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Payback Calculator for IJ- and IJ-H for flanges

This payback calculator provides a method for calculating the payback period based on the energy saving to be made by fitting an insulation jacket type IJ- and IJ-H to a pair of flanges DN15 to DN80.
The method equates the cost of energy (to be agreed with end user), the cost of the insulation jacket (which may include the cost of installation) and the annual heat loss from the flanges (the ambient temperature is to be agreed with the end user).
The annual heat saving is determined from the graph.
Select the ambient temperature value on the x-axis and run a vertical line up to the operating temperature. Then run a horizontal line to the y-axis where the value of annual heat saving can be read.

For example, at an ambient temperature of 15°C and an operating temperature of 185°C the annual heat saving will be 2.3 GJ / year.

The payback period can be calculated using the following equations:

for **DN15** $P = \frac{J}{1\ SE}$

for **DN20** $P = \frac{J}{1.29\ SE}$

for **DN25** $P = \frac{J}{1.62\ SE}$

for **DN32** $P = \frac{J}{3\ SE}$

for **DN40** $P = \frac{J}{3.29\ SE}$

for **DN50** $P = \frac{J}{3.86\ SE}$

for **DN65** $P = \frac{J}{4.68\ SE}$

for **DN80** $P = \frac{J}{5.02\ SE}$

Where:-

S	=	Annual heat saving from graph	GJ
J	=	Cost of insulation jacket	£
E	=	Cost of energy	£ / GJ
P	=	Payback period	year

The equations are valid providing E and S are in the same units of energy and E and J are in the same units of currency.

Conversion factors
1 GJ = 1000 MJ
1 GJ = 9.48×10^5 BTU

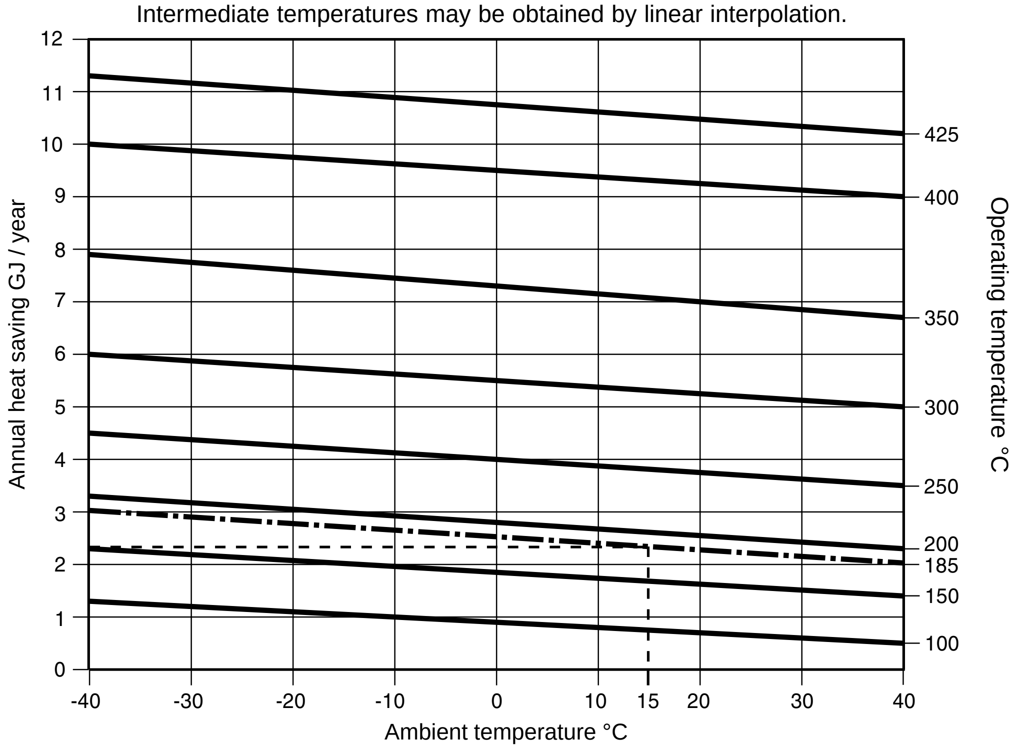
Example 1
Consider a DN15 operating at 10 bar g, 185°C with an ambient temperature of 15°C.
From the graph below the annual heat saving, S, is 2.3 GJ / year.
The cost of insulation jacket, J, including installation is assumed to be £45.

Customer informs us that cost of energy, E, is £5 / GJ

Hence:- $P = \frac{J}{1\ SE} = \frac{45}{1 \times 2.3 \times 5} = 3.9$ years

Note: The table overleaf gives exact values used to plot this graph.

Intermediate temperatures may be obtained by linear interpolation.



Annual heat saving in GJ per year versus temperature for various steam temperatures

These values are those used to plot the graph on the previous page

Ambient temperature	Steam temperature							
	100°C	**150°C**	**200°C**	**250°C**	**300°C**	**350°C**	**400°C**	**425°C**
-40°C	1.47	2.29	3.31	4.53	6.04	7.87	10.07	11.34
-35°C	1.40	2.21	3.23	4.46	5.96	7.80	9.99	11.27
-30°C	1.35	2.16	3.16	4.38	5.89	7.72	9.94	11.19
-25°C	1.30	2.11	3.11	4.33	5.83	7.67	9.86	11.11
-20°C	1.24	2.06	3.06	4.28	5.76	7.59	9.79	11.04
-15°C	1.19	1.98	2.98	4.20	5.68	7.52	9.71	10.96
-10°C	1.14	1.93	2.93	4.15	5.63	7.44	9.63	10.91
-5°C	1.09	1.88	2.85	4.08	5.55	7.39	9.58	10.83
0°C	1.02	1.81	2.80	4.00	5.50	7.31	9.51	10.76
5°C	0.96	1.75	2.72	3.95	5.43	7.24	9.43	10.68
10°C	0.91	1.70	2.67	3.87	5.35	7.16	9.35	10.60
15°C	0.86	1.63	2.61	3.79	5.27	7.11	9.28	10.53
20°C	0.81	1.58	2.55	3.74	5.22	7.03	9.20	10.45
25°C	0.76	1.53	2.47	3.67	5.17	6.96	9.12	10.40
30°C	0.71	1.45	2.42	3.59	5.10	6.88	9.07	10.32
35°C	0.66	1.40	2.34	3.51	5.02	6.83	9.00	10.25
40°C	0.61	1.35	2.29	3.46	4.94	6.73	8.92	10.17

Certain assumptions have been made to compile this data:

1. Still air conditions.
2. All heat loss is by radiation.
3. Surface metal temperature is equal to operating temperature.
4. 8 760 hours operation per year.

Effect of wind speed

The following table gives the approximate effect of air movement.

Wind speed km/h	Additional heat saving
11	16%
22	116%
33	156%
55	218%

Example 2

Example 1 provided a payback for still air conditions.
If the average wind speed was 22 km/h then the
annual heat saving, G, becomes 2.3 x 2.16 = 5 GJ / year

Hence:- $P = \frac{45}{1 \times 5 \times 5} = 1.8$ years