

Policy Guidelines for Motor Driven Units

Part 1: Analysis of standards and regulations for pumps, fans and compressors

Motor systems are responsible for 47% of global electricity consumption. A Motor Driven Unit converts electrical power into rotational mechanical power and may consist of the following individual components: variable frequency drive, electric motor, mechanical equipment (gear, belt, clutch, brake, throttle) and a driven application (pump, fan, compressor, transport) (see Figure 1).

The global annual energy consumption of pumps, fans and compressors is estimated at 6,560 TWh, which is larger than the total electricity consumption of China. An MDU with energy efficient individual components matched together to meet the required task is able to deliver energy savings of 20% to 30%. Experience indicates that governments can stimulate the development and adoption of more energy efficient components and MDUs through implementing Minimum Energy Performance Standards (MEPS).

This document summarises the first part of an investigation into policy options for harmonising standards and regulations for Motor Driven Units (MDUs), focusing on pumps, fans and compressors. Part 1 describes existing standards and regulations for MDUs in economies that account for 85% of global motor system electricity use.

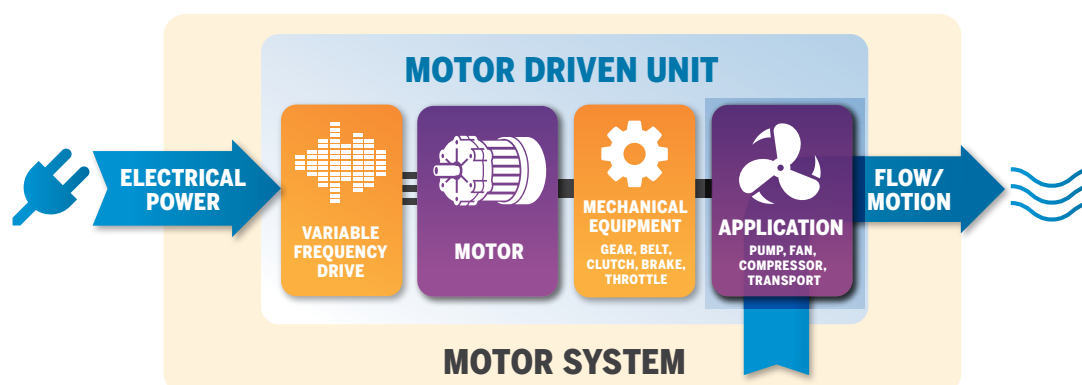


FIGURE 1: Motor Driven Unit definition. The purple boxes are components that are always part of a MDU

Major findings

- The differences in product definitions and/or product categories, efficiency metrics, test methods, how calculations are conducted, the specification of load and other parameters in national regulations, hinder analyses and international comparisons.
- MEPS regulations specify the efficiency of the target application (e.g. pump, fan) and measurement method, and when other components are present these are typically accounted for by default values and/or calculated values. This may not encourage the most efficient MDUs.
- Although regulators typically examine existing MEPS from other regions when preparing new or revised regulations, there appears no structured way of sharing intelligence or co-ordinating amongst regulators.
- For pumps, fans and compressors above 5 kW, many countries find it easier to define and implement individual component regulations. While regulations for a MDU system is much more complex and challenging to enforce, it offers the potential for greater energy savings.
- The following policies for MDUs that are now under development or scheduled for revision provide opportunities for improved alignment:
 - » Compressors (under development in the EU and USA).
 - » Fans (under revision in the EU, under development in the USA, under consideration in China).
 - » Pumps and motors (under revision in the EU, under development in the USA).

Policy Guidelines for Motor Driven Units - Part 1

EXECUTIVE
SUMMARY

This study covers the following economies, accounting for 85% of global electricity use: Australia, Brazil, Canada, China, European Union (EU28 plus Switzerland, Norway and Turkey), India, Japan, Korea, Mexico, New Zealand, Russia, Saudi Arabia, South Africa and USA.

As of 2016 (see Table 1):

- 11 of the 14 countries studied have MEPS for motors.
- 4 countries have MEPS for pumps.
- 3 countries have MEPS for fans.
- 1 country has MEPS for compressors.

TABLE 1: Overview of existing regulations for MDUs in main economic regions

Region (ranked by electricity use of motor systems)	Presence of Regulations (*)				% of global electricity use of motor systems
	Motors	Pumps	Fans	Compressors	
China					28.3%
USA					15.6%
EU28 *					15.0%
India					5.0%
Japan					4.4%
Russia					4.1%
Korea					2.7%
Brazil					2.5%
Canada					2.3%
Mexico					1.4%
South Africa					1.2%
Saudi Arabia					1.0%
Australia					1.0%
New Zealand					0.2%
% Global electricity use by motor systems covered by regulations	76%	60%	43%	28%	85%

Notes

- = regulations in place
- ▨ = regulations under development
- 💧 = regulations for swimming pool pumps
- ⚙️ = regulations for domestic small fans

* Including Norway, Switzerland and Turkey

(Source: CLASP's Global S&L Database, April 2016; World Bank 2014; IEA 2014.)

Local Variations in MDU Regulations

The current variety of regulated performance requirements across regions impairs the international trade of products. The use of different terminology and definitions related to MDUs across regions makes it difficult to compare standards and regulations applied in different countries and can lead to confusion.

The MEPS for each type of MDU (within the categories pumps, fans and compressors) show significant differences across countries regarding the:

- **Product Definitions** – how MDUs are defined.;
- **Scope** – the components included in the MDU;
- **Metrics** – the determination of energy efficiency;
- **Methodology** – how the different components are included: default values, reference or test values, measured, calculated.

There is a wide spectrum of **product definitions** in regulations for MDUs (within the categories pumps, fans and compressors). Some of this is explained by differences in climate and domestic markets (e.g. swimming pool pumps, fan systems, air conditioners), others by differences in the type of technology base used by local manufacturers (e.g. fans together with motor and without).

For pumps, which are most widely covered by MEPS, there are considerable differences in **scope**. In China, regulation for clean water pumps considers only one individual component, the impeller of a pump. The EU has two separate regulations for circulators and clean water pumps. For circulators the entire MDU of the integrated product is included; while for clean water pumps only the bare pump is included. In the USA the entire MDU is considered in the pump regulation, however, it applies to the MDU “as manufactured”, i.e. this may include the bare pump, the motor and pump or the variable frequency drive, motor, pump.

In China, both the regulation for industrial fans and for centrifugal blowers consider only the fan as an individual component; while the EU considers all components within two different regulations: one for “fans driven by motors” and one for “ventilation units”. In the USA, MEPS for industrial fans is under development.

Regulation for compressors is in place in China, and includes the compressor itself. In the EU and USA, regulations for air compressors are under development.

The **metrics** and **methodologies** used to define efficiency within MEPS also differ between countries. China uses input/output metrics in all types of MDU. In the EU and USA, the efficiency metric used for clean water pumps is aligned (hydraulic pump efficiency), but there are differences in the calculation methodology. For circulators the EU uses a relative efficiency index.



FIGURE 2: Fan-MDU: motor and fan
(Source: ebm papst, 2016)

The Roll of International Standards

Many regulations for MDU-components (like motors, pumps) build on international IEC and ISO standards to define testing methods and performance classifications. In some cases countries adopt these standards without change into national standards, in other cases countries make alterations depending on specific national circumstances.

As countries/regions (EU, US) seek to establish minimum efficiency requirements for complete MDUs, they also consider appropriate testing, calculation methods and performance requirements. International standards for complete MDUs are not as advanced as for MDU-components and the need for further work in this area is evident, as illustrated by the development of ISO 12759 standard for fans, which originated from the EU regulations for circulators and fans.



FIGURE 3: Three pump-MDUs. Composition of one unit (from left to right): pump, mechanical equipment (clutch), motor (Source: Impact Energy, 2016)

Part 2 of this Study

Further analysis will be undertaken to identify in more detail the differences of the standards and policies under development, in effect or under revision, in Part 2 of this study. An action plan will be formulated for advancing and harmonising MDU standards and regulations, covering components and MDUs and how to formulate policies for MDUs in new installations. The focus will be on those MDUs where most impact can be expected in the short term, and where regulators are aiming to develop or revise existing MEPS.

Further Information

▶ A copy of the full report is available [here](#)

