	109.0	17.92	1.655	16.475	2.660	5440	607	7.07	1990	241	4.27
W14X342	101.0	17.54	1.540	16.360	2.470	4900	559	6.98	1810	221	4.24
W14X311	91.4	17.12	1.410	16.230	2.260	4330	506	6.88	1610	199	4.20
W14X283	83.3	16.74	1.290	16.110	2.070	3840	459	6.79	1440	179	4.17
W14X257	75.6	16.38	1.175	15.995	1.890	3400	415	6.71	1290	161	4.13
W14X233	68.5	16.04	1.070	15.890	1.720	3010	375	6.63	1150	145	4.10
W14X211	62.0	15.72	0.980	15.800	1.560	2660	338	6.55	1030	130	4.07
W14X193	56.8	15.48	0.890	15.710	1.440	2400	310	6.50	931	119	4.05
W14X176	51.8	15.22	0.830	15.650	1.310	2140	281	6.43	838	107	4.02
W14X159	46.7	14.98	0.745	15.565	1.190	1900	254	6.38	748	96.2	4.00
W14X145	42.7	14.78	0.680	15.500	1.090	1710	232	6.33	677	87.3	3.98
W14X132	38.8	14.66	0.645	14.725	1.030	1530	209	6.28	548	74.5	3.76
W14X120	35.3	14.48	0.590	14.670	0.940	1380	190	6.24	495	67.5	3.74
W14X109	32.0	14.32	0.525	14.605	0.860	1240	173	6.22	447	61.2	3.73
W14X99	29.1	14.16	0.485	14.565	0.780	1110	157	6.17	402	55.2	3.71
W14X90	26.5	14.02	0.440	14.520	0.710	999	143	6.14	362	49.9	3.70
W14X82	24.1	14.31	0.510	10.130	0.855	882	123	6.05	148	29.3	2.48
W14X74	21.8	14.17	0.450	10.070	0.785	796	112	6.04	134	26.6	2.48
W14X68	20.0	14.04	0.415	10.035	0.720	723	103	6.01	121	24.2	2.46
W14X61	17.9	13.89	0.375	9.995	0.645	640	92.2	5.98	107	21.5	2.45
W14X53	15.6	13.92	0.370	8.060	0.660	541	77.8	5.89	57.7	14.3	1.92
W14X48	14.1	13.79	0.340	8.030	0.595	485	70.3	5.85	51.4	12.8	1.91
W14X43	12.6	13.66	0.305	7.995	0.530	428	62.7	5.82	45.2	11.3	1.89
W14X38	11.2	14.10	0.310	6.770	0.515	385	54.6	5.87	26.7	7.88	1.55
W14X34	10.0	13.98	0.285	6.745	0.455	340	48.6	5.83	23.3	6.91	1.53
W14X30	8.85	13.84	0.270	6.730	0.385	291	42.0	5.73	19.6	5.82	1.49
W14X26	7.69	13.91	0.255	5.025	0.420	245	35.3	5.65	8.91	3.54	1.08
W14X22	6.49	13.74	0.230	5.000	0.335	199	29.0	5.54	7.00	2.80	1.04



Wide Flange Section Data

Designation	Area	Depth	Web	Flange		Elastic Properties					
			Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W18X119	35.1	18.97	0.655	11.265	1.060	2190	231	7.90	253	44.9	2.69
W18X106	31.1	18.73	0.590	11.200	0.940	1910	204	7.84	220	39.4	2.66
W18X97	28.5	18.59	0.535	11.145	0.870	1750	188	7.82	201	36.1	2.65
W18X86	25.3	18.39	0.480	11.090	0.770	1530	166	7.77	175	31.6	2.63
W18X76	22.3	18.21	0.425	11.035	0.680	1330	146	7.73	152	27.6	2.61
W18X71	20.8	18.47	0.495	7.635	0.810	1170	127	7.50	60.3	15.8	1.70
W18X65	19.1	18.35	0.450	7.590	0.750	1070	117	7.49	54.8	14.4	1.69
W18X60	17.6	18.24	0.415	7.555	0.695	984	108	7.47	50.1	13.3	1.69
W18X55	16.2	18.11	0.390	7.530	0.630	890	98.3	7.41	44.9	11.9	1.67
W18X50	14.7	17.99	0.355	7.495	0.570	800	88.9	7.38	40.1	10.7	1.65
W18X46	13.5	18.06	0.360	6.060	0.605	712	78.8	7.25	22.5	7.43	1.29
W18X40	11.8	17.90	0.315	6.015	0.525	612	68.4	7.21	19.1	6.35	1.27
W18X35	10.3	17.70	0.300	6.000	0.425	510	57.6	7.04	15.3	5.12	1.22
W16X100	29.4	16.97	0.585	10.425	0.985	1490	175	7.10	186	35.7	2.51
W16X89	26.2	16.75	0.525	10.365	0.875	1300	155	7.05	163	31.4	2.49
W16X77	22.6	16.52	0.455	10.295	0.760	1110	134	7.00	138	26.9	2.47
W16X67	19.7	16.33	0.395	10.235	0.665	954	117	6.96	119	23.2	2.46
W16X57	16.8	16.43	0.430	7.120	0.715	758	92.2	6.72	43.1	12.1	1.60
W16X50	14.7	16.26	0.380	7.070	0.630	659	81.0	6.68	37.2	10.5	1.59
W16X45	13.3	16.13	0.345	7.035	0.565	586	72.7	6.65	32.8	9.34	1.57
W16X40	11.8	16.01	0.305	6.995	0.505	518	64.7	6.63	28.9	8.25	1.57
W16X36	10.6	15.86	0.295	6.985	0.430	448	56.5	6.51	24.5	7.00	1.52
W16X31	9.12	15.88	0.275	5.525	0.440	375	47.2	6.41	12.4	4.49	1.17
W16X26	7.68	15.69	0.250	5.500	0.345	301	38.4	6.26	9.59	3.49	1.12

http://www.toolsforengineer.com/w18x55/



W18X55

July 14, 2016 admin

	Type	W
	AISC Manual Label	W18X55
W	W – Nominal weight, (kg/m)	55
A	A – Cross-sectional area,(mm2)	16.2
d	d – Overall depth of member, (mm)	18.1
ddet	ddet – Detailing value of member depth,(mm)	18.125
Ht	Ht – Overall depth of square or rectangular HSS, (mm)	□
h	h – Depth of the flat wall of square or rectangular HSS,(mm)	□
OD	OD – Outside diameter of round HSS or pipe, in. (mm)	□
bf	bf – Flange width, in. (mm)	7.53
bfdet	bfdet – Detailing value of flange width, in. (mm)	7.5
B	B – Overall width of square or rectangular HSS, in. (mm)	□
b	b – Width , in. (mm)	□
ID	ID – Inside diameter of round HSS or pipe, in. (mm)	□
tw	tw – Web thickness, in. (mm)	0.39
twdet	twdet – Detailing value of web thickness, in. (mm)	0.375
twdet/2	twdet/2 – Detailing value of tw/2, in. (mm)	0.1875
tf	tf – Flange thickness, in. (mm)	0.63
tfdet	tfdet – Detailing value of flange thickness, in. (mm)	0.625
t	t – Thickness of angle leg, in. (mm)	□
tnom	tnom – HSS and pipe nominal wall thickness, (mm)	□

Steel Section – CISC

https://www.amazon.com/gp/top-rated/?tag=tools-banners-20&linkCode=ur1

https://www.engineeringtoolbox.com/american-wide-flange-steel-beams-d_1319.html

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** (in^2)	**Weight** *(lb/ft)*	I_x (in^4)	I_y (in^4)	W_x (in^3)	W_y (in^3)
W 27 x 178	27.8	14.09	0.725	1.190	52.3	178	6990	555	502	78.8
W 27 x 161	27.6	14.02	0.660	1.080	47.4	161	6280	497	455	70.9
W 27 x 146	27.4	14	0.605	0.975	42.9	146	5630	443	411	63.5
W 27 x 114	27.3	10.07	0.570	0.930	33.5	114	4090	159	299	31.5
W 27 x 102	27.1	10.02	0.515	0.830	30.0	102	3620	139	267	27.8
W 27 x 94	26.9	10	0.490	0.745	27.7	94	3270	124	243	24.8
W 27 x 84	26.7	9.96	0.460	0.640	24.8	84	2850	106	213	21.2
W 24 x 162	25	13	0.705	1.220	47.7	162	5170	443	414	68.4
W 24 x 146	24.7	12.9	0.650	1.090	43.0	146	4580	391	371	60.5
W 24 x 131	24.5	12.9	0.605	0.960	38.5	131	4020	340	329	53.0
W 24 x 117	24.3	12.8	0.55	0.850	34.4	117	3540	297	291	46.5
W 24 x 104	24.1	12.75	0.500	0.750	30.6	104	3100	259	258	40.7
W 24 x 94	24.1	9.07	0.515	0.875	27.7	94	2700	109	222	24.0
W 24 x 84	24.1	9.02	0.470	0.770	24.7	84	2370	94.4	196	20.9

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 24 x 76	23.9	9	0.440	0.680	22.4	76	2100	82.5	176	18.4
W 24 x 68	23.7	8.97	0.415	0.585	20.1	68	1830	70.4	154	15.7
W 24 x 62	23.7	7.04	0.430	0.590	18.2	62	1550	34.5	131	9.8
W 24 x 55	23.6	7.01	0.395	0.505	16.2	55	1350	29.1	114	8.3
W 21 x 147	22.1	12.51	0.720	1.150	43.2	147	3630	376	329	60.1
W 21 x 132	21.8	12.44	0.650	1.035	38.8	132	3220	333	295	53.5
W 21 x 122	21.7	12.39	0.600	0.960	35.9	122	2960	305	273	49.2
W 21 x 111	21.5	12.34	0.550	0.875	32.7	111	2670	274	249	44.5
W 21 x 101	21.4	12.29	0.500	0.800	29.8	101	2420	248	227	40.3
W 21 x 93	21.6	8.42	0.580	0.930	27.3	93	2070	92.9	192	22.1
W 21 x 83	21.4	8.36	0.515	0.835	24.3	83	1830	81.4	171	19.5
W 21 x 73	21.2	8.3	0.455	0.740	21.5	73	1600	70.6	151	17.0
W 21 x 68	21.1	8.27	0.430	0.685	20.0	68	1480	64.7	140	15.7
W 21 x 62	21	8.24	0.400	0.615	18.3	62	1330	57.5	127	13.9
W 21 x 57	21.1	6.56	0.405	0.650	16.7	57	1170	30.6	111	9.4
W 21 x 50	20.8	6.53	0.380	0.535	14.7	50	984	24.9	94.5	7.6
W 21 x 44	20.7	6.5	0.350	0.450	13.0	44	843	20.7	81.6	6.4

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 18 x 119	19	11.27	0.655	1.060	35.1	119	2190	253	231	44.9
W 18 x 106	18.7	11.2	0.590	0.940	31.1	106	1910	220	204	39.4
W 18 x 97	18.6	11.15	0.535	0.870	28.5	97	1750	201	188	36.1
W 18 x 86	18.4	11.09	0.480	0.770	25.3	86	1530	175	166	31.6
W 18 x 76	18.2	11.04	0.425	0.680	22.3	76	1330	152	146	27.6
W 18 x 71	18.5	7.64	0.495	0.810	20.8	71	1170	60.3	127	15.8
W 18 x 65	18.4	7.59	0.450	0.750	19.1	65	1070	54.8	117	14.4
W 18 x 60	18.2	7.56	0.415	0.695	17.6	60	984	50.1	108	13.3
W 18 x 55	18.1	7.53	0.390	0.630	16.2	55	890	44.9	98.3	11.9
W 18 x 50	18	7.5	0.355	0.570	14.7	50	800	40.1	88.9	10.7
W 18 x 46	18.1	6.06	0.360	0.605	13.5	46	712	22.5	78.8	7.4
W 18 x 40	17.9	6.02	0.315	0.525	11.8	40	612	19.1	68.4	6.4
W 18 x 35	17.7	6	0.300	0.425	10.3	35	510	15.3	57.6	5.1
W 16 x 100	16.97	10.425	0.585	0.985	29.4	100	1490	186	175	35.7
W 16 x 89	16.75	10.365	0.525	0.875	26.2	89	1300	163	155	31.4
W 16 x 77	16.52	10.295	0.455	0.760	22.6	77	1100	138	134	26.9

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	**I_x** *(in^4)*	**I_y** *(in^4)*	**W_x** *(in^3)*	**W_y** *(in^3)*
W 16 x 67	16.33	10.235	0.395	0.665	19.7	67	954	119	117	23.2
W 16 x 57	16.43	7.120	0.430	0.715	16.8	57	758	43.1	92.2	12.1
W 16 x 50	16.26	7.070	0.380	0.630	14.7	50	659	37.2	81	10.5
W 16 x 45	16.13	7.035	0.345	0.565	13.3	45	586	32.8	72.7	9.3
W 16 x 40	16.01	6.995	0.305	0.505	11.8	40	518	28.9	64.7	8.3
W 16 x 36	15.86	6.985	0.295	0.430	10.6	36	448	24.5	56.5	7
W 16 x 31	15.88	5.525	0.275	0.440	9.12	31	375	12.4	47.2	4.5
W 16 x 26	15.69	5.5	0.250	0.345	7.68	26	301	9.6	38.4	3.5
W 14 x 132	14.66	14.725	0.645	1.030	38.8	132	1530	548	209	74.5
W 14 x 120	14.48	14.670	0.590	0.940	35.3	120	1380	495	190	67.5
W 14 x 109	14.32	14.605	0.525	0.860	32	109	1240	447	173	61.2
W 14 x 99	14.16	14.565	0.485	0.780	29.1	99	1110	402	157	55.2
W 14 x 90	14.02	14.520	0.440	0.710	26.5	90	999	362	143	49.9
W 14 x 82	14.31	10.130	0.510	0.855	24.1	82	882	148	123	29.3
W 14 x 74	14.17	10.070	0.450	0.785	21.8	74	796	134	112	26.6
W 14 x 68	14.04	10.035	0.415	0.720	20.0	68	723	121	103	24.2
W 14 x 61	13.89	9.995	0.375	0.645	17.9	61	640	107	92.2	21.5

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 14 x 53	13.92	8.060	0.370	0.660	15.6	53	541	57.7	77.8	14.3
W 14 x 48	13.79	8.030	0.340	0.595	14.1	48	485	51.4	70.3	12.8
W 14 x 43	13.66	7.995	0.305	0.530	12.6	43	428	45.2	62.7	11.3
W 14 x 38	14.10	6.770	0.310	0.515	11.2	38	385	26.7	54.6	7.9
W 14 x 34	13.98	6.745	0.285	0.455	10.0	34	340	23.3	48.6	6.9
W 14 x 30	13.84	6.730	0.270	0.385	8.85	30	291	19.6	42.0	5.8
W 14 x 26	13.91	5.025	0.255	0.420	7.69	26	245	8.9	35.3	3.5
W 14 x 22	13.74	5	0.230	0.335	6.49	22	199	7	29.0	2.8
W 12 x 136	13.41	12.4	0.79	1.250	39.9	136	1240	398	186	64.2
W 12 x 120	13.12	12.32	0.71	1.105	35.3	120	1070	345	163	56.0
W 12 x 106	12.89	12.22	0.61	0.990	31.2	106	933	301	145	49.3
W 12 x 96	12.71	12.16	0.55	0.900	28.2	96	833	270	131	44.4
W 12 x 87	12.53	12.125	0.515	0.810	25.6	87	740	241	118	39.7
W 12 x 79	12.38	12.08	0.47	0.735	23.2	79	662	216	107	35.8
W 12 x 72	12.25	12.04	0.43	0.670	21.1	72	597	195	97.4	32.4
W 12 x 65	12.12	12	0.39	0.605	19.1	65	533	174	87.9	29.1
W 12 x 58	12.19	10.01	0.36	0.640	17.0	58	475	107	78	21.4

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	**I_x** *(in^4)*	**I_y** *(in^4)*	**W_x** *(in^3)*	**W_y** *(in^3)*
W 12 x 53	12.06	9.995	0.345	0.575	15.6	53	425	95.8	70.6	19.2
W 12 x 50	12.19	8.08	0.37	0.640	14.7	50	394	56.3	64.7	13.9
W 12 x 45	12.06	8.045	0.335	0.575	13.2	45	350	50.0	58.1	12.4
W 12 x 40	11.94	8.005	0.295	0.515	11.8	40	310	44.1	51.9	11.0
W 12 x 35	12.50	6.56	0.3	0.520	10.3	35	285	24.5	45.6	7.5
W 12 x 30	12.34	6.52	0.26	0.440	8.8	30	238	20.3	38.6	6.2
W 12 x 26	12.22	6.490	0.23	0.380	7.7	26	204	17.3	33.4	5.3
W 12 x 22	12.31	4.03	0.26	0.425	6.5	22	156	4.7	25.4	2.3
W 12 x 19	12.16	4.005	0.235	0.350	5.6	19	130	3.8	21.3	1.9
W 12 x 16	11.99	3.990	0.22	0.265	4.7	16	103	2.8	17.1	1.4
W 12 x 14	11.91	3.970	0.2	0.225	4.2	14	88.6	2.4	14.9	1.2
W 10 x 112	11.36	10.415	0.755	1.250	32.9	112	716	236	126	45.3
W 10 x 100	11.1	10.340	0.680	1.1120	29.4	100	623	207	112	40.0
W 10 x 88	10.84	10.265	0.605	0.990	25.9	88	534	179	98.5	34.8
W 10 x 77	10.60	10.190	0.530	0.870	22.6	77	455	154	85.9	30.1
W 10 x 68	10.40	10.130	0.470	0.770	20.0	68	394	134	75.7	26.4
W 10 x 60	10.22	10.080	0.420	0.680	17.6	60	341	116	66.7	23.0

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 10 x 54	10.09	10.030	0.370	0.615	15.8	54	303	103	60.0	20.6
W 10 x 49	9.98	10	0.340	0.560	14.4	49	272	93.4	54.6	18.7
W 10 x 45	10.10	8.020	0.350	0.620	13.3	45	248	53.4	49.1	13.3
W 10 x 39	9.92	7.985	0.315	0.530	11.5	39	209	45.0	42.1	11.3
W 10 x 33	9.73	7.960	0.290	0.435	9.71	33	170	36.6	35.0	9.2
W 10 x 30	10.47	5.81	0.3	0.510	8.84	30	170	16.7	32.4	5.8
W 10 x 26	10.33	5.770	0.26	0.440	7.6	26	144	14.1	27.9	4.9
W 10 x 22	10.17	5.750	0.240	0.360	6.5	22	118	11.4	23.2	4
W 10 x 19	10.24	4.020	0.250	0.395	5.6	19	96.3	4.3	18.8	2.1
W 10 x 17	10.11	4.010	0.240	0.330	5	17	81.9	3.6	16.2	1.8
W 10 x 15	9.99	4	0.230	0.270	4.4	15	68.9	2.9	13.8	1.5
W 10 x 12	9.87	3.960	0.190	0.210	3.5	12	53.8	2.2	10.9	1.1
W 8 x 67	9.00	8.280	0.570	0.935	19.7	67	272	88.6	60.4	21.4
W 8 x 58	8.75	8.220	0.510	0.810	17.1	58	228	75.1	52.0	18.3
W 8 x 48	8.5	8.110	0.400	0.685	14.1	48	184	60.9	43.3	15.0
W 8 x 40	8.25	8.070	0.360	0.560	11.7	40	146	49.1	35.5	12.2
W 8 x 35	8.12	8.020	0.310	0.495	10.3	35	127	42.6	31.2	10.6

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 8 x 31	8.00	7.995	0.285	0.435	9.1	31	110	37.1	27.5	9.3
W 8 x 28	8.06	6.535	0.285	0.465	8.3	28	98.0	21.7	24.3	6.6
W 8 x 24	7.93	6.495	0.245	0.400	7.1	24	82.8	18.3	20.9	5.6
W 8 x 21	8.28	5.270	0.250	0.400	6.2	21	75.3	9.8	18.2	3.7
W 8 x 18	8.14	5.250	0.230	0.330	5.3	18	61.9	8	15.2	3
W 8 x 15	8.11	4.015	0.245	0.315	4.4	15	48.0	3.4	11.8	1.7
W 8 x 13	7.99	4	0.230	0.255	3.8	13	39.6	2.7	9.9	1.4
W 8 x 10	7.89	3.940	0.170	0.205	2.9	10	30.3	2.1	7.8	1.1
W 6 x 25	6.38	6.080	0.320	0.455	7.3	25	53.4	17.1	16.7	5.6
W 6 x 20	6.20	6.020	0.260	0.365	5.9	20	41.4	13.3	13.4	4.4
W 6 x 16	6.28	4.030	0.260	0.405	4.7	16	32.1	4.4	10.2	2.2
W 6 x 15	5.99	5.990	0.230	0.260	4.4	15	29.1	9.3	9.7	3.1
W 6 x 12	6.03	4	0.230	0.280	3.6	12	22.1	3	7.3	1.5
W 6 x 9	5.90	3.940	0.170	0.215	2.7	9	16.4	2.2	5.6	1.1
W 5 x 19	5.15	5.030	0.270	0.430	5.5	19	26.2	9.1	10.2	3.6
W 5 x 16	5.01	5	0.240	0.360	4.7	16	21.3	7.5	8.5	3

Designation	**Dimensions**						**Static Parameters**			
							Moment of Inertia		**Elastic Section Modulus**	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 4 x 13	4.16	4.060	0.280	0.345	3.8	13	11.3	3.9	5.5	1.9

Based on 95.6 in³ (1566.82 cm³)
select the most economic section by referring
AISC Table steel shape | section data.
W12 x55 has 98.3 in³. use it.

in x lb/ft

W 18 x 55 $\longrightarrow$ 98.2 in^3 (1609.50 cm^3)

Total load = W/ft x Total Length

= 1700 x 30

= 51000 lb (226848 N)

Select the most economy section

According to http://www.toolsforengineer /w18x55/

Nominal weight for W18x55 is 55

Calculate backward

$\boxed{\text{use W18x55 ; W allow = 52000}}$

what it means ?

If we choose W18x55 → S = 98.3

$\therefore$ m = S x f = 98.3 x 24000 = 2359200 in lb

$$m = \frac{wl^2 \times 12}{8}$$

$$\therefore w = \frac{m \times 8}{l^2 \times 12} = \frac{2359200 \times 8}{30^2 \times 12}$$

= 1747 lb/Lin ft

↑ Linear

for 30ft ⇒ 1747 x 30

= 52426 ≃ 52000 lb

original design was based on 51000 ∴ can choose W18x55

In the above worked example, based on solution outline

- Internet research was performed to exactly know the meaning of technical terms/ formula
- Internet research was performed to exactly know the details of materials usage
- Internet research was performed to exactly know the details technical table.

Although you may not have the AISC Manual, by doing appropriate search, you can have the necessary technical data.

- By using such data, the details and simplified calculation/ solution was made.
- The statement in the original outline solution was more detailly explained.

This is my worked example for **STRUCTURAL STEEL DESIGN**

BAE701 Engineering Fundamentals

Mechanical

www.mongroupsydney1.com/1.pdf

Then study **Section 3-Mechanical Engineering (PDF File Page 307)**

For every topic, you need to write the short note on what you understand, formula, summary, outlines and at least 2 problems solution (Please note, each problem is solved in short form, you need to clearly reproduce them by step by step)

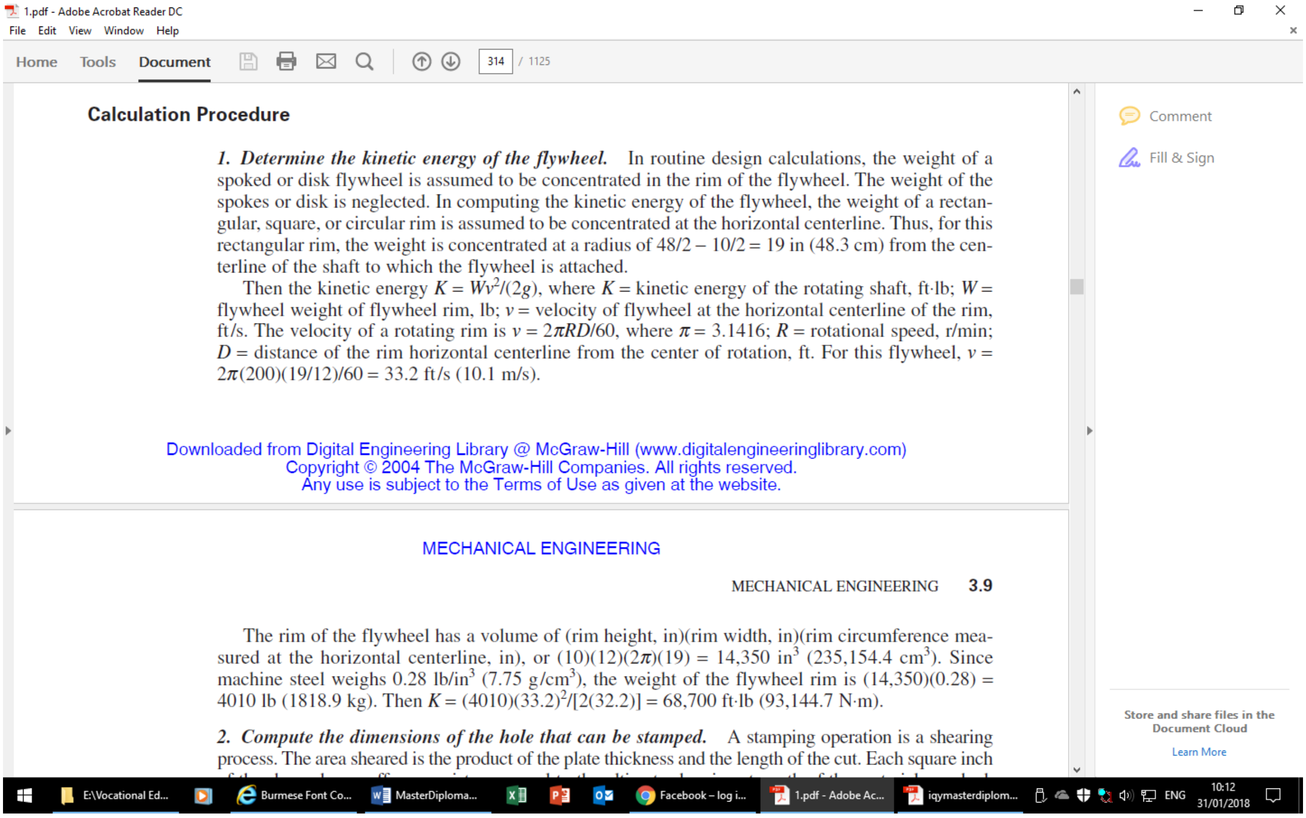
MECHANICAL DESIGN AND ANALYSIS 3.8

Page 314 Energy Stored in Rotating Flywheel

The Questions and suggested solution in the book

A 48-in (121.9-cm) diameter spoked steel flywheel having a 12-in wide × 10-in (30.5-cm × 25.4-cm) deep rim rotates at 200 r/min. How long a cut can be stamped in a 1-in (2.5-cm) thick aluminium plate if the stamping energy is obtained from this flywheel? The ultimate shearing strength of the aluminum is 40,000 lb/in2 (275,789.9 kPa).

Procedure written in the book



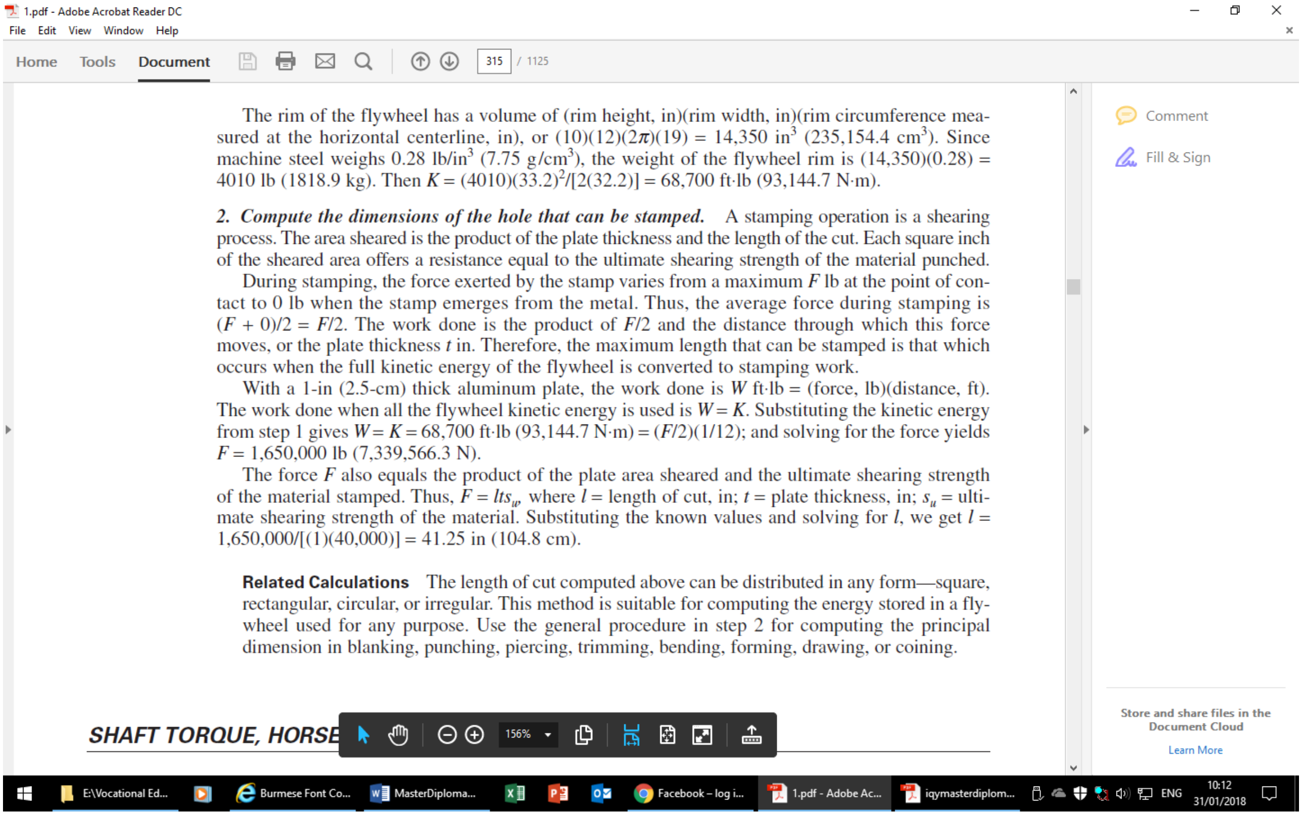
Calculation Procedure

1. ***Determine the kinetic energy of the flywheel.*** In routine design calculations, the weight of a spoked or disk flywheel is assumed to be concentrated in the rim of the flywheel. The weight of the spokes or disk is neglected. In computing the kinetic energy of the flywheel, the weight of a rectangular, square, or circular rim is assumed to be concentrated at the horizontal centerline. Thus, for this rectangular rim, the weight is concentrated at a radius of 48/2 – 10/2 = 19 in (48.3 cm) from the centerline of the shaft to which the flywheel is attached.

Then the kinetic energy $K = Wv^2/(2g)$, where K = kinetic energy of the rotating shaft, ft·lb; W = flywheel weight of flywheel rim, lb; v = velocity of flywheel at the horizontal centerline of the rim, ft/s. The velocity of a rotating rim is $v = 2\pi RD/60$, where $\pi = 3.1416$; R = rotational speed, r/min; D = distance of the rim horizontal centerline from the center of rotation, ft. For this flywheel, $v = 2\pi(200)(19/12)/60 = 33.2$ ft/s (10.1 m/s).

The rim of the flywheel has a volume of (rim height, in)(rim width, in)(rim circumference measured at the horizontal centerline, in), or $(10)(12)(2\pi)(19) = 14{,}350$ in^3 (235,154.4 cm^3). Since machine steel weighs 0.28 lb/in^3 (7.75 g/cm^3), the weight of the flywheel rim is $(14{,}350)(0.28) = 4010$ lb (1818.9 kg). Then $K = (4010)(33.2)^2/[2(32.2)] = 68{,}700$ ft·lb (93,144.7 N·m).

2. ***Compute the dimensions of the hole that can be stamped.*** A stamping operation is a shearing process. The area sheared is the product of the plate thickness and the length of the cut. Each square inch



The rim of the flywheel has a volume of (rim height, in)(rim width, in)(rim circumference measured at the horizontal centerline, in), or $(10)(12)(2\pi)(19) = 14{,}350$ in^3 (235,154.4 cm^3). Since machine steel weighs 0.28 lb/in^3 (7.75 g/cm^3), the weight of the flywheel rim is $(14{,}350)(0.28) = 4010$ lb (1818.9 kg). Then $K = (4010)(33.2)^2/[2(32.2)] = 68{,}700$ ft·lb (93,144.7 N·m).

2. ***Compute the dimensions of the hole that can be stamped.*** A stamping operation is a shearing process. The area sheared is the product of the plate thickness and the length of the cut. Each square inch of the sheared area offers a resistance equal to the ultimate shearing strength of the material punched.

During stamping, the force exerted by the stamp varies from a maximum F lb at the point of contact to 0 lb when the stamp emerges from the metal. Thus, the average force during stamping is $(F + 0)/2 = F/2$. The work done is the product of $F/2$ and the distance through which this force moves, or the plate thickness t in. Therefore, the maximum length that can be stamped is that which occurs when the full kinetic energy of the flywheel is converted to stamping work.

With a 1-in (2.5-cm) thick aluminum plate, the work done is W ft·lb = (force, lb)(distance, ft). The work done when all the flywheel kinetic energy is used is $W = K$. Substituting the kinetic energy from step 1 gives $W = K = 68{,}700$ ft·lb (93,144.7 N·m) $= (F/2)(1/12)$; and solving for the force yields $F = 1{,}650{,}000$ lb (7,339,566.3 N).

The force F also equals the product of the plate area sheared and the ultimate shearing strength of the material stamped. Thus, $F = lts_u$, where l = length of cut, in; t = plate thickness, in; s_u = ultimate shearing strength of the material. Substituting the known values and solving for l, we get $l = 1{,}650{,}000/[(1)(40{,}000)] = 41.25$ in (104.8 cm).

Related Calculations The length of cut computed above can be distributed in any form—square, rectangular, circular, or irregular. This method is suitable for computing the energy stored in a flywheel used for any purpose. Use the general procedure in step 2 for computing the principal dimension in blanking, punching, piercing, trimming, bending, forming, drawing, or coining.

SHAFT TORQUE, HORSE

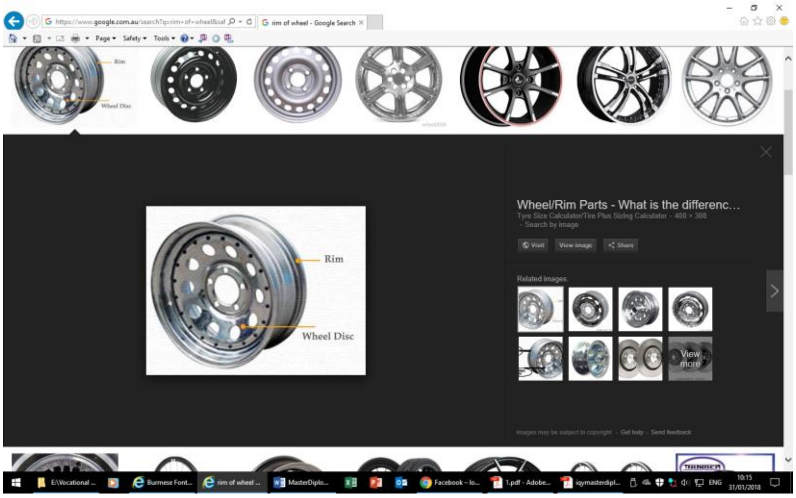
That process is simplified as below

Step 1

1. Determine the kinetic energy of the flywheel. In routine design calculations, the weight of a spoked or disk flywheel is assumed to be concentrated in the rim of the flywheel. The weight of the spokes or disk is neglected. In computing the kinetic energy of the flywheel, the weight of a rectangular, square, or circular rim is assumed to be concentrated at the horizontal centerline. Thus, for this

rectangular rim, the weight is concentrated at a radius of 48/2 10/2 = 19 in (48.3 cm) from the centreline of the shaft to which the flywheel is attached.

The weight of flywheel is at the rim of wheel (rim of wheel? Internet search –



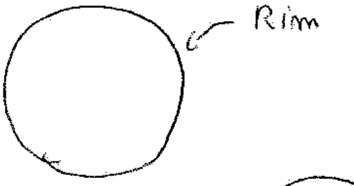
Wheel/Rim Parts - What is the differenc...

Tyre Size Calculator/Tire Plus Sizing Calculator - 400 × 300 - Search by image

step (1)

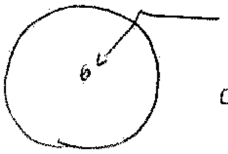
①

The weight of flywheel is at the rim of wheel



weight of Spoke is neglected

kinetic energy is at centre Line



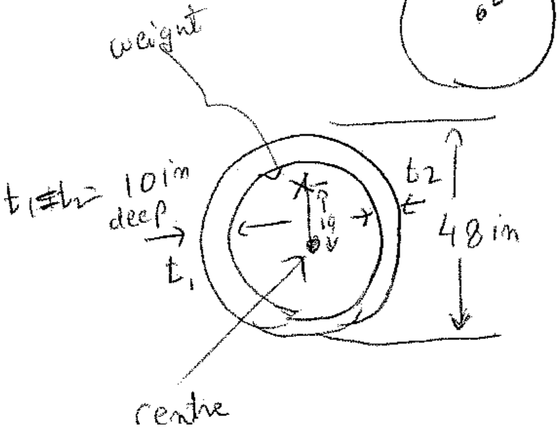
weight is at = $\frac{48}{2} - \frac{10}{2}$

= 19 in

Weight is at 19 in

(19×2.54= 48.3 cm)

from centre Line



Step 2

Then the kinetic energy $K = Wv2/(2g)$, where K = kinetic energy of the rotating shaft, ft⊕lb; W =flywheel weight of flywheel rim, lb; v = velocity of flywheel at the horizontal centerline of the rim, ft /s.

The velocity of a rotating rim is $v = 2\pi RD/60$, where $\pi = 3.1416$; R = rotational speed, r/min;

D = distance of the rim horizontal centerline from the center of rotation, ft. For this flywheel,

$v = 2\pi(200)(19/12)/60 = 33.2$ ft /s (10.1 m/s).

step(2) Kinetic Energy $K = \dfrac{Wv^2}{2g}$

K = kinetic Energy of rotating shaft (ft-lb)

W = weight of fly wheel (lb)

v = velocity of fly wheel at the horizontal Centre Line of the rim (ft/s)

$\mathcal{V}$ = velocity of rotating rim

$$\mathcal{V} = \frac{2\pi RD}{60}$$

$\pi = 3.1416$, R = Rotational speed r/min

D = Distance of the rim horizontal centre Line from centre of rotation (ft)

D = 19 in = 19/12 ft

$$\mathcal{V} = \frac{2\pi RD}{60} = \frac{2 \times 3.1416 \times \overset{②}{200} \times \left(\frac{19 \text{ in}}{12}\right) \text{ft}}{60}$$

$= 33.2$ ft/sec

3.3 ft = 1 m ∴ $33.2 \text{ ft/sec} = \dfrac{33.2}{3.3}$

$= 10.1$ m/s.

Step 3

The rim of the flywheel has a volume of (rim height, in)(rim width, in)(rim circumference measuredat the horizontal centerline, in), or (10)(12)(2π)(19) = 14,350 in3 (235,154.4 cm3).

Since machine steel weighs 0.28 lb/in3 (7.75 g/cm3), the weight of the flywheel rim is (14,350)(0.28) = 4010 lb (1818.9 kg). Then K = (4010)(33.2)2/[2(32.2)] = 68,700 ft⊕lb (93,144.7 N⊕m).

step(3) volume of fly wheel

Rim height = 10

Rim weight = 12

Rim circumference = $2\pi(19)$

Because it was given

$\underset{10}{\underset{\downarrow}{(\text{rim height, in})}}\ \underset{12}{\underset{\downarrow}{(\text{rim width, in})}}\ \underset{(2\pi)(19)}{\underset{\downarrow}{(\text{rim circumference})}}$

$\therefore\ 10 \times 12 \times 2\pi \times 19 = 14350\ \text{in}^3$

(or) 1 in = 2.54cm

$14350 \times (2.54)^3 = 235154.4\ \text{cm}^3$

Steel weight $0.28\ \text{lb/in}^3$ (or) $7.75\ \text{gm/cm}^3$

$\therefore$ weight of flywheel rim = 14350×0.28

$= 4010\ \text{lb}$

$\underline{1}\ \text{Kg} = \underline{\text{lb}} \times 0.456$

$\therefore (4010 \times 0.456)$

$= 1818.9\ \text{Kg}$

③

$$K = \frac{w v^2}{2g} = \frac{4010 \times 33.2^2}{2 \times 32.2} = 68700 \text{ ft-lb}$$

(or)

$$= \frac{1818.9 \times 10.2^2}{2 \times 9.8} = 93144.7 \text{ N-m}$$

Step 4

2. Compute the dimensions of the hole that can be stamped.

A stamping operation is a shearing process. The area sheared is the product of the plate thickness and the length of the cut. Each square inch of the sheared area offers a resistance equal to the ultimate shearing strength of the material punched.

During stamping, the force exerted by the stamp varies from a maximum F lb at the point of contact to 0 lb when the stamp emerges from the metal. Thus, the average force during stamping is $(F + 0)/2 = F/2$.

The work done is the product of $F/2$ and the distance through which this force moves, or the plate thickness t in. Therefore, the maximum length that can be stamped is that which occurs when the full kinetic energy of the flywheel is converted to stamping work.

With a 1-in (2.5-cm) thick aluminum plate, the work done is W ft⊕lb = (force, lb)(distance, ft).

The work done when all the flywheel kinetic energy is used is $W = K$. Substituting the kinetic energy

from step 1 gives $W = K = 68,700$ ft⊕lb (93,144.7 N⊕m) $= (F/2)(1/12)$; and solving for the force yields

$F = 1,650,000$ lb (7,339,566.3 N).

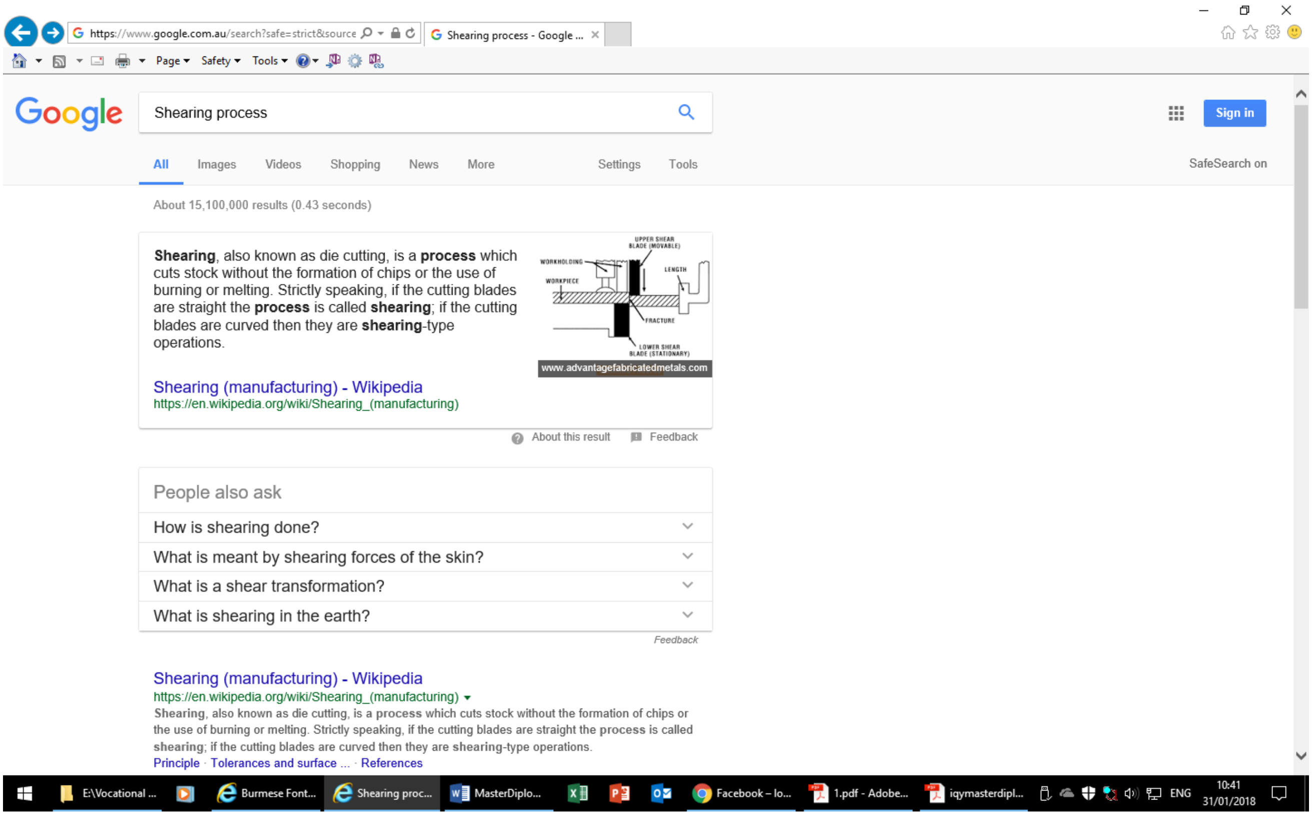
The force F also equals the product of the plate area sheared and the ultimate shearing strength

of the material stamped. Thus, $F = ltsu$, where l = length of cut, in; t = plate thickness, in; su = ultimate shearing strength of the material. Substituting the known values and solving for l, we get $l = 1{,}650{,}000/[(1)(40{,}000)] = 41.25$ in (104.8 cm).

Note

A stamping operation is a shearing process.The area sheared is the product of the plate thickness and the length of the cut. Each square inch of the sheared area offers a resistance equal to the ultimate shearing strength of the material punched.

Shearing process—Internet search



About 15,100,000 results (0.43 seconds)

Shearing, also known as die cutting, is a **process** which cuts stock without the formation of chips or the use of burning or melting. Strictly speaking, if the cutting blades are straight the **process** is called **shearing**; if the cutting blades are curved then they are **shearing**-type operations.

Shearing (manufacturing) - Wikipedia
https://en.wikipedia.org/wiki/Shearing_(manufacturing)

People also ask

- How is shearing done?
- What is meant by shearing forces of the skin?
- What is a shear transformation?
- What is shearing in the earth?

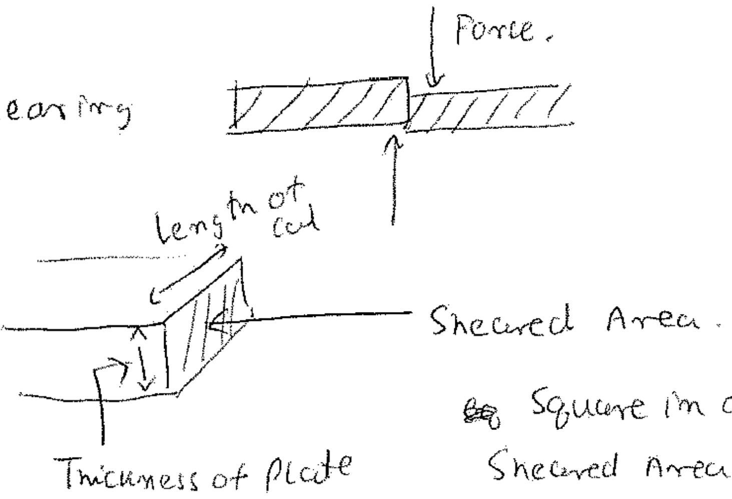
Shearing (manufacturing) - Wikipedia
https://en.wikipedia.org/wiki/Shearing_(manufacturing)

Shearing, also known as die cutting, is a **process** which cuts stock without the formation of chips or the use of burning or melting. Strictly speaking, if the cutting blades are straight the **process** is called **shearing**; if the cutting blades are curved then they are **shearing**-type operations.

Principle · Tolerances and surface ... · References

Step 4

Shearing



Square in of Sheared Area = ultimate Shearing Strength.

Average force during stamping $= \frac{F+0}{2} = \frac{F}{2}$

Because 0 lb at stamp emerged from metal

work done = Product of $\frac{F}{2}$ and thickness 't'

$= \frac{F}{2} \times t$

work done when all flywheel kinetic Energy used

$W = K$ where $K = 68700$ ft-lb
(or)
93144.7 N-m

$\therefore W = 68700$ ft-lb (93144.7 N-m)

$$w = \frac{f}{2} \times t \qquad \text{where } t = 1 \text{ in} \text{ (or) } \frac{1}{12} \text{ ft}$$

$$\therefore \; w = \frac{f}{2} \times \frac{1}{12}$$

$$68700 = \frac{f}{2} \times \frac{1}{12} \qquad \therefore F = 68700 \times 2 \times 12$$

$$= 1650000 \text{ lb}$$

(or)

$$93144.7 = \frac{f}{2} \times \frac{1}{12} \qquad \therefore F = 93144.7 \times 2 \times 12$$

$$= 7339566.3 \text{ N}$$

F equals the product of the plate area sheared and the ultimate shearing strength

$$F = \text{plate area sheared} \times \text{ultimate shearing strength}$$

$$F = l\,t\,s_u$$

l = length of cut

t = plate thickness

s_u = ultimate shearing strength of material

$$F = l\;t\;s_u$$

$$1650000 = l \times (1 \text{ in}) \times 40{,}000$$

given ultimate shearing strength of Aluminium

$$l = \frac{1650000}{1 \times 40{,}000} = 41.25 \text{ in} \text{ (or) } 104.8 \text{ cm}$$

In this problem

You know

- Rim of wheel
- Shearing process
- Kinetic energy
- $$K = \frac{Wv^2}{2g}$$
- Average force during stamping $= \frac{F+0}{2} = \frac{F}{2}$
- work done = Product of $\frac{F}{2}$ and thickness 't' $= \frac{F}{2} \times t$

  $F =$ plate area sheared $\times$ ultimate shearing strength
- $F = l\,t\,s_u$

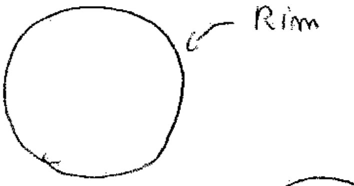
Additional notes

Related Calculations The length of cut computed above can be distributed in any form—square, rectangular, circular, or irregular. This method is suitable for computing the energy stored in a flywheel used for any purpose. Use the general procedure in step 2 for computing the principal dimension in blanking, punching, piercing, trimming, bending, forming, drawing, or coining.

All calculations on the next page

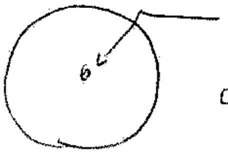
Step(1)

The weight of flywheel is at the rim of wheel



weight of Spoke is neglected

Kinetic energy is at centre Line



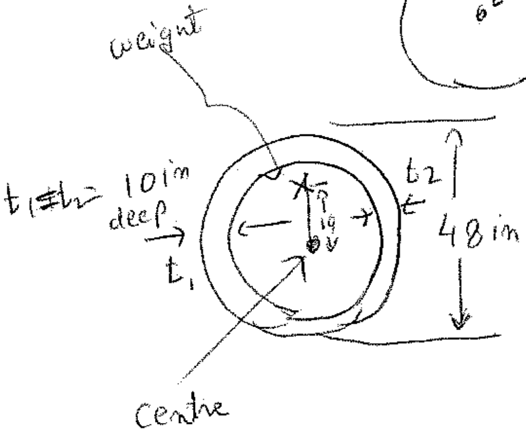
weight is at = $\frac{48}{2} - \frac{10}{2}$

= 19 in

Weight is at 19 in

(19×2.54= 48.3 cm)

from centre line



Step(2)

Kinetic Energy $K = \frac{W v^2}{2g}$

K = kinetic Energy of rotating shaft (ft-lb)

W = weight of fly wheel (lb)

V = velocity of fly wheel at the horizontal centre line of the rim (ft/s)

v = velocity of rotating rim

$$v = \frac{2\pi R D}{60}$$

π = 3.1416 , R = Rotational speed r/min

D = Distance of the rim horizontal centre line from centre of rotation (ft)

$D = 19\ in = 19/12\ ft$

②

$$v = \frac{2\pi R D}{60} = \frac{2 \times 3.1416 \times 200 \times \left(\frac{19\ in}{12}\right) ft}{60}$$

$$= 33.2\ ft/sec$$

$3.3\ ft = 1\ m$ $\quad\therefore\quad$ $33.2\ ft/sec = \frac{33.2}{3.3}$

$$= 10.1\ m/s$$

Step(3) Volume of fly wheel

Rim height = 10

Rim weight = 12

Rim circumference = $2\pi\ (19)$

Because it was given

(rim height, in) (rim width, in) (rim circumference)

$\downarrow$ $\quad\downarrow\quad$ $\downarrow$

10 $\quad$ 12 $\quad$ $(2\pi)(19)$

$\therefore\ 10 \times 12 \times 2\pi \times 19 = 14350\ in^3$

(or) $\quad 1\ in = 2.54\ cm$

$14350 \times (2.54)^3 = 235154.4\ cm^3$

Steel weight $0.28\ lb/in^3$ (or) $7.75\ gm/cm^3$

$\therefore$ weight of flywheel rim $= 14350 \times 0.28$

$= 4010\ lb$

$\underline{1}\ kg = \underline{\ lb\ } \times 0.456$ $\quad\therefore\ (4010 \times 0.456)$

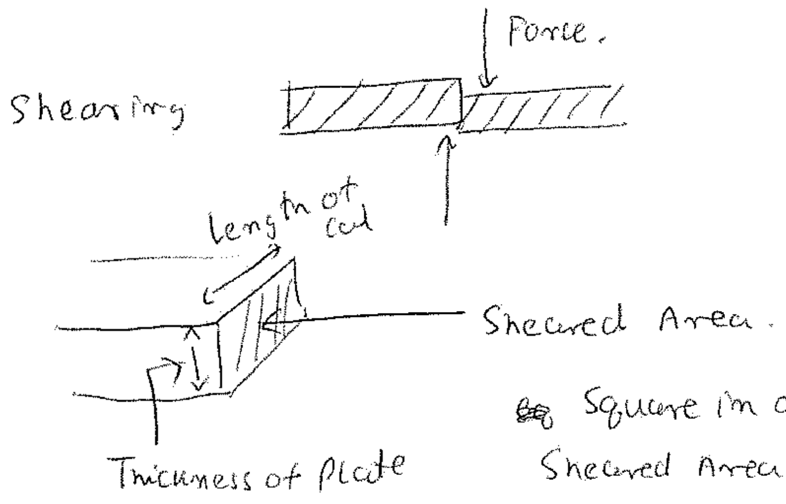
$= 1818.9\ kg$

$$K = \frac{w v^2}{2g} = \frac{4010 \times 33.2^2}{2 \times 32.2} = 68700 \text{ ft-lb}$$ ③

(or)

$$= \frac{1818.9 \times 10.2^2}{2 \times 9.8} = 93144.7 \text{ N-m}$$

Step 4



~~Sq~~ Square in of Sheared Area = ultimate Shearing Strength.

Average force during stamping $= \frac{F+0}{2} = \frac{F}{2}$

Because 0 lb at stamp emerged from metal

work done = Product of $\frac{F}{2}$ and thickness 't'

$= \frac{F}{2} \times t$

work done when all flywheel kinetic Energy used

$w = K$ where $K = 68700$ ft-lb (or) 93144.7 N-m

$\therefore w = 68700$ ft-lb (93144.9 N-m)

④

$w = \frac{f}{2} \times t$ where $t = 1$ in (or) $\frac{1}{12}$ ft

$\therefore w = \frac{F}{2} \times \frac{1}{12}$

$68700 = \frac{F}{2} \times \frac{1}{12}$ $\therefore F = 68700 \times 2 \times 12$

$= 1650000$ lb

(or)

$93144.7 = \frac{F}{2} \times \frac{1}{12}$ $\therefore F = 93144.7 \times 2 \times 12$

$= 7339566.3$ N

F equals the product of the plate area sheared and the ultimate shearing strength

F = plate area sheared × ultimate shearing strength

$F = l\,t\,s_u$

l = length of cut

t = plate thickness

S_u = ultimate shearing strength of material

$F = l\,t\,s_u$

$1650000 = l \times (1\text{ in}) \times 40{,}000$ — given ultimate shearing strength of Aluminium

$l = \frac{1650000}{1 \times 40{,}000} = 41.25$ in (or) 104.8 cm

Electrical

www.mongroupsydney1.com/1.pdf

Then study **Section 4-Electrical Engineering (PDF File Page 885)**
For every topic, you need to write the short note on what you understand, formula, summary, outlines and at least 2 problems solution (Please note, each problem is solved in short form, you need to clearly reproduce them by step by step)

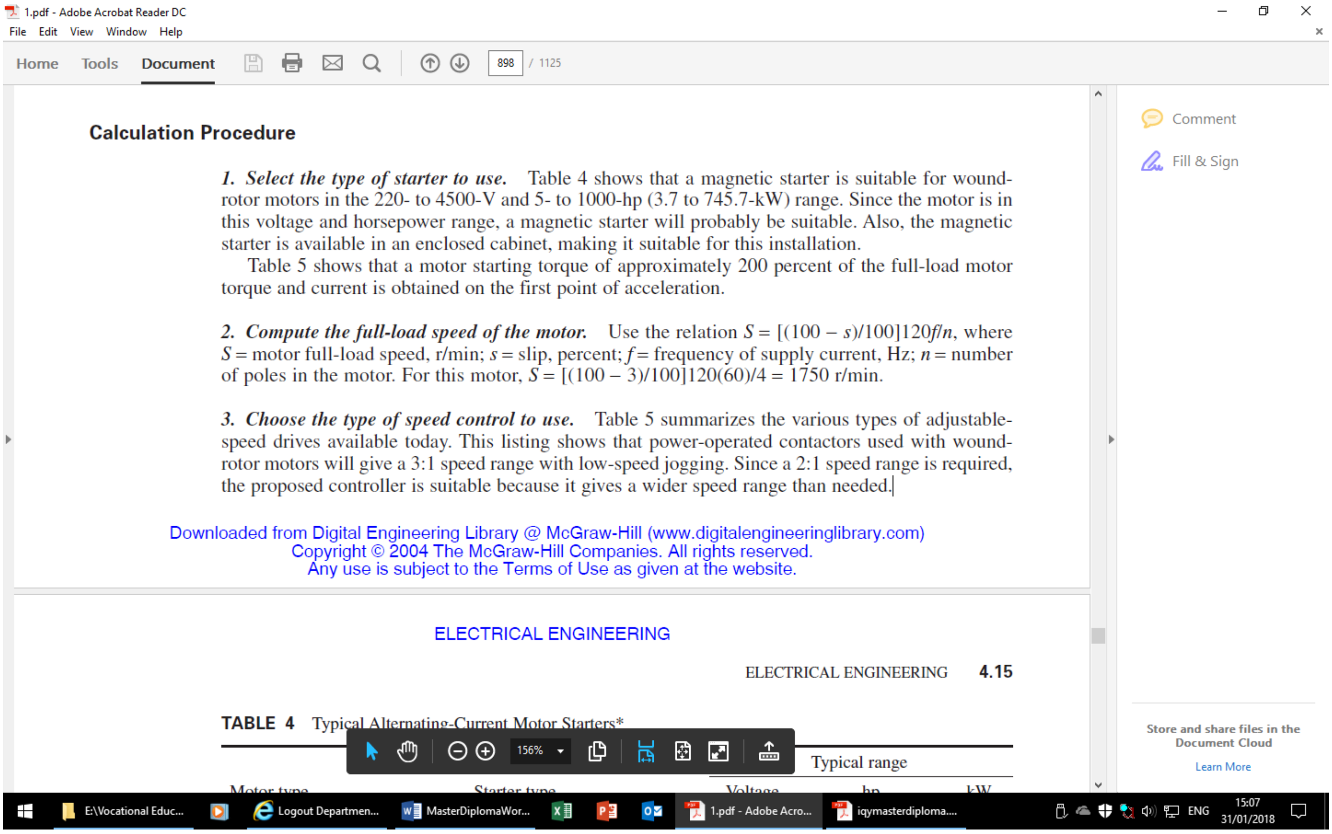
This is my worked example for Selecting Electric-Motor Starting and Speed Controls
Sections ,

SELECTING ELECTRIC-MOTOR STARTING AND SPEED CONTROLS

Problem

Choose a suitable starter and speed control for a 500-hp (372.8-kW) wound-rotor ac motor that mus thave a speed range of 2 to 1 with a capability for low-speed jogging. The motor is to operate at about 1800 r/min with current supplied at 4160 V, 60 Hz. An enclosed starter and a controller are desirable from the standpoint of protection. What is the actual motor speed if the motor has four poles and a slip of 3 percent?

Outlined Solution



Calculation Procedure

1. Select the type of starter to use. Table 4 shows that a magnetic starter is suitable for wound-rotor motors in the 220- to 4500-V and 5- to 1000-hp (3.7 to 745.7-kW) range. Since the motor is in this voltage and horsepower range, a magnetic starter will probably be suitable. Also, the magnetic starter is available in an enclosed cabinet, making it suitable for this installation.

Table 5 shows that a motor starting torque of approximately 200 percent of the full-load motor torque and current is obtained on the first point of acceleration.

2. Compute the full-load speed of the motor. Use the relation $S = [(100 - s)/100]120f/n$, where S = motor full-load speed, r/min; s = slip, percent; f = frequency of supply current, Hz; n = number of poles in the motor. For this motor, $S = [(100 - 3)/100]120(60)/4 = 1750$ r/min.

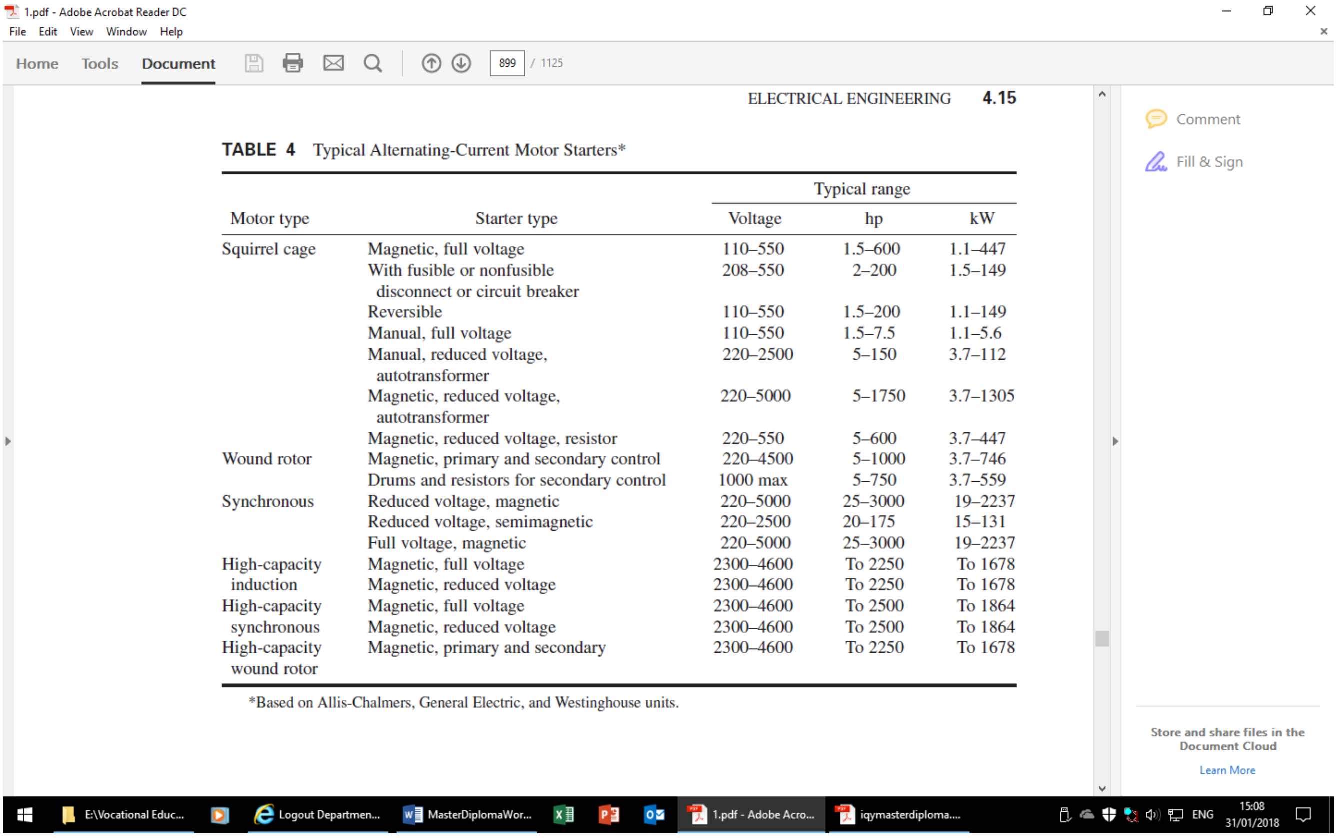
3. Choose the type of speed control to use. Table 5 summarizes the various types of adjustable-speed drives available today. This listing shows that power-operated contactors used with wound-rotor motors will give a 3:1 speed range with low-speed jogging. Since a 2:1 speed range is required, the proposed controller is suitable because it gives a wider speed range than needed.

ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING **4.15**

TABLE 4 Typical Alternating-Current Motor Starters*

Typical range



ELECTRICAL ENGINEERING **4.15**

TABLE 4 Typical Alternating-Current Motor Starters*

		Typical range		
Motor type	Starter type	Voltage	hp	kW
Squirrel cage	Magnetic, full voltage	110–550	1.5–600	1.1–447
	With fusible or nonfusible disconnect or circuit breaker	208–550	2–200	1.5–149
	Reversible	110–550	1.5–200	1.1–149
	Manual, full voltage	110–550	1.5–7.5	1.1–5.6
	Manual, reduced voltage, autotransformer	220–2500	5–150	3.7–112
	Magnetic, reduced voltage, autotransformer	220–5000	5–1750	3.7–1305
	Magnetic, reduced voltage, resistor	220–550	5–600	3.7–447
Wound rotor	Magnetic, primary and secondary control	220–4500	5–1000	3.7–746
	Drums and resistors for secondary control	1000 max	5–750	3.7–559
Synchronous	Reduced voltage, magnetic	220–5000	25–3000	19–2237
	Reduced voltage, semimagnetic	220–2500	20–175	15–131
	Full voltage, magnetic	220–5000	25–3000	19–2237
High-capacity induction	Magnetic, full voltage	2300–4600	To 2250	To 1678
	Magnetic, reduced voltage	2300–4600	To 2250	To 1678
High-capacity synchronous	Magnetic, full voltage	2300–4600	To 2500	To 1864
	Magnetic, reduced voltage	2300–4600	To 2500	To 1864
High-capacity wound rotor	Magnetic, primary and secondary	2300–4600	To 2250	To 1678

*Based on Allis-Chalmers, General Electric, and Westinghouse units.

Refer table 4,

wound rotor motor – magnetic, Primary and Secondary control

Drums and resistors for Secondary control

for wound rotor motors in 220 → 4500V

5 to 1000 HP (3.7 to 745.7 kW)

As this motor is in this voltage and horse power range, a magnetic starter is suitable

motor full load speed

$$S = \left[\frac{(100-\textcircled{s})}{100}\right] \times \frac{120f}{n}$$

S = motor full load speed r/min

$\textcircled{s}$ = slip (%)

f = frequency of supply current (Hz)

n = number of poles in motor

$$S = \frac{(100-3)}{100} \times \frac{120 \times 60}{4} = 1750 \text{ r/min}$$

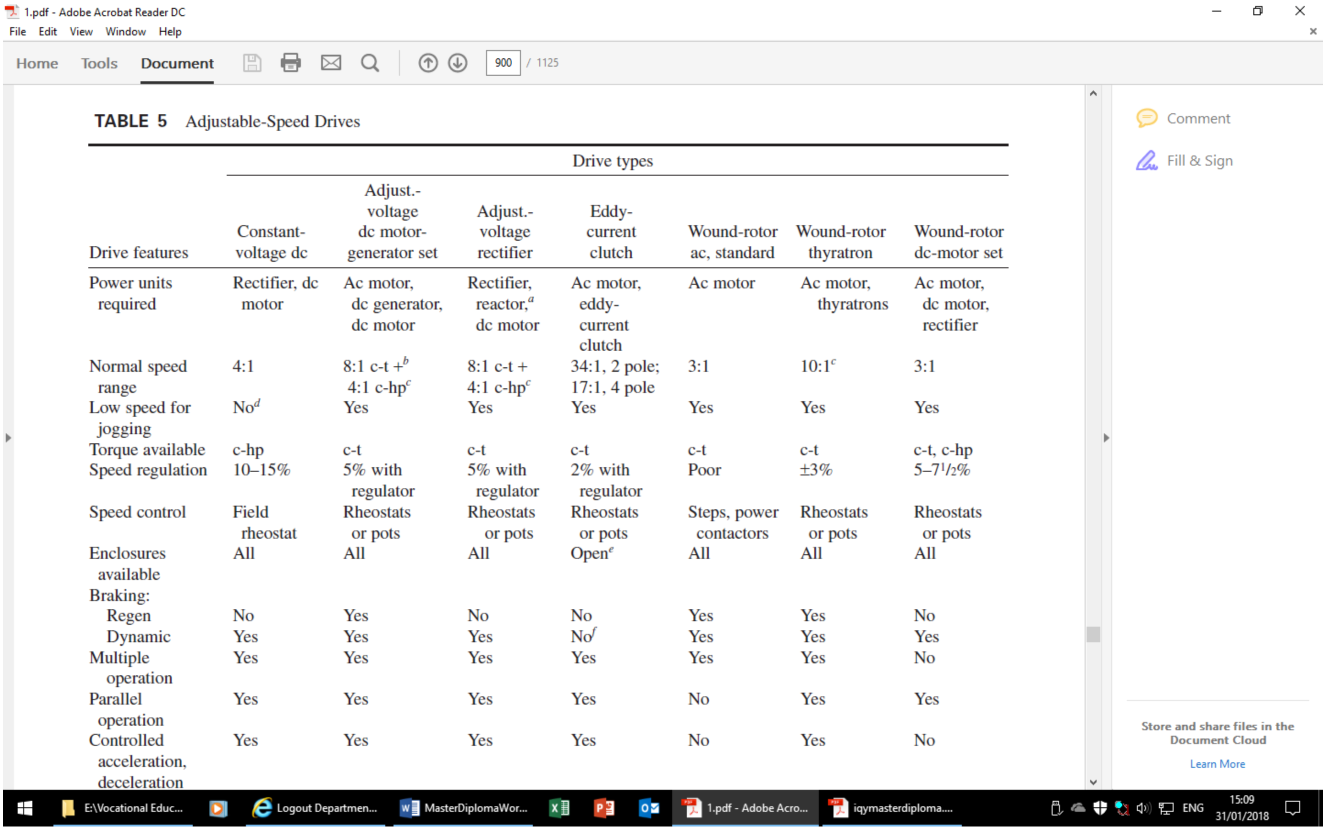
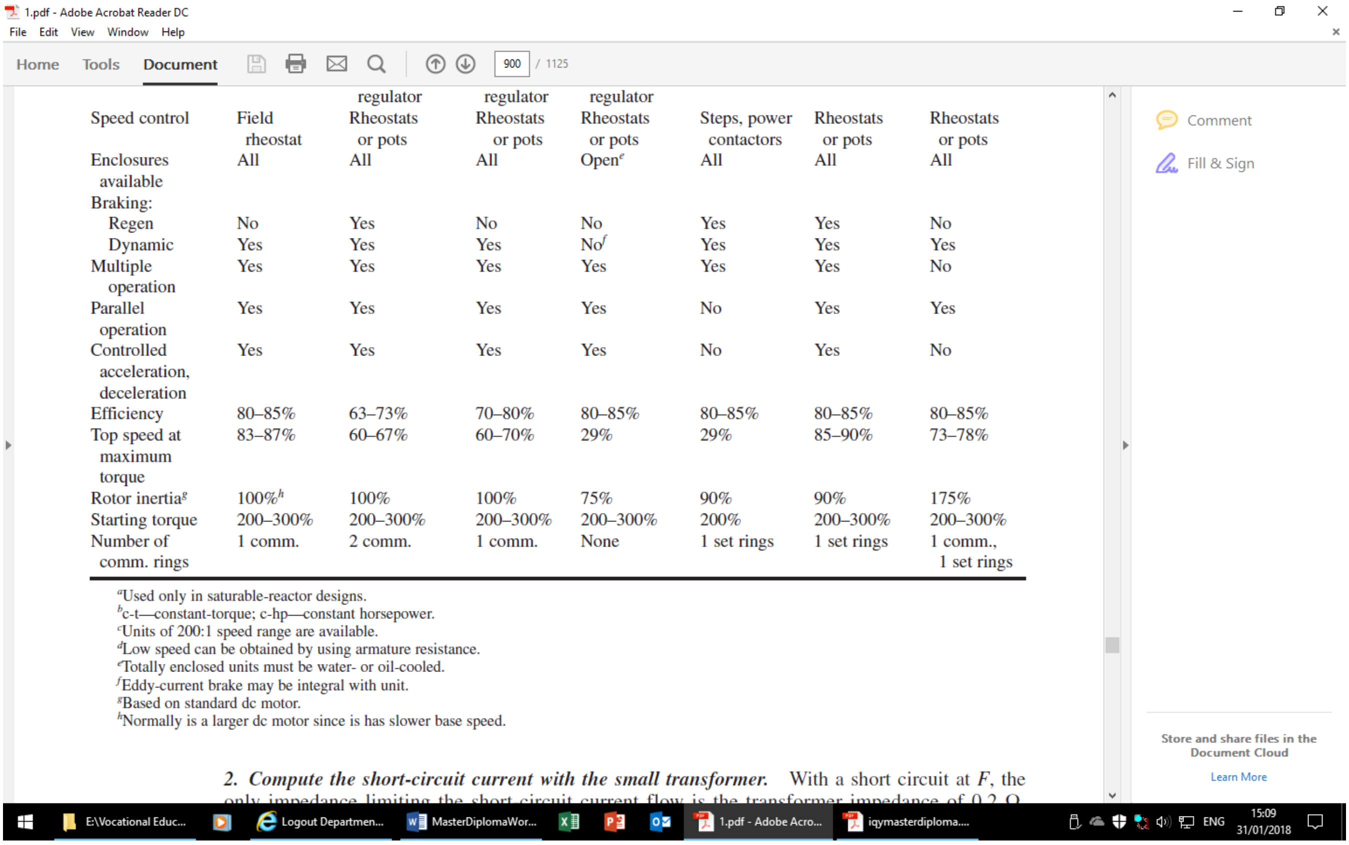


TABLE 5 Adjustable-Speed Drives

	Drive types						
Drive features	Constant-voltage dc	Adjust.-voltage dc motor-generator set	Adjust.-voltage rectifier	Eddy-current clutch	Wound-rotor ac, standard	Wound-rotor thyratron	Wound-rotor dc-motor set
Power units required	Rectifier, dc motor	Ac motor, dc generator, dc motor	Rectifier, reactor,[a] dc motor	Ac motor, eddy-current clutch	Ac motor	Ac motor, thyratrons	Ac motor, dc motor, rectifier
Normal speed range	4:1	8:1 c-t +[b] 4:1 c-hp[c]	8:1 c-t + 4:1 c-hp[c]	34:1, 2 pole; 17:1, 4 pole	3:1	10:1[c]	3:1
Low speed for jogging	No[d]	Yes	Yes	Yes	Yes	Yes	Yes
Torque available	c-hp	c-t	c-t	c-t	c-t	c-t	c-t, c-hp
Speed regulation	10–15%	5% with regulator	5% with regulator	2% with regulator	Poor	±3%	5–7½%
Speed control	Field rheostat	Rheostats or pots	Rheostats or pots	Rheostats or pots	Steps, power contactors	Rheostats or pots	Rheostats or pots
Enclosures available	All	All	All	Open[e]	All	All	All
Braking:							
Regen	No	Yes	No	No	Yes	Yes	No
Dynamic	Yes	Yes	Yes	No[f]	Yes	Yes	Yes
Multiple operation	Yes	Yes	Yes	Yes	Yes	Yes	No
Parallel operation	Yes	Yes	Yes	Yes	No	Yes	Yes
Controlled acceleration, deceleration	Yes	Yes	Yes	Yes	No	Yes	No



		regulator	regulator	regulator			
Speed control	Field rheostat	Rheostats or pots	Rheostats or pots	Rheostats or pots	Steps, power contactors	Rheostats or pots	Rheostats or pots
Enclosures available	All	All	All	Open[e]	All	All	All
Braking:							
Regen	No	Yes	No	No	Yes	Yes	No
Dynamic	Yes	Yes	Yes	No[f]	Yes	Yes	Yes
Multiple operation	Yes	Yes	Yes	Yes	Yes	Yes	No
Parallel operation	Yes	Yes	Yes	Yes	No	Yes	Yes
Controlled acceleration, deceleration	Yes	Yes	Yes	Yes	No	Yes	No
Efficiency	80–85%	63–73%	70–80%	80–85%	80–85%	80–85%	80–85%
Top speed at maximum torque	83–87%	60–67%	60–70%	29%	29%	85–90%	73–78%
Rotor inertia[g]	100%[h]	100%	100%	75%	90%	90%	175%
Starting torque	200–300%	200–300%	200–300%	200–300%	200%	200–300%	200–300%
Number of comm. rings	1 comm.	2 comm.	1 comm.	None	1 set rings	1 set rings	1 comm., 1 set rings

[a] Used only in saturable-reactor designs.
[b] c-t—constant-torque; c-hp—constant horsepower.
[c] Units of 200:1 speed range are available.
[d] Low speed can be obtained by using armature resistance.
[e] Totally enclosed units must be water- or oil-cooled.
[f] Eddy-current brake may be integral with unit.
[g] Based on standard dc motor.
[h] Normally is a larger dc motor since is has slower base speed.

2. *Compute the short-circuit current with the small transformer.* With a short circuit at *F*, the only impedance limiting the short-circuit current flow is the transformer impedance of 0.2 Ω

Type of speed control, Refer Table 5

	wound rotor ac motor
Normal speed range	3:1
Low speed for jogging	Yes
speed control	step/ power contactor

as 2:1 speed range is required, we can choose power contactor

Note from Table 5 that if a wider speed range were required, a thyratron control could produce a range up to 10:1 on a wound-rotor motor. Also, a wound-rotor dc motor set might be used too.

In such an arrangement, an ac and dc motor are combined on the same shaft. The rotor current is converted to dc by external silicon rectifiers and fed back to the dc armature through the commutator.

Related Calculations Use the two tables presented here to guide the selection of starters and controls for ac motors serving industrial, commercial, marine, portable, and residential applications.

To choose a dc motor starter, use Table 6 as a guide.

Speed controls for dc motors can be chosen by using Table 7 as a guide. Dc motors are finding increasing use in industry. They are also popular in marine service.

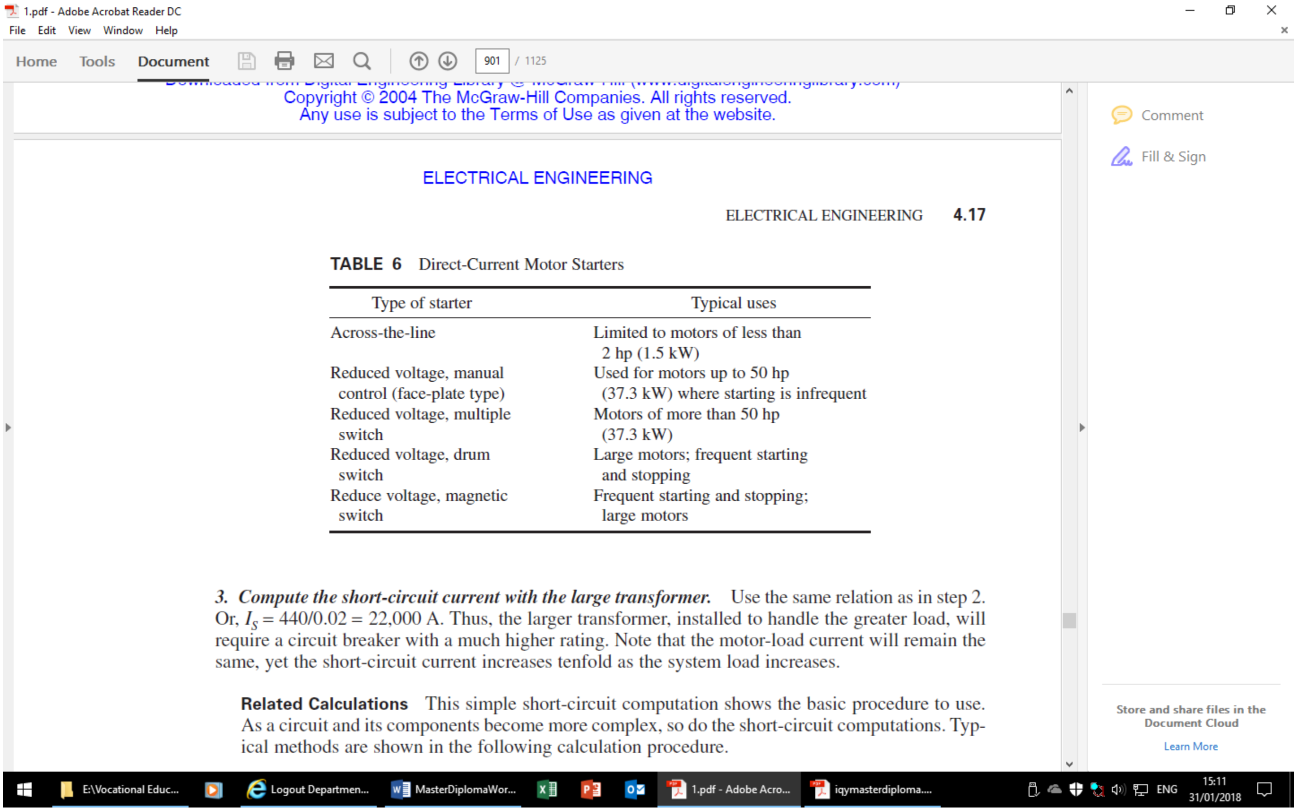
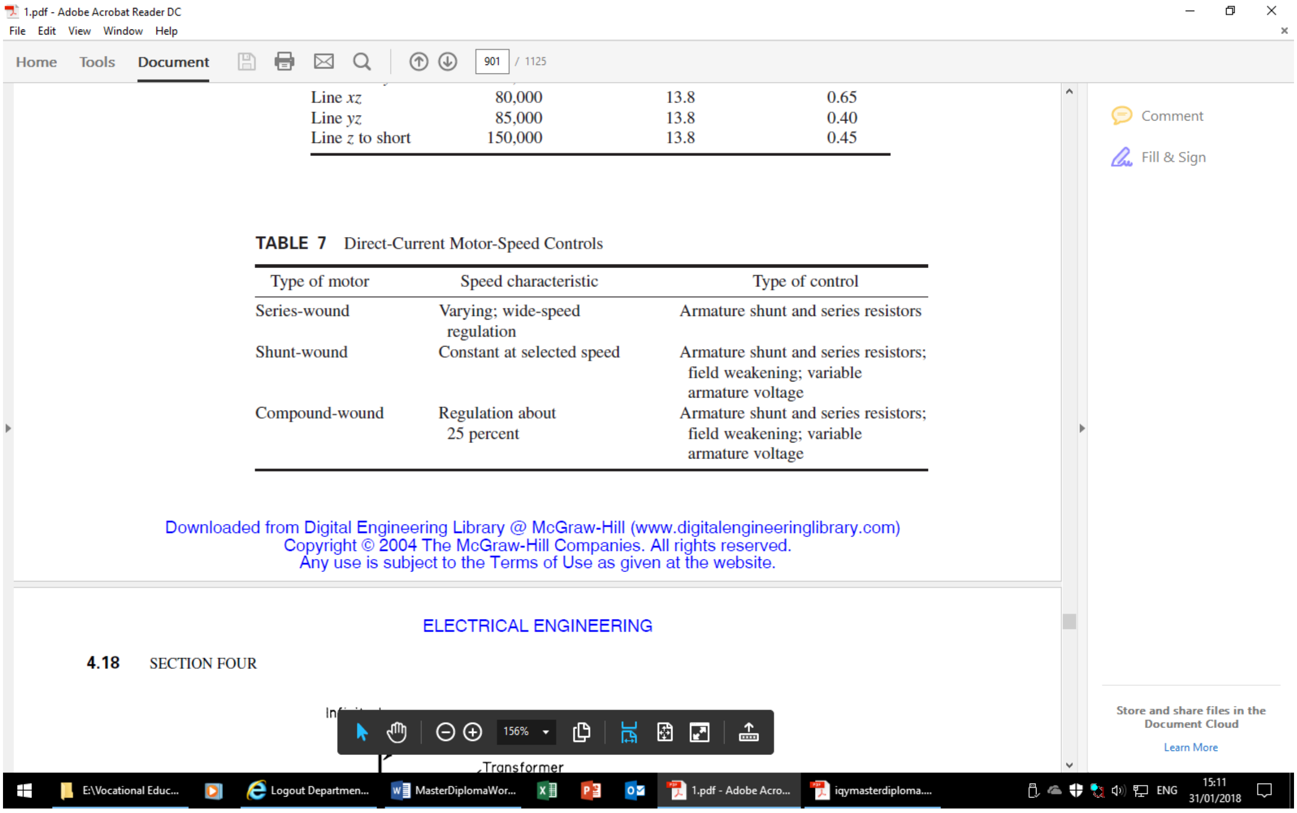


TABLE 6 Direct-Current Motor Starters

Type of starter	Typical uses
Across-the-line	Limited to motors of less than 2 hp (1.5 kW)
Reduced voltage, manual control (face-plate type)	Used for motors up to 50 hp (37.3 kW) where starting is infrequent
Reduced voltage, multiple switch	Motors of more than 50 hp (37.3 kW)
Reduced voltage, drum switch	Large motors; frequent starting and stopping
Reduce voltage, magnetic switch	Frequent starting and stopping; large motors

3. Compute the short-circuit current with the large transformer. Use the same relation as in step 2. Or, $I_S = 440/0.02 = 22{,}000$ A. Thus, the larger transformer, installed to handle the greater load, will require a circuit breaker with a much higher rating. Note that the motor-load current will remain the same, yet the short-circuit current increases tenfold as the system load increases.

Related Calculations This simple short-circuit computation shows the basic procedure to use. As a circuit and its components become more complex, so do the short-circuit computations. Typical methods are shown in the following calculation procedure.



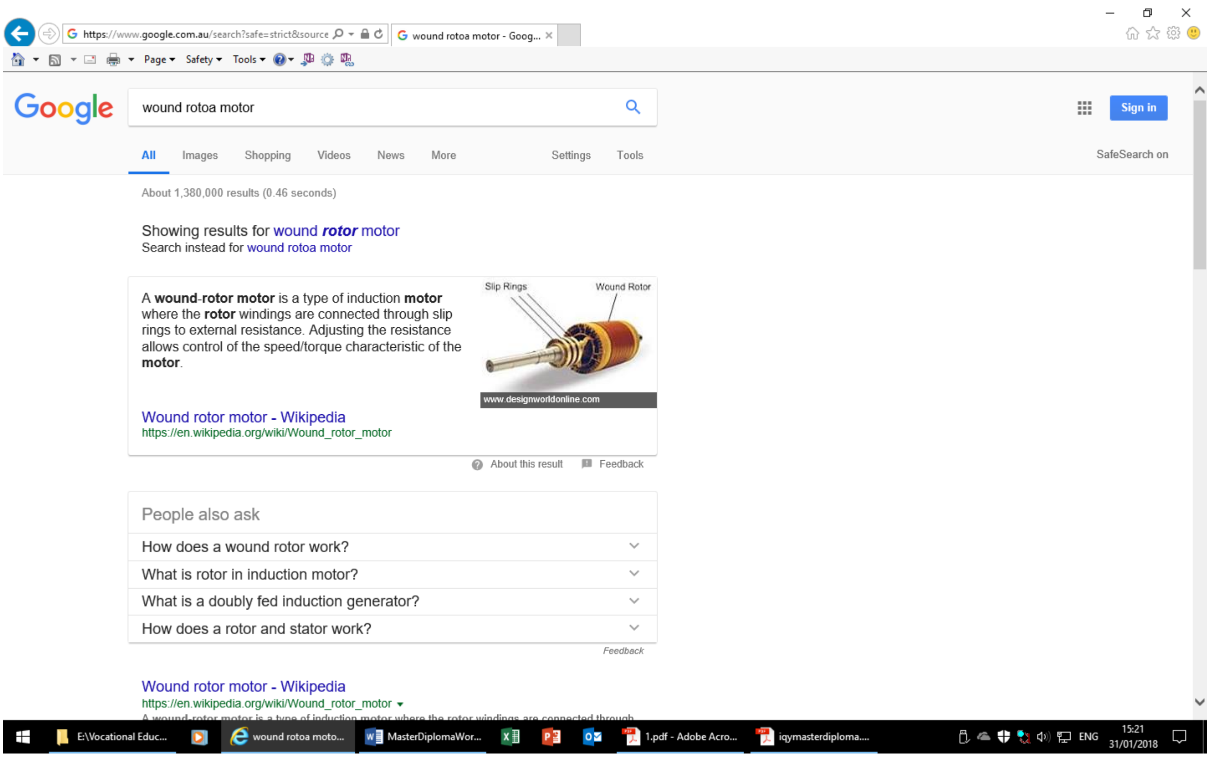
Line *xz*	80,000	13.8	0.65
Line *yz*	85,000	13.8	0.40
Line *z* to short	150,000	13.8	0.45

TABLE 7 Direct-Current Motor-Speed Controls

Type of motor	Speed characteristic	Type of control
Series-wound	Varying; wide-speed regulation	Armature shunt and series resistors
Shunt-wound	Constant at selected speed	Armature shunt and series resistors; field weakening; variable armature voltage
Compound-wound	Regulation about 25 percent	Armature shunt and series resistors; field weakening; variable armature voltage

TECHNICAL TERMS

Wound rotor motor? , Do internet search



wound rotoa motor

About 1,380,000 results (0.46 seconds)

Showing results for wound ***rotor*** motor
Search instead for wound rotoa motor

A **wound-rotor motor** is a type of induction **motor** where the **rotor** windings are connected through slip rings to external resistance. Adjusting the resistance allows control of the speed/torque characteristic of the **motor**.

Wound rotor motor - Wikipedia
https://en.wikipedia.org/wiki/Wound_rotor_motor

People also ask

- How does a wound rotor work?
- What is rotor in induction motor?
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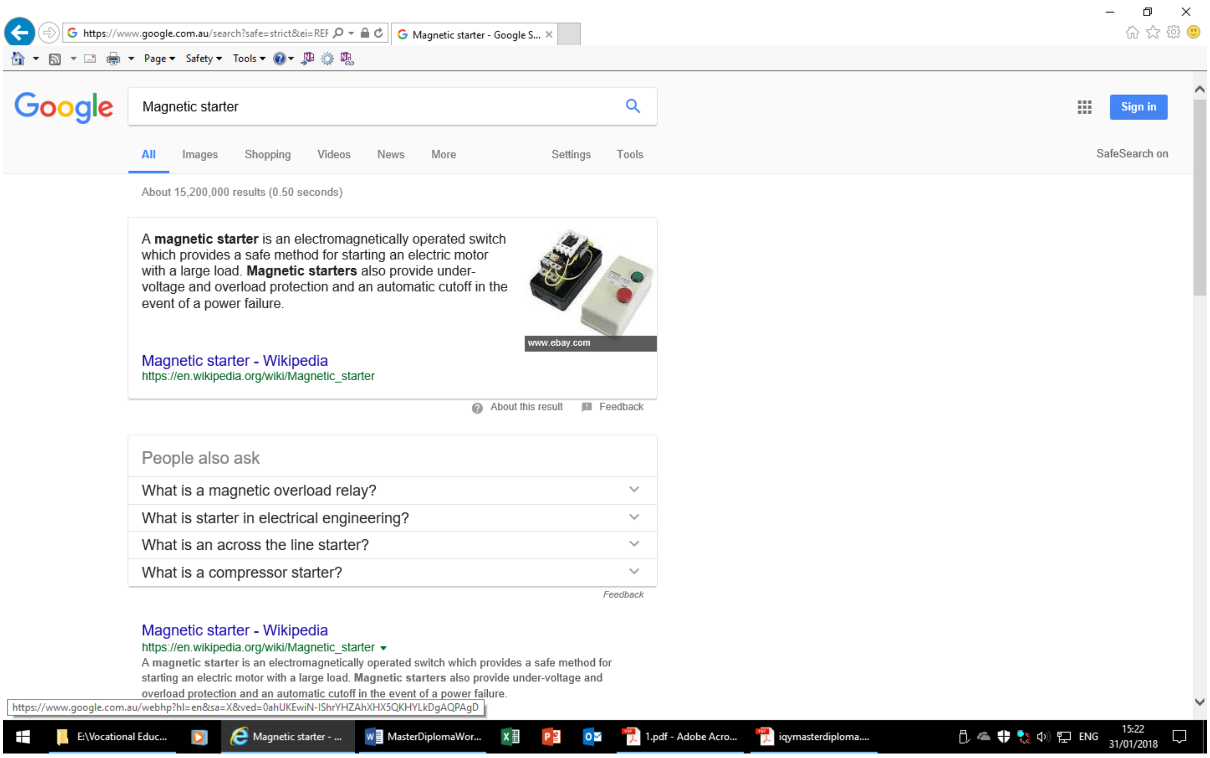
https://en.wikipedia.org/wiki/Wound_rotor_motor
A wound-rotor motor is a type of induction motor where the rotor windings are connected through

Magnetic starter, Do internet search



Magnetic starter

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A **magnetic starter** is an electromagnetically operated switch which provides a safe method for starting an electric motor with a large load. **Magnetic starters** also provide under-voltage and overload protection and an automatic cutoff in the event of a power failure.

Magnetic starter - Wikipedia
https://en.wikipedia.org/wiki/Magnetic_starter

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A **magnetic starter** is an electromagnetically operated switch which provides a safe method for starting an electric motor with a large load. **Magnetic starters** also provide under-voltage and overload protection and an automatic cutoff in the event of a power failure.

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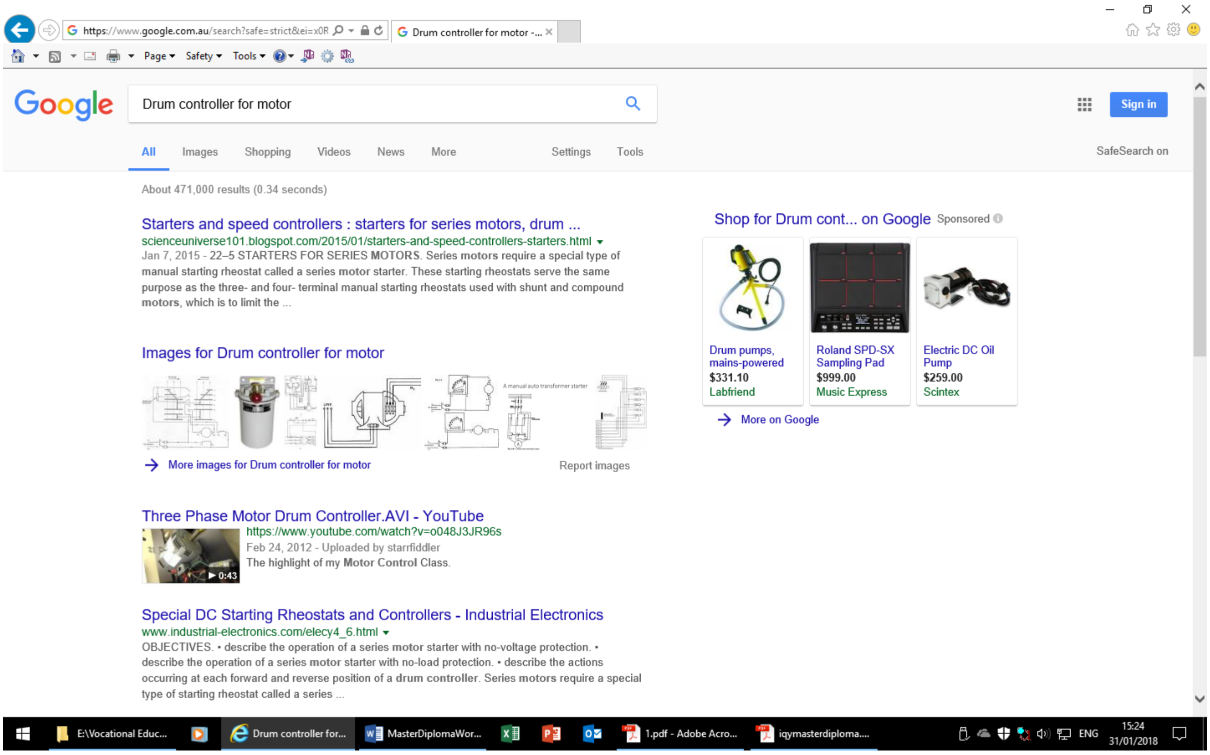
Drum control, do Internet search



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Jan 7, 2015 - 22–5 STARTERS FOR SERIES MOTORS. Series motors require a special type of manual starting rheostat called a series motor starter. These starting rheostats serve the same purpose as the three- and four- terminal manual starting rheostats used with shunt and compound motors, which is to limit the ...

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Three Phase Motor Drum Controller.AVI - YouTube
https://www.youtube.com/watch?v=o048J3JR96s
Feb 24, 2012 - Uploaded by starrfiddler
The highlight of my Motor Control Class.

Special DC Starting Rheostats and Controllers - Industrial Electronics
www.industrial-electronics.com/elecy4_6.html
OBJECTIVES. • describe the operation of a series motor starter with no-voltage protection. • describe the operation of a series motor starter with no-load protection. • describe the actions occurring at each forward and reverse position of a drum controller. Series motors require a special type of starting rheostat called a series ...

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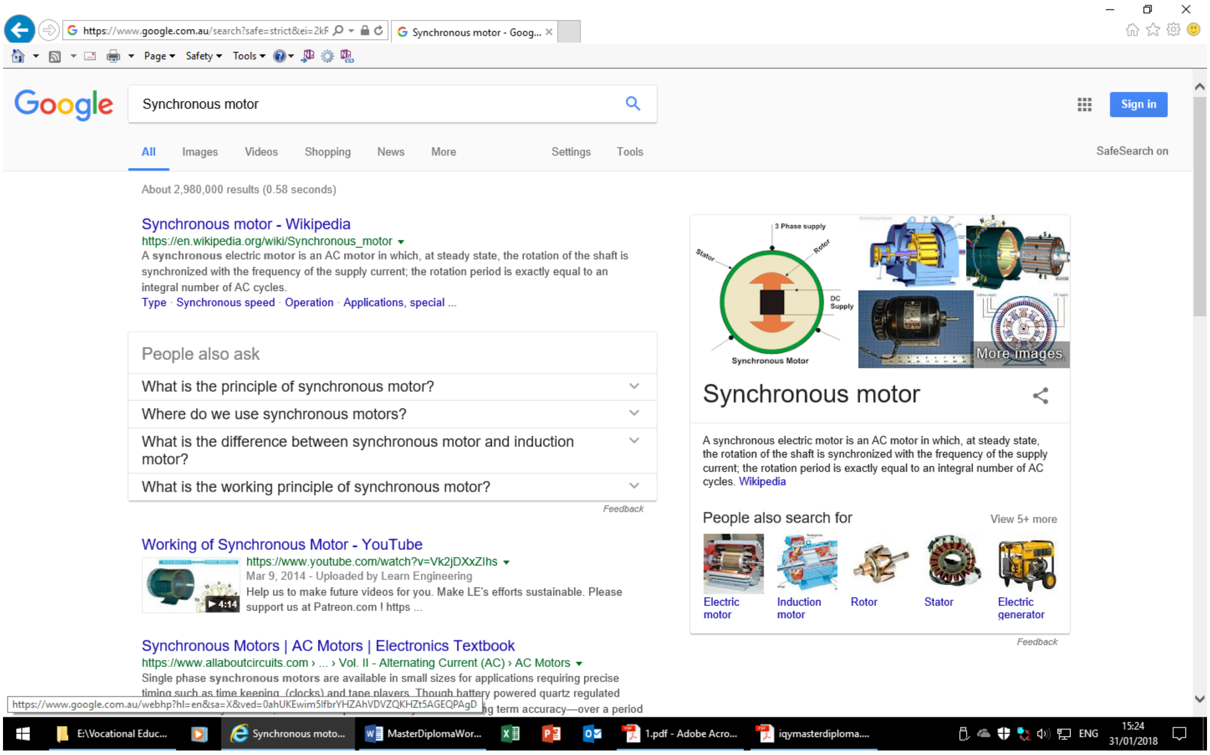

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Synchronous motor - Wikipedia
https://en.wikipedia.org/wiki/Synchronous_motor
A synchronous electric motor is an AC motor in which, at steady state, the rotation of the shaft is synchronized with the frequency of the supply current; the rotation period is exactly equal to an integral number of AC cycles.
Type · Synchronous speed · Operation · Applications, special ...

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- What is the principle of synchronous motor?
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https://www.allaboutcircuits.com › ... › Vol. II - Alternating Current (AC) › AC Motors
Single phase synchronous motors are available in small sizes for applications requiring precise timing such as time keeping, (clocks) and tape players. Though battery powered quartz regulated ... ng term accuracy—over a period

Synchronous motor

A synchronous electric motor is an AC motor in which, at steady state, the rotation of the shaft is synchronized with the frequency of the supply current; the rotation period is exactly equal to an integral number of AC cycles. Wikipedia

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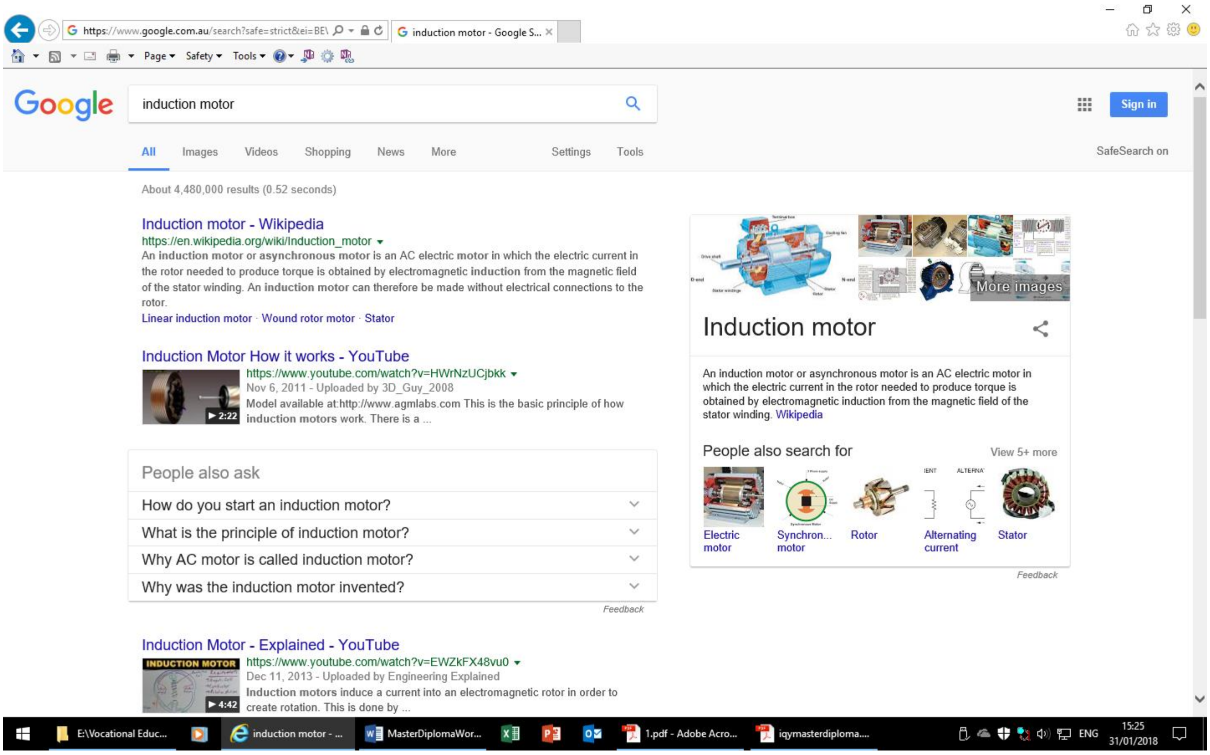

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https://en.wikipedia.org/wiki/Induction_motor
An **induction motor** or **asynchronous motor** is an AC electric **motor** in which the electric current in the rotor needed to produce torque is obtained by electromagnetic **induction** from the magnetic field of the stator winding. An **induction motor** can therefore be made without electrical connections to the rotor.
Linear induction motor · Wound rotor motor · Stator

Induction Motor How it works - YouTube
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