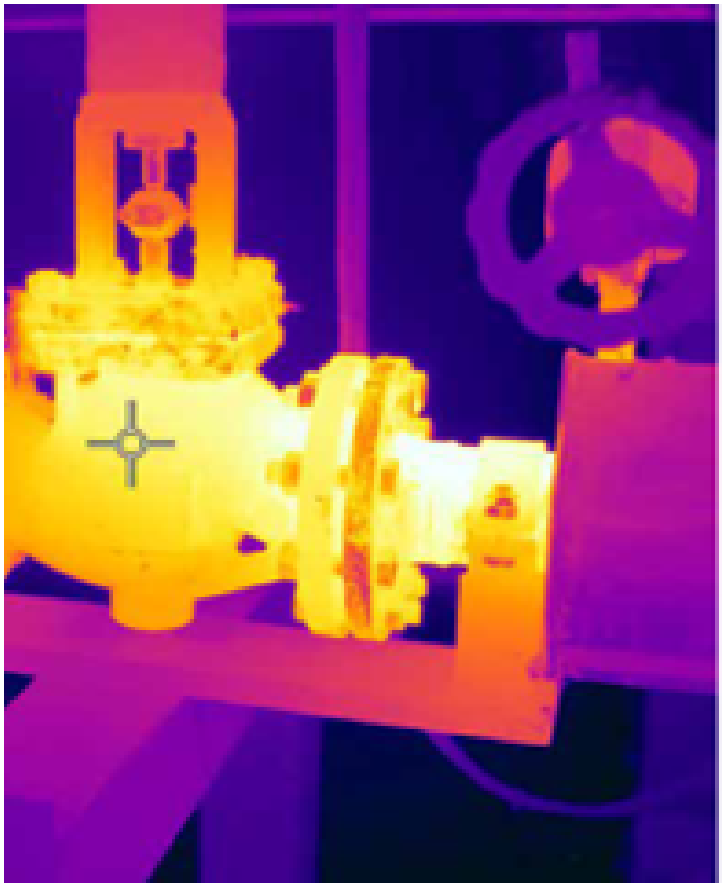
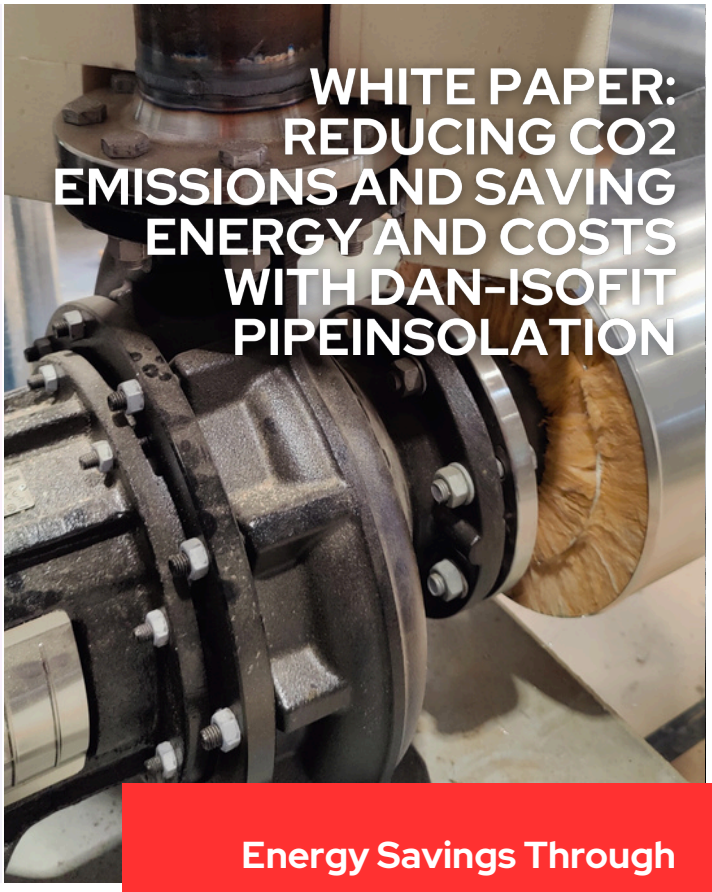




WHITE PAPER: REDUCING CO2 EMISSIONS AND SAVING ENERGY AND COSTS WITH DAN-ISOFIT PIPEINSOLATION

Energy Savings Through Better Insulation

Figure 1: Thermal imaging of a valve (from EiiF_WhitePaper_24-07)

Introduction

Industries today face the critical challenge of reducing their carbon footprint while simultaneously managing operational costs. One often overlooked yet highly effective solution is improving the insulation of industrial equipment, particularly valves, pumps and other non-standard pipe geometries, which are typically under-insulated or entirely uninsulated. This white paper explores how Dan-isoFIT pipeinsulation, an innovative insulation product, can play a pivotal role in reducing CO2 emissions, saving energy, and lowering operational costs for industries.

The Current Situation: Uninsulated Valves and Energy Loss

Due to the complexity of their geometry, valves, flanges, and other fittings in industrial systems are frequently left uninsulated, leading to significant energy losses. According to the European Industrial Insulation Foundation (EiiF), uninsulated valves can result in considerable thermal energy loss, which, in turn, increases both CO2 emissions and energy costs.

For example, a single uninsulated process valve operating at 150°C can lose up to 10,500 kWh of energy annually (EiiF_WhitePaper_24-07).

Dan-isoFIT pipeinsulation: The Smart Insulation Solution

Dan-isoFIT pipeinsulation are designed to address this specific issue by providing a robust, easy-to-install insulation solution for valves and other irregularly shaped equipment. The shells are pre-fabricated and tailored to fit specific valve types, ensuring minimal heat loss and maximum energy efficiency.

Benefits of Dan-isoFIT pipeinsulation:

Energy Savings: By insulating valves with Dan-isoFIT pipeinsulation, industries can significantly reduce energy loss. The EiiF reports that insulating a single valve can save up to 10,000 kWh of thermal energy annually (EiiF_WhitePaper_24-07). Over time, these savings compound, leading to substantial reductions in energy consumption.

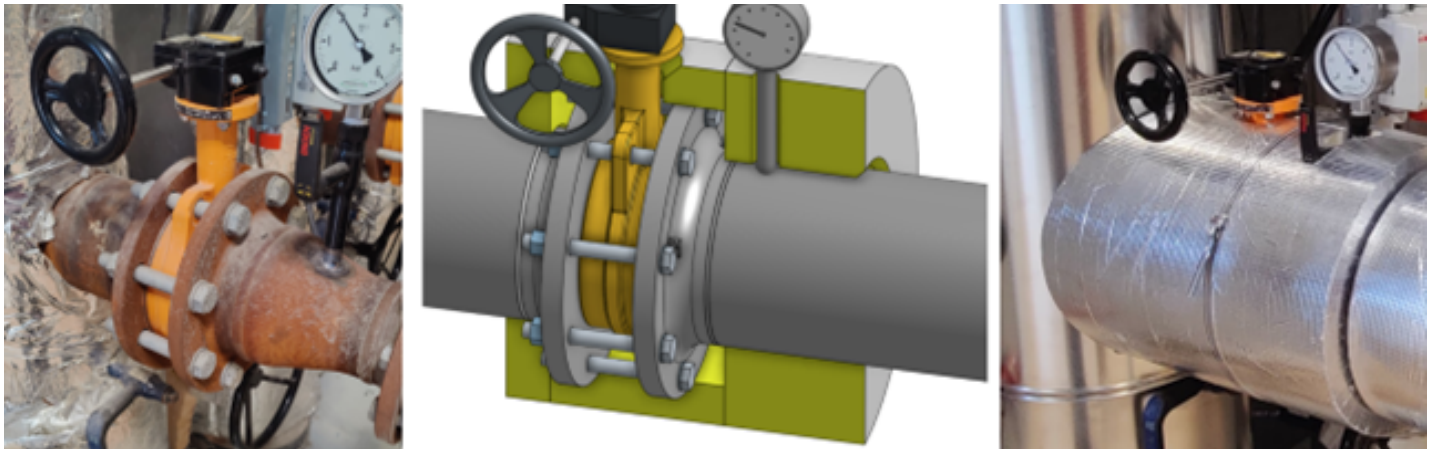


Figure 2: schematic of a Dan-isoFIT pipeinsulation designed for insulation of a valve flange connection fitted with a manometer.

CO2 Emission Reduction

Energy savings directly correlate with a reduction in CO2 emissions. For every 10,000 kWh of energy saved, approximately 2,000 kg of CO2 emissions can be avoided. Thus, widespread adoption of FIT-ISO-Shells could lead to a considerable decrease in the industrial sector's carbon footprint.

Cost Savings

The financial benefits of insulating valves are equally compelling. The initial investment in Dan-isoFIT pipeinsulation is quickly recovered through energy cost savings. For example, insulating 30 uninsulated valves could result in an annual energy cost saving of €8,000, with a payback period of less than one year (EiiF_WhitePaper_24-07).

Case study from industrial facility in the district heating sector

Improved Operational Efficiency: Insulated valves not only save energy but also contribute to maintaining optimal process temperatures, thereby improving overall operational efficiency and reducing the need for additional energy input to maintain desired temperatures.

A case study conducted by EiiF demonstrates the impact of technical insulation on uninsulated valves. After insulating 30 valves, the facility observed significant energy savings and a rapid return on investment.

Case Study: Background

An industrial facility in the district heating sector identified a significant opportunity to reduce energy losses by insulating uninsulated valves and flanges throughout their pump house. The facility had previously relied on minimal insulation, focusing primarily on process piping while neglecting valves, flanges, and other fittings. Over time, this oversight led to substantial energy wastage with the corresponding increase in CO2 emissions compared to an equivalent heat output.

Implementation of Dan-isoFIT pipeinsulation

The facility decided to retrofit 44 uninsulated valves (ranging in size from DN100to DN 250) with Dan-isoFIT pipeinsulation. The pipeinsulation were selected for their precise fit, ease of installation, and high insulating properties. The installation process was straightforward performed within hours and with no disruption to ongoing operations.

Assumptions

The energy savings obtained by the facility were calculated using the methods described by the DS/EN ISO 12241:2008 standard. According to this standard, the additional heat losses incurred by a flange connection shall be assessed by an increase in the pipe length called the equivalent length Dl.

The standard provides a list of equivalent lengths for DN flanges from DN 50 to DN500. The equivalent lengths span over a large range, since they must cover the effects of various temperatures and pressure stages, with flanges and fittings rated for higher pressures giving higher values.Table 1 below shows an excerpt from the standard with the relevant DN sizes.

DN size	Insulated In buildings at 20°C *Δl in m*	*Insulated* *In open air at 0°C* *Δl in m*	Uninsulated In buildings at 20°C *Δl in m*	Uninsulated In open air at 0°C *Δl in m*
DN 100	4-7	9-14	0,7-1,0	0,7-1,1
DN 150	4-9	11-18	0,8-1,1	0,8-1,1
DN 200	5-11	13-24	0,8-1,3	0,8-1,3
DN 300	6-16	16-35	0,8-1,4	0,8-1,4

Table 1: Excerpt from Table A.1-Equivalent length for installation-related "thermal bridges", as presented in DS/EN ISO 12241:2008.

The standard states that "to be on the safe side, use the highest value". In the present document, the estimates for energy savings will be calculated using the most conservative value, i.e. the lowest loss value for the uninsulated installation will be compared to the higher loss value of the insulated installation. The equivalent length values utilized for estimating the uninsulated installation losses are shown in the table below, along with the number of uninsulated flanges of each type, present in the pump house. It is worth noting that the standard does not specify a value for DN250 flanges, so the lowest value for DN300 has been used.

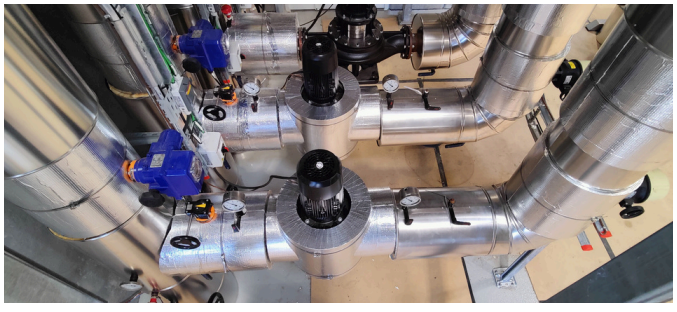
DN size	Utilized uninsulated *Δl in m*	Quantity	Total length *Δl in m*
DN 100	4	2	8
DN 150	4	8	32
DN 200	5	26	130
DN 250	6	8	48

Table 2: values of equivalent length for the uninsulated heat loosed used for estimating total heat losses in the installation

The equivalent length values used for the estimation of heat losses in the insulated installation are presented in Table 3.

DN size	Utilized insulated *Δl in m*	Quantity	Total length *Δl in m*
DN 100	1	2	2
DN 150	1.1	8	9.8
DN 200	1.3	26	33.8
DN 250	1.4	8	11.2

Table 3: values of equivalent length for the insulated heat loosed used for estimating total heat losses in the installation.



Input Parameters

The energy losses have been estimated using the methods established by the DS/EN ISO 12241:2008 standard. With the following parameters:

Property	DN100	DN150	DN200	DN250
Ambient temperature	30C	30C	85C	85C
Media temperature	85C	85C	85C	85C
Pipe diameter	114mm	168mm	219mm	273mm
Total equivalent length, uninsulated	8m	32m	130m	48m
Total equivalent length, insulated	2m	8.8m	33.8m	11.2m
Pipe external surface	Oxidized steel	Oxidized steel	Oxidized steel	Oxidized steel
Forced convection	No	No	No	No
Pipe orientation	Horizontal	Horizontal	Horizontal	Horizontal

Table 4: input parameters for calculation of heat losses.

Based on the input parameters above, the following heat losses may be estimated for the installation:

Property	DN100	DN150	DN200	DN250	Total
Heat loss uninsulated	1769W	9923W	50882W	22814W	85388W
Heat loss insulated	442W	2729W	13229W	5323W	21724W
Difference	1327W	7194W	37653W	17491W	**63665W**

Table 5: estimated heat losses by flange connection diameter and totals.

By a conservative estimate, the insulation installed on all flanges is expected to prevent the loss of ~63.6 kW of heat. The facility emits an average of 95.4g of CO2 per kWh produced. This means the heat that is prevented from escaping the system is equivalent to 6.073kg of CO2 per hour of operation, assuming all flange connection are fully operational.

It is important to remark that most of the flange connection also included valves and other components that would increase heat losses beyond the scope contemplated by standard. The values provided in Table 5 are thus very conservative.

Case study findings

Energy Savings

After the installation of Dan-isoFIT pipeinsulation, it is estimated that the facility can save at reduce the energy losses to the surroundings by at least 63.6 kW provided the complete installation is running. If an 80% utilization is assumed to account for the fact that not all the insulated valves and flanges are heated all the time, the expected reduction in energy losses is equivalent to 446.1 MWh.

CO2 Emission Reduction

With the assumptions presented above, the energy losses prevented by insulating the installation are equivalent to 42.56 tons of CO2. In 2025 Denmark will introduce a CO2 tax for all industrial activities. The tax for entities covered by the EU Emissions Trading System will start at 825 DKK in 2025 and reach 1125 DKK in 2030. This means the conservative CO2 equivalent estimated in this document would amount to 35 115 DKK in 2025 and 47 884 DKK in 2030.

Operational Efficiency

It is worth noting that the installation of Dan-isoFIT pipeinsulation did not in any way hampered the normal operation of the facility.

The case study clearly demonstrates the value of investing in Dan-isoFIT pipeinsulation for insulating industrial valves. The solution not only provided a rapid return on investment but also delivered ongoing savings and environmental benefits. This case highlights the potential for significant operational improvements when technical insulation is applied comprehensively, especially in areas like valves and fittings that are often overlooked.
This case study serves as a compelling example for other industries considering similar upgrades, showcasing how a relatively small investment in high-quality insulation like Dan-isoFIT pipeinsulation can yield substantial long-term benefits.

Dan-iso A/S
Insulating & Saving Energy

White Paper
2024

CONCLUSION:
A Win-Win-Win Solution

Implementing Dan-isoFIT pipeinsulation is a smart, cost-effective strategy for industries aiming to reduce their carbon footprint, save energy, and lower operational costs. As industries face increasing pressure to decarbonize and improve energy efficiency, products like Dan-isoFIT pipeinsulation will become essential components of sustainable industrial practices.

By adopting this innovative insulation solution, industries can contribute to global climate goals while enhancing their own operational efficiency and profitability.

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Sources
EiiF WHITE PAPER 07 – 2024, European Industrial Insulation Foundation / Thermal insulation for building equipment and industrial installations Calculation rules (ISO 12241:2008) / Fjernvarmedeklaration 2023