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Explosion-proof requirements for Electrical Machines in Chemical, Oil and Gas Industry in Russia and CIS Countries

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ABSTRACT

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Explosion-proof requirements for Electrical Machines in Chemical, Oil and Gas Industry in Russia and CIS Countries

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One of the main industries which form the basis of Russian Economical structure is oil and gas. This industry is also playing a significant role for CIS countries. Oil and gas industry is developing intensively attracting foreign investments. This situation is providing sustainable development of machinery production for hazardous areas. Operating in oil and gas areas is always related with occurrence of explosion gas atmospheres. Machines for hazardous areas must be furnished with additional protection of different types. Explosion protection is regulated with standards according to which equipment must be manufactured. In Russia and CIS countries explosion-proof equipment must be constructed in compliance with GOST standards. To confirm that equipment is manufactured according to standards' requirements and is safe and reliable it must undergo the approval procedure. Certification in Russia is governed by Federal Laws and legislation. Each CIS country has its own approval certificates and permissions for operating in hazardous areas.

PREFACE

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ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ATEX	Appareils destinés à être utilisés en Atmosphères Explosibles
AZS	State Standard of Republic of Azerbaijan
AZSTAND	State Agency on Standardization, Metrology and Patents of Azerbaijan Republic
BU	Business Unit
CIS	Commonwealth of Independent States
CSEx	Certification Scheme for Ex-Equipment in Russia
COG	Chemical, Oil and Gas
DERZHPOZHYVASTANDART	State Committee of Ukraine for Technical regulation and consumer policy
DSSU	Derzhpozhyvstandart
EPC	Engineering Procurement Construction-company
EU	Europe Union
FDI	Foreign Direct Investment
FEED	Front End and Engineering Design
FISCO	Fieldbus intrinsically safe concept
FNISCO	Fieldbus non-incentive concept
GOSPOZHNADZOR	State Fire Supervising Department of Russia
GOSPROMNADZOR	Ministry on Emergency Situations of Republic Belarus
GOSSTANDART	State Committee for Standardization of the Republic of Belarus
GOST	State Standards
GOST-K	State Standard of Republic of Kazakhstan
GOST-R	State Standard of Russian Federation
HDPE	High Density Polyethylene
IEC	International Electrotechnical Commission

IECEx	IEC System for the certification to standards for Electrical Equipment for Explosive Atmospheres
ISO	International Organization for Standardization
KAZMEMST	Committee for Standardization, Metrology and Certification in Kazakhstan
NEMA	National Electrical Manufacturers Association
OEM	Original Equipment Manufacturer
OPK	Russian Product Classification
ROSPOTREBNADZOR	Russian Federal Service for Supervision in the Area of Consumer Rights and Welfare Protection
ROSTECHNADZOR	Ministry of National Resources and Environment of Russian Federation
ROSTECHREGULIROVANIJE	Federal Agency for Technical Regulation and Metrology of Russia
RTN	Rostechnadzor
STB	Sate Standard of Republic of Belarus
TC	Technical Committee
TNVED	International Trade Classification
UkrSEPRO	Certification System in Ukraine
US	United States
VSD	Voltage Source Drive
PB	Mining Explosion Safety (Rudnichnoje vzryvobezopasnoje)
PO	Special Mining Explosion Safety (Rudnichnoje osobovzryvobezopasnoje)
РП	Increased Mining Explosion Safety (Rudnichnoje povyshennoj nadezhnosti protiv vzryva)

INTRODUCTION

Our society is deeply embedded in an oil powered economy. Mobility, agriculture, distribution of food and many other fields of industries are all dependent on plentiful and reliable oil supplies. Russia has a wide natural resource base including major deposits of oil, natural gas and other important strategic material. Chemical, Oil and Gas Industry is playing significant role in the economical structure of the country. This industry is an attractive area for global investments. A lot of manufacturers of explosion-proof equipment are willing to achieve this market offering a wide range of products for COG Industry.

Equipment for hazardous areas is liable to national certifications and permitting systems. These certificates and authorities are issued by relevant authorities and approve that Ex-Equipment is in compliance with national Standards and Rules. On the territory of Russian Federation is a special system of State Standards – GOST. It is of utmost importance to clarify what kind of discrepancies are between Russian and International Standards according to which are produced Ex-Motors in Europe. The other challenging task is to understand what the approval system in CIS countries is. Is it possible to sell equipment in Kazakhstan and Belarus if the company has already certified its equipment in Russia?

Russia has a special way of historical development - long time of state-controlled economy during the Soviet Union period and then hard period of reformations and transitional economy. Self-evidently this is bound to be reflected in current way of doing business Russia. What are the main factors which play significant role for decision makers? Are there any special requirements for Ex-Equipment in Russia considering geographical location and climate conditions of the country? What are the most promising fields for supply of Ex-Equipment?

The answers to the series of above mentioned questions may be found on the pages of the work that you hold in your hands.

1. CHEMICAL, OIL AND GAS INDUSTRY

1.1 Segment description

ABB has been manufacturing high quality electric motors and generators for more than 100 years. ABB is the world's leading supplier to Chemical, Oil and Gas (COG) Industries. Motors for hazardous areas represent one of ABB's special areas of focus. Working together with major companies in the oil and gas, petrochemical and chemical industries, ABB has developed a comprehensive range of products that offer safety, reliability and energy efficiency. (www.abb.com)

COG Industry segment includes all applications, systems and their support facilities whose investments are primarily driven by investments in upstream, midstream, downstream or petrochemicals, chemicals and pharmaceuticals projects, Figure 1.

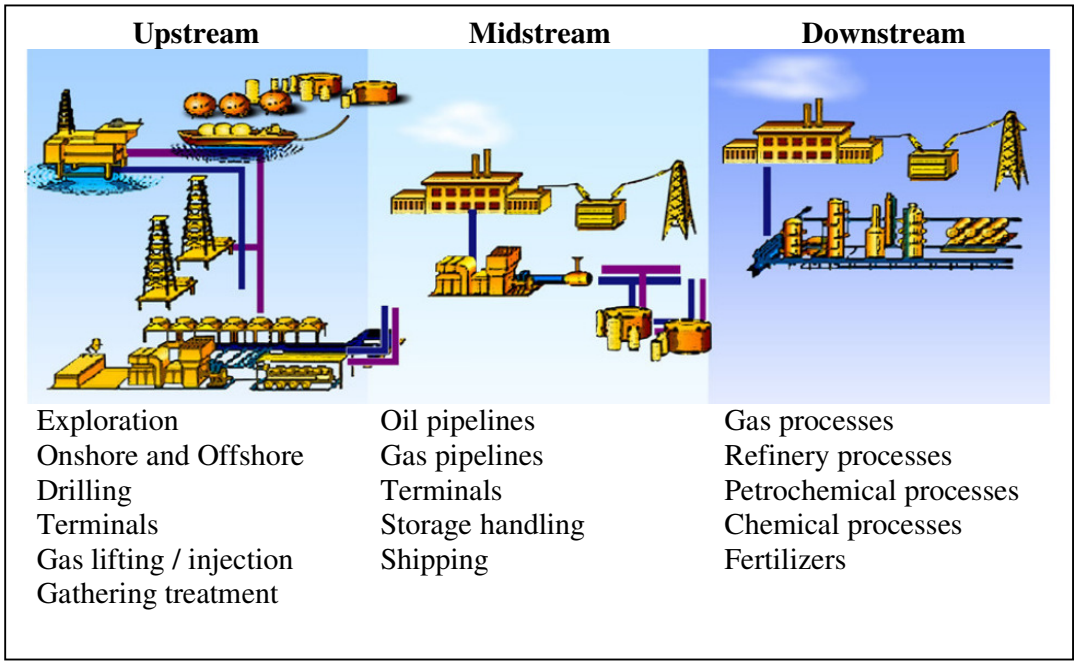

Figure 1 COG Processes

Source: Jussi Rautee, 2009

The terminology is briefly explained in the following:

- Upstream – applies to oil and gas exploration and production from the reservoir up to the surface. It can be onshore or offshore.
- Midstream – is now used for the pipelines and terminals to connect wells to the downstream facilities.
- Downstream – starts as soon as crude oil and gas are separated and transformed in up graders or refineries.
- Petrochemicals, Chemicals and Pharmaceuticals – covers all transformations after the refineries from olefins to fibers or tablets or powders.

Hydrocarbon supply chain includes such stages as production, processing, transportation, storage and distribution of the oil products. Operations may be implemented in the field, on a platform, at the terminal, along the pipeline, in the refinery, or in the boardroom. In the processes there are locations where hydrocarbon vapours may have a concentration that can ignite e.g. by minimal electrical sparking. Such areas are called hazardous areas. In hazardous areas explosion-proof electrical machines (Ex-Machines) must be used. The final objective of Ex-Machines is to keep oil and gas moving from the wellhead to the customer.

When speaking about Oil and Gas Industry a number of special terms and definitions are used. They are as follows:

- End User of COG equipment runs the operation in the oil and gas extraction, transportation and supply to customer.
- Consultant helps the End User to define the “Basic Design” or “Front End Engineering and Design” (FEED). Has a strong influence on the specifications of future projects.
- Contractor constructs a part of or the whole project in respect with the specifications defined above.
- Original Equipment Manufacturer (OEM) – produces equipment for COG Industry. Such equipments are pumps, fans, compressors. They incorporate in

their own equipments Automation Products according to specifications and vendors lists defined by End Users.

- Systems Integrators build complete systems in integrating large quantities of components. These components may come from ABB or other companies. (Jussi Rautee, 2009)

For Hazardous Areas ABB offers a wide range of low and high voltage motors for different protection types, certified according to all major standards. An example of one of the manufactured motors is on the Figure 2.

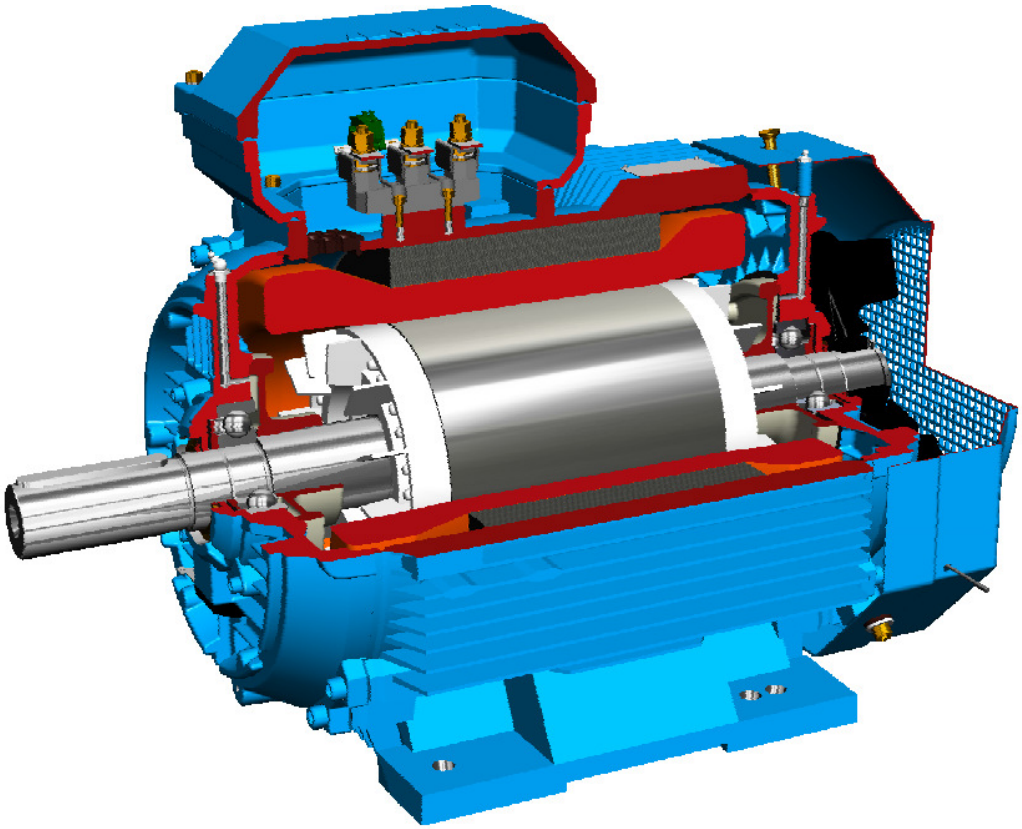

Figure 2 Induction Machine for Hazardous Areas manufactured by ABB
Source: www.abb.com

Induction Machines for Hazardous Areas have an additional protection that allows them operate in explosion atmosphere where is a high risk of igniting.

1.2 Classification of Hazardous Areas

In hazardous areas, it is the utmost importance to ensure the safe use of electrical apparatus. To this end, many countries have regulations concerning both the design and use of such apparatus. These regulations are becoming increasingly harmonized within the framework of International Electrotechnical Committee (IEC) recommendations and European Standards. The hazard may be due to an explosive atmosphere composed of a mixture of gas, vapours or dust with air. (Brenon, 2001)

Hazardous areas worldwide are classified by zone, according to the risk posed by explosive gas in the atmosphere. They have similar definitions in the GOST-R Certification system of electrical equipment for explosive atmospheres and International IECEx Scheme for certification to standards relating to electrical equipment for explosive gas atmospheres. (Klausmeyer, 2002) On the Figure 3 the description of hazardous areas is shown.

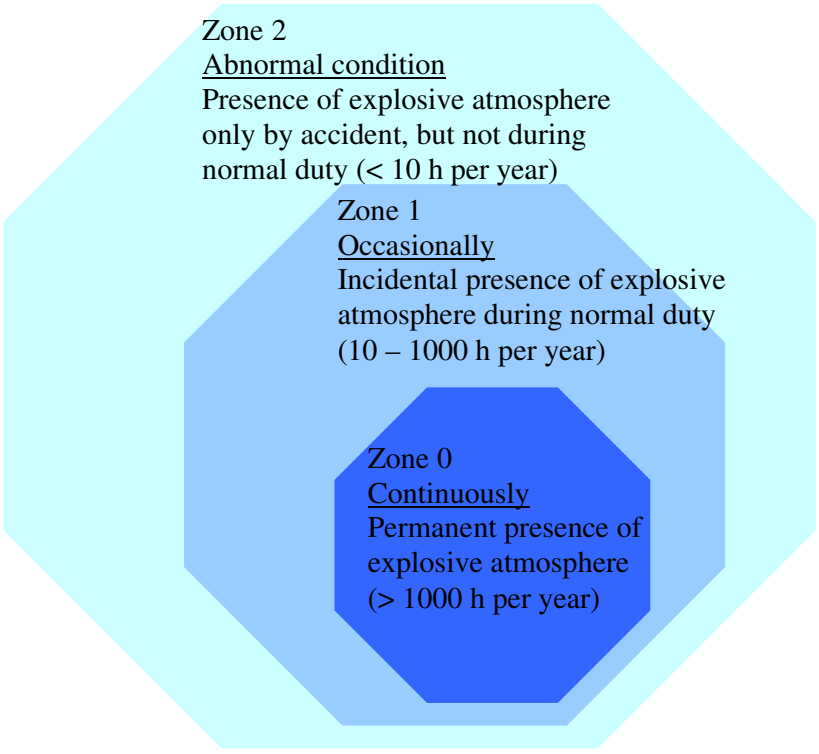

Figure 3 Hazardous areas according to the IEC/GOST classification

Currently in Russia two classifications are used at the same time. New classification is according to the GOST-R (see chapter 2) and the old one is according to the "Electric installation code", 2002 (Pravila Ustanovki Elektroustanovok – PUE). PUE was regulating the classification of hazardous areas for equipment. Currently it is not cancelled and operates in parallel with the GOST-R requirements. This is connected to the fact that during long period the classification of hazardous areas in Russia was carried out in accordance with PUE. Thus, on many operating and renovated facilities this classification is valid. Therefore, explosion-proof equipment should be selected in accordance with the requirements set in PUE. Figure 4 shows the description of hazardous areas represented in both classifications. (Lipavsky, 2005)

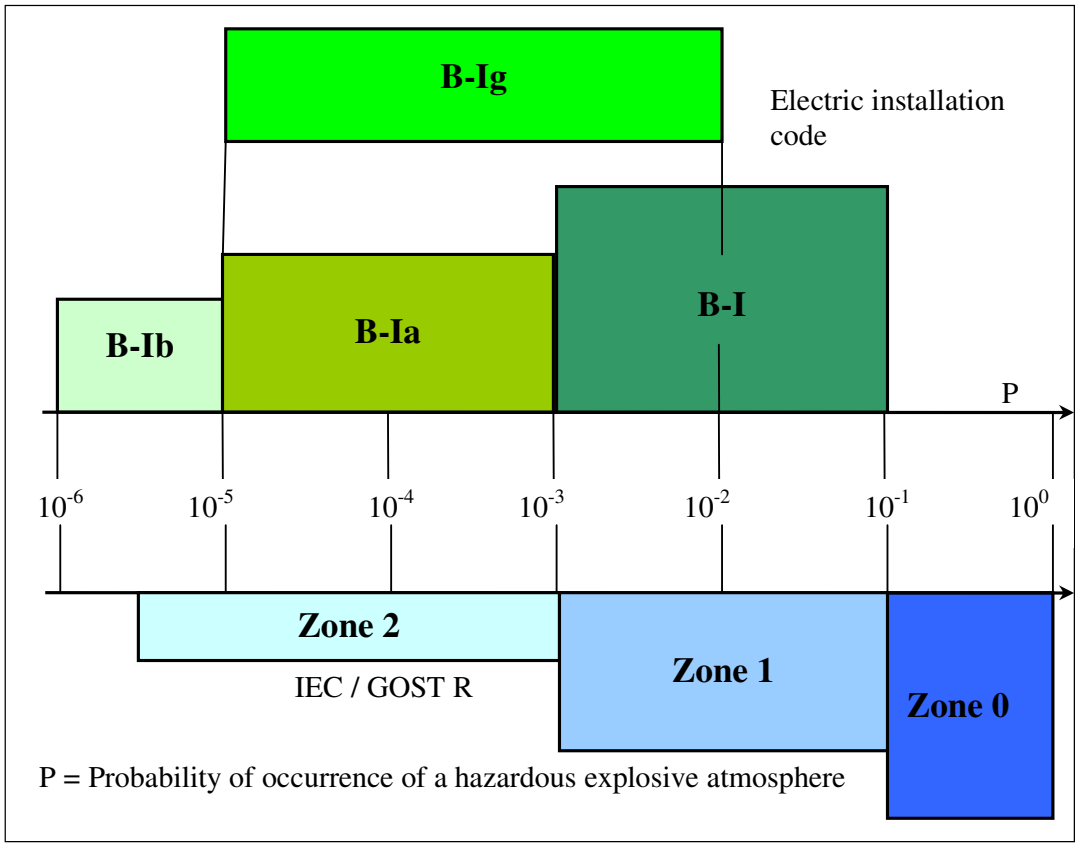

Figure 4 Classification of hazardous areas into Zones on the basis of the old and new Russian Standards

According to the PUE hazardous areas for electrical apparatus of Group II are classified as follows:

- Zone B-I - buildings where explosive mixtures of flammable gases or vapours with air can be present in normal operation.
- Zone B-Ia - industrial buildings where explosive mixtures of flammable gases or vapours with air can occur.
- Zone B-Ib –- industrial buildings where explosive mixtures of flammable gases or vapours with air can appear because of break-downs or faults, but with the following peculiarities:
    - Flammable gases have high lower concentration limit of the explosive range (15 % and more) and strong smell e.g. ammonia.
    - Industrial buildings only have explosive areas in their higher parts and during the technological process explosive mixture in the amount over 5 % of free volume of industrial buildings cannot occur.
    - Areas in laboratories and other rooms where flammable gases and vapours are present in small quantities insufficient to produce explosive mixture in a volume exceeding 5 % of free volume of the rooms.
- Zone B-Ig - areas near outdoor installations: process plants containing flammable gases and vapours; surface and underground tanks; open oil-removers. Dependent on the design of a specific plant and properties of gases and vapours, the hazardous area is considered to exist; within 0.5 m to 20 m.
- Zone B-II - areas in industrial buildings where combustible dusts and fibres can occur and form explosive mixtures with air in normal operation.
- Zone B-IIa - areas in industrial buildings where combustible dusts and fibres can only occur because of break-downs and faults. (See GOST-R 51330.9-99 (IEC 60079-10-95)

In accordance with the GOST-R standards the user guide for the electrical equipment must describe in details the explosion-proof facilities and means and measures for their installation, maintenance and repair. (Electrical Installation Code, 2002)

1.3 Classification of Ex-Machines

According to GOST standards explosion-proof electrical equipments are divided into two groups: Group I – mine equipment including that for mines susceptible to firedamp; and Group II, explosion-proof electrical equipment for outdoor and indoor installation (other than mines). There are different types of explosion protection in hazardous areas, Table 1.

Table 1 Protection types of Ex-Motors for explosive gas atmospheres

Type of explosion protection		**Schematic representation**	**Definition**	**GOST-R**
Increased safety 'e'	**e**		Additional measures are applied to increase the level of safety, thus preventing the possibility of excessive temperatures and the occurrence of sparks or electric arcs within the enclosure or on exposed parts of electrical apparatus, where such ignition sources would not occur in normal service or under specified abnormal conditions.	IEC 60079-7 GOST-R 52350.7
Flameproof enclosure 'd'	**d**		Parts which can ignite a potentially explosive atmosphere are surrounded by an enclosure which withstands the pressure of an explosive mixture exploding inside the enclosure, and prevents the transmission of the explosion to the atmosphere surrounding the enclosure.	IEC 60079-1 GOST-R IEC 60079-1
Pressurization 'p'	**p**		The formation of a potentially explosive atmosphere inside a casing is prevented by maintaining a positive internal pressure of protective gas in relation to the surrounding atmosphere and, where necessary, by supplying the inside of the casing with a constant flow of protective gas acting to dilute any combustible mixtures.	IEC 60079-2 GOST-R 52350.2

Type of protection 'nA'	**nA**		Electrical apparatus cannot ignite an explosive atmosphere surrounding them (in normal operation and under defined abnormal operating conditions).	IEC 60079-15 GOST-R 52350.15

The term "explosion protection level" basically corresponds to the stipulation regarding the Equipment Category in European Directive 94/9/EC but with different numbering, a different assignment of the types of protection, and a different grading in the underground sector. Neither is there a direct assignment of level of protection 0, 1 and 2 to Zone 0, 1 and 2. The GOST-R 51330.13-99 Installation Regulations define the types of protection to be used in the particular Zone. This corresponds to the stipulation in IEC 60079-14. Explosion-proof electrical equipments are subdivided into different groups by the level of protection.

Explosion protection level 2. Electrical equipment of improved safety. This equipment is explosion-proof in normal operation. Electrical equipment ensuring a normal level of protection (the number 2 for apparatus of Group II and the combination of Cyrillic letters 'PB' for Group I are added in the explosion protection marking). This relates to explosion protected electrical apparatus for which explosion protection is guaranteed under normal operating conditions. This explosion protection level can be guaranteed by the following types of protection: 'ia', 'ib', 'ic', 'px', 'pz', 'q', 'e', 'n', 'd', 'o', 's'.

Explosion protection level 1. Explosion-proof electrical equipment. This equipment is explosion-proof both in normal operation and in case of probable faults except in the means of explosion protection. Explosion protected electrical equipment ensuring a high level of protection (The number 1 for electrical apparatus of Group II and the combination of Cyrillic letters 'PII' for Group I are added in the explosion protection marking). The means of protection related to this equipment ensures the requisite level of protection, even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account. This explosion protection level may be guaranteed by the following types of protection: 'ia', 'ib', 'px', 'd', 's'.

Explosion protection level 0. Extra-explosion-proof electrical equipment. This equipment has additional means of protection in comparison with explosion-proof electrical equipment according to standards for types of protection. Special explosion protected electrical equipment with a very high level of protection (the number 0 for electrical apparatus of Group II and the combination of Cyrillic letters 'PO' for Group I are stated in the explosion protection marking). This relates to explosion protected electrical apparatus on which additional protection measures are taken using a standardized type of protection. This explosion protection level may be guaranteed in the case of the following types of protection: 'ia', 's'.

According to the preferences of Russian customers of Ex-Machines the protection type 'd' is most commonly used. For high power systems (> 2,000 kW) the protection type 'p' is used. The protection type 'e' is used very rarely in Russia – just in case of application for Ex-Machines for drilling equipment. In the following table you can see the European classification of the protection for explosion-proof equipment. It is recognized in Russia and is outlined in the certificates of Ex-Machines. (Zverev, 2009)

PUE specifies which Ex-Machine protection degree may be used in which hazardous areas. Table 2 lists the correlation between hazardous areas and degree of protection.

Table 2 Allowable degree of explosion-proof protection

Hazardous area zone	**Degree of protection**
B – I, B – II	Explosion-proof – Level '1' Extra-explosion-proof – Level '0'
B – Ia, B – Ig	Increased safety – Level '2'
B – Ib, B – IIa	Low level of protection

1.4 Marking of equipment

Marking of explosion-proof electrical equipment is provided in accordance with GOST-R 51330.0-99 (IEC 60079-0-98). Figure 5 shows an example of marking for electrical equipment 1ExdIIAT3.

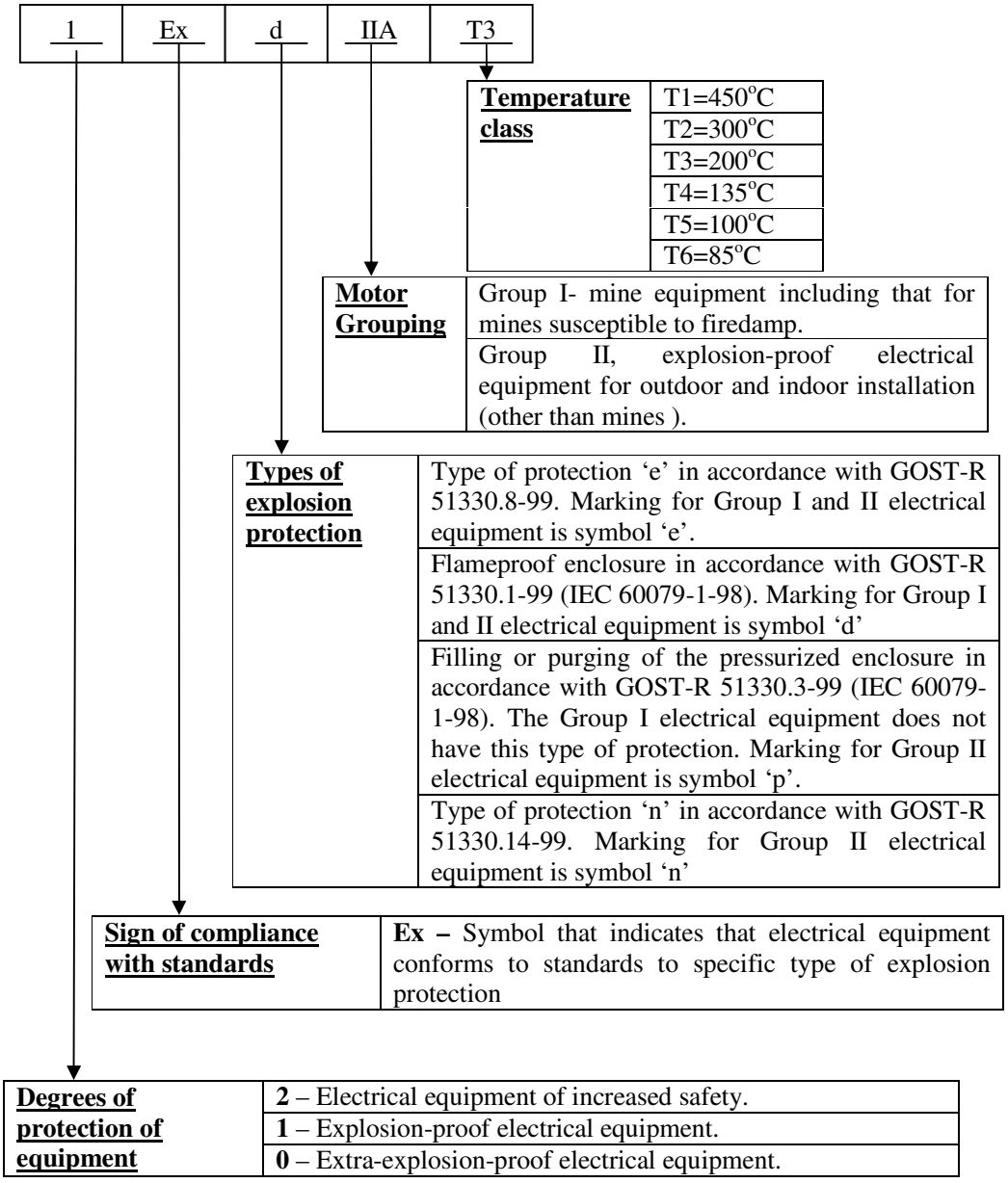

Figure 5 Marking according to the GOST-R standards

Each chemical gas or vapour on the refinery or chemical works comes under a certain gas group, Table 3.

Table 3 Groups of Electrical Equipment for different gases

Group	**Representative Gases**
IIA	Industrial methane, propane, petrol and the majority of industrial gases
IIB	Ethylene, coke oven gas and other industrial gases
IIC	Hydrogen, acetylene, carbon disulphide

If a piece of equipment has just II in marking and no A, B or C after then it is suitable for any gas group. The above groups are formed in order of how volatile the gas or vapour would be if it was ignited, IIC being the most volatile and IIA being the least. The groups also indicate how much energy is required to ignite the gas by spark ignition, Group IIA requiring the most energy and IIC the least.

1.5 Application of Ex-Machines in Electrical Equipment

All COG processes include similar pumps, compressors and blowers. Small and medium size motors are used across the entire production process (up-, mid- and downstream). Larger induction and synchronous motors are more used in specific processes or applications.

Compressors may be centrifugal, rotary or reciprocating. Turbo compressors are typically equipped with 2 or 4 pole motors, often with lower starting current requirement. Screw compressors are driven by 2 pole motors. Inertia is very low typically. Load curve of screw compressors is more difficult to handle than quadratic shape. Due to vibration from the compressor side ball bearings cannot be used, and only sleeve bearing can be offered. Reciprocating compressors generate high torque pulsation, and therefore, torsional stress to motor shaft system.

Centrifugal fan comprises an impeller, which rotates in a casing shaped like a scroll. The air enters the inlet axially, turns at right angles through the blades, and is discharged radially. Axial fans comprise an impeller rotating within a cylindrical casing. They are good to move large air volumes against low resistances.

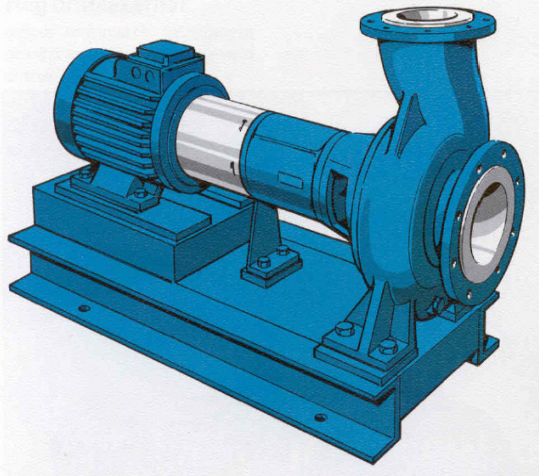

Figure 6 Centrifugal Pump
Source: www.abb.com

Pump is a machine that transfers liquids. Approximately 80% of all motors drive pumps. Typical load characteristics are quadratic load torque and low inertia. Speed depends on pump application, for example boiler feed pumps are driven by 2 or 4 pole motors, cooling water pumps can be very slow speed (14-18 pole). Typically pumps are constructed with lower starting current requirements, Figure 6.

1.6 Conclusions

Ex-Motors are operating in different fields of COG industry: upstream, midstream and downstream. They are used as components for different electrical equipments which are involved in oil and gas transportation process. For example these machines are pumps, fans and blowers which provide oil extraction, transportation and supply to the customer. It is very important to ensure the safe use of electrical equipment. Explosion-proof electrical equipment shall conform to the national standards, norms and safety rules.

Classifications of hazardous areas and protection types in GOST-R and IEC systems do not have a lot of differences. Hazardous areas have three zones which are classified according to the presence of explosive gas atmospheres. Protection types in both systems are similar.

There is a very important thing that must be mentioned about marking of electrical equipment. Compared to International system in Russian marking is present additional symbol that shows the level of explosion protection. There is no strict correlation between the type of explosion protection and the level of explosion protection. Therefore, sometimes it leads to misunderstanding. According to the Russian standards in Zone 1 may operate electrical equipment with protection types of 'd', 'px' and 'e'. Protection type 'n' may operate in Zone 2. Ex-Equipment with protection types 'd' and 'px' has in marking indicator 2. Ex-equipment with protection type 'e', 'de', 'pxe' and 'pz' has in marking indicator 1 and Ex-Equipment with protection type 'n' does not have any indicators in marking. (Serov, 2009)

Actually the level of explosion protection is deeply tied with the classification of hazardous areas according to the PUE. PUE specifies strictly what kind of level of explosion protection is possible in a certain zone. PUE has long history on the territory of Russian Federation. It existed long time before GOST-R standards for "Explosion-proof electrical apparatus" and nowadays they operate in parallel. Therefore, in my opinion it is of utmost importance to be capable with PUE to be able to install electrical equipment on the territory of Russian Federation.

During work with material of certificates and standards I have met one misunderstanding in classification system and protection types. All the equipments with marking 'e' have the marking 2 indicating the level of protection type. That is electrical equipment with increased safety level. If we speak about IEC classification system there are no indicators of levels of explosion protection in the marking. But that is self-evident that equipment with marking 'e' has higher protection characteristics than equipment with level of protection type 2. Thus, it should belong to the level 1 of protection type.

According to the consultations of experts of certification centers the work on this misunderstanding is still in the progress. And most probably very soon some of the standards will be modified and corrected to harmonize it with IEC standards.

Nevertheless, levels of explosion protection are not tied with zones of hazardous areas as it was mentioned before. Thus electrical equipment with marking ‘e’ or ‘de’ may be installed in Zone 1 of hazardous areas even though it belongs to the second level of explosion protection.

All these requirements and deviations are based on the GOST-R standards. Therefore, it is very important to know the content of the standards, procedure of issuing them and deviations from IEC standards if they exist.

2 STANDARDIZATION IN COG INDUSTRY

2.1 Standardization system in Russia

The fuel and energy complex of Russia is demonstrating its key role in ensuring the country's energy security, consolidating its regions, generating budget revenues and receiving a larger part of foreign investments. Russian oil and gas industry guarantees the stable and independent development of the economy as a whole through the most efficient use of unique hydrocarbon reserves that are Russia's main national asset.

During production of oil and gas equipment a great importance is attached to regulatory framework. The Regulatory framework including standardization represents a set of laws and rules, as well as requirements for professional terminology, which are provided for the production and functioning of any products.

In Russia, the work of drafting a package of national latest-generation standards is at the initial stage: of almost 5,000 engineering standards, only less than 1,500 have been harmonized with international standards while the situation with standard harmonization in the sphere of oil, gas and chemical machine-building is even worse (less than 10%). (Kershenbaum, 2009)

This situation is attributable to several reasons. First of all, the business community (oil and gas companies), which would be logically expected to act as the customer, is quite satisfied with foreign or corporate standards. Russian oil and gas equipment producers have a low rate of return and thus are unable to finance the process of standardization. Meanwhile, the existing legislation does not create legal or economic prerequisites stimulating efforts to sponsor the development of national standards.

The Law on Technical Regulation has failed to reverse the situation contrary to expectations. Budget financing of the sphere of standardization is, as it used to be, based on the "leftover principle" and is ridiculously small. In this respect, it should be

noted that a powerful layer of bureaucracy is found between state budget financing and the sphere of standardization. Therefore, all discussions of the possibility for the state and the business community to jointly finance the national standardization system are still nothing more than declarations and empty words. (Kershenbaum, 2009)

2.2 Ex-Standards in Russia

The National Standardization Committee of Russia is the Federal Agency on Technical Regulating and Metrology (Rostechregulirovanije) which provides standardization management, creates and implements state policy in the field of standardization. Standards applicable in Russia are GOST-R standards. This abbreviation means State Standard of the Russian Federation. (www.gost.ru)

The working bodies of standardization are the Technical Committees (TCs). TC 403 "Equipment for explosive gas atmospheres" is analog of IEC TC 31 with the same name. Standards for Ex-Equipment are harmonized with IEC standards. Therefore the procedure of working is similar to working on IEC standards in Russia. (Serov, 2009)

The procedure of working and harmonization of the standards for explosion-proof equipment is managed by organization "Ex-Standard". It is responsible for the directing of IEC standard for translation. After translation the standard is directed for editing to the working groups of Technical Committees. The representatives of industry and other interested parties participate in these working groups. After receiving of a feedback and proposals of working groups voting is arranged.

The work of the Technical Committee starts with a collection of applications to formulate the standard. Public authorities and organizations, associations, scientific and technical societies, companies, firms, entrepreneurs may act as applicants. The need to develop a regulatory document must be justified in the application form. Furthermore a draft of standard may be required. Further work is being conducted on

the basis of agreements between the applicant and the TC to develop a new standard. It consists of the following stages:

- Preparation of technical specifications
- Preparation of standard
- Presentation of the final project to the Rostechregulirovanije for adoption
- Updating the standard
- Revision and abolition of the standard

The procedure of working on the standard consists of the following stages represented on Figure 7.

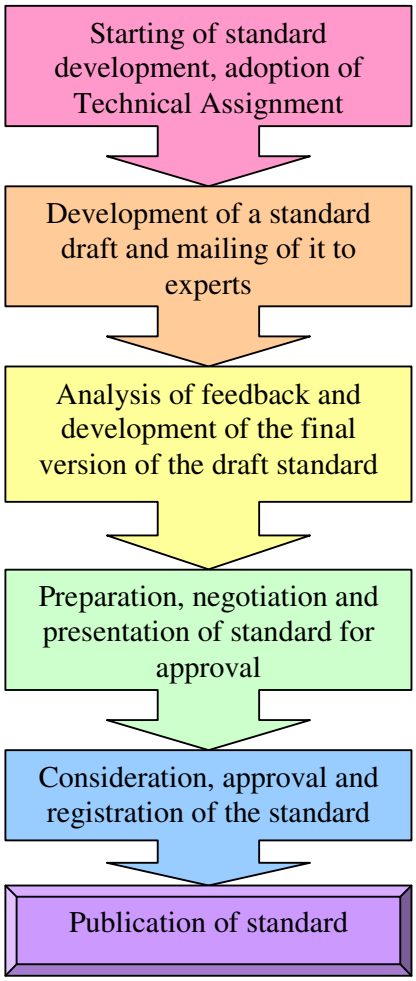

Figure 7 Procedure of working on developing a new Ex-standard

The technical task defines timing of each stage to be included in the content of work, the content and structure of the future standard, and a list of requirements to the object of standardization, a list of interested potential users of the standard (state bodies, enterprises, firms, etc.). The draft of the standard is sent for feedback to these organizations. The development of a draft standard is preceded by the organizational work to be done by TC. It is connected with placing assignments in subcommittees and working groups in accordance with objects of standardization. At this stage TC is looking for organizations to get a useful feedback on the draft of the standard. For that purpose a summary of the emerging regulatory documents is published in a special edition of Information Directory Catalogue of "National Standards". (Serov, 2009)

The development of the project is divided in two parts. Initially the first edition is produced. Basic requirement for the first edition is conformity to the legislation of Russia. Moreover, it has to be in accordance with the international rules and norms, as well as national standards of foreign countries. The project in the first edition is considered on a special meeting or by mail.

The second phase of development is to analyze the received feedback, the preparation of the final version of the draft instrument and prepare it for adoption. If the final version of the draft is accepted by two-thirds of the members of TC, the document is considered approved and recommended for adoption. The standard should not be an obstacle to economic development in line with technological progress. But because the period of validity is not established, it is necessary to work all the TC members and interested parties, aimed at the timely updating of the instrument.

Revision of the state standard is essentially a new one replacing the existing. The need for a revision occurs if the changes are associated with a significant adjustment of basic indicators of quality of production and affect its compatibility. Cancellation of a standard can be arranged by replacement with a new standard. Final decision on modification, revision and abolition of public standards and related publications in the

Information Directory Catalogue of “National Standards” is the responsibility of the Rostechregulirovanije. (Law “On Standardization”)

GOST-standards prepared by Rostechregulirovanije apply for all standardized equipment in the Russian Federation. Electrical equipment for potentially explosive atmospheres must comply a set of GOST-standards. Practically for some standards describing special types of protection against igniting a surrounding explosive gas atmosphere there always have been GOST-standards existing with many similarities to the concepts of the IEC 60079- series. (www.ccve.ru)

2.3 Comparison of motor standard requirements IEC vs. GOST

Explosion-proof electrical equipment shall conform to the national standards, norms and safety rules. From the 1st of January 2001 Russia follows the new system of standards, regulatory requirements for the construction of explosion protected electrical equipment, the classification of hazardous areas and the use of equipment in hazardous areas of any category.

A series of state standards GOST-R 51330, GOST-R 52350 and GOST-R IEC 60079 for explosion-proof electrical equipment have been harmonized with IEC standards. These standards are authentic texts of corresponding international standards of IEC 60079 series. They have the same numbering of clauses, sub-clauses and paragraphs.

Additional requirements which are absent from IEC 60079 series standards and reflect the needs of the Russian Economy are set off in italics.

These standards are currently in force in Russia. Also in the table are represented corresponding IEC standards of Series 60079. Table 4 provides an overview of the main Standards which are more commonly used when we speak about equipment protection in explosive gas atmospheres.

Table 4 Explosion Protection GOST standards by comparison with IEC standards

№	IEC	Scope of Standard	GOST
1	IEC 60079-0:2007	Explosive atmospheres - Part 0: Equipment - General requirements	GOST-R IEC 60079-0-2007
2	IEC 60079-2:2007	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure ‘p’	GOST-R 52350.2-2006
3	IEC 60079-7:2006	Explosive atmospheres - Part 7: Equipment protection by increased safety ‘e’	GOST-R 52350.7-2005
4	IEC 60079-15:2005	Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection ‘n’ electrical apparatus	GOST-R 52350.15-2005
5	IEC 61241-0:2004	Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements	GOST-R IEC 61241-0-2007
6	IEC 61241-1:2004	Electrical apparatus for use in the presence of combustible dust - Part 1: Protection by enclosures ‘tD’	-
7	IEC 61241-1-1:1999	Electrical apparatus for use in the presence of combustible dust. Part 1-1. Electrical apparatus protected by enclosures and surface temperature limitation. Specification for apparatus	GOST-R IEC 61241-1-1-99

As it can be seen Russian standards are published at the same year as IEC standards. It is a result of harmonization line that is provided by Federal Agency on Technical Regulating and Metrology. Therefore, these standards are identical to each other and have just few discrepancies which are discussed closely in further chapters. In Table 5 are listed GOST standards that are valid for hazardous area equipment nowadays.

Table 5 GOST Standards for electrical apparatus for explosive gas atmospheres

№	GOST	Scope of Standard
1	GOST-R IEC 60079-0-2007	Explosive atmospheres. Part 0. Equipment. General requirements
2	GOST-R IEC 60079-1-2008	Explosive atmospheres. Part 1. Equipment protection by flameproof enclosures ‘d’
3	GOST-R IEC 60079-10-1-2008	Explosive atmospheres. Part 10-1. Classification of areas. Explosive gas atmospheres
4	GOST-R IEC 60079-18-2008	Explosive atmospheres. Part 18. Equipment protection by encapsulation ‘m’
5	GOST-R IEC 60079-25-2008	Explosive atmospheres. Part 25. Intrinsically safe systems

6	GOST-R IEC 60079-27-2008	Explosive atmospheres. Part 27. Fieldbus intrinsically safe concept (FISCO)
7	GOST-R 52350.0-2005	Electrical apparatus for explosive gas atmospheres. Part 0. General requirements
8	GOST-R 52350.1-2005	Electrical apparatus for explosive gas atmospheres. Part 1. Flameproof enclosures ‘d’
9	GOST-R 52350.1.1-2006	Electrical apparatus for explosive gas atmospheres. Part 1-1. Flameproof enclosures ‘d’. Method of testing for ascertainment of maximum experimental safe gap
10	GOST-R 52350.2-2006	Electrical apparatus for explosive gas atmospheres. Part 2. Pressurized enclosures ‘p’
11	GOST-R 52350.5-2006	Electrical apparatus for explosive gas atmospheres. Part 5. Powder filling ‘q’
12	GOST-R 52350.6-2006	Electrical apparatus for explosive gas atmospheres. Part 6. Oil-immersion ‘o’
13	GOST-R 52350.7-2005	Electrical apparatus for explosive gas atmospheres. Part 7. Increased safety ‘e’
14	GOST-R 52350.10-2005	Electrical apparatus for explosive gas atmospheres. Part 10. Classification of hazardous areas
15	GOST-R 52350.11-2005	Electrical equipment for explosive atmospheres. Part 11. Equipment protection by intrinsic safety ‘i’
16	GOST-R 52350.14-2006	Electrical apparatus for explosive gas atmospheres. Part 14. Electrical installations in hazardous areas (other than mines)
17	GOST-R 52350.15-2005	Electrical apparatus for explosive gas atmospheres. Part 15. Construction, test and marking of type of protection ‘n’ electrical apparatus
18	GOST-R 52350.17-2006	Electrical apparatus for explosive gas atmospheres. Part 17. Inspection and maintenance of electrical installations in hazardous areas (other than mines)
19	GOST-R 52350.18-2006	Electrical apparatus for explosive gas atmospheres. Part 18. Construction, test and marking of type of protection encapsulation ‘m’ electrical apparatus
20	GOST-R 52350.19-2007	Explosive atmospheres. Part 19. Electric equipment, overhaul and reclamation
21	GOST-R 52350.25-2006	Electrical apparatus for explosive gas atmospheres. Part 25. Intrinsically safe systems
22	GOST-R 52350.26-2007	Explosive atmospheres. Part 26. Equipment with equipment protection level (EPL) Ga
23	GOST-R	Electrical apparatus for explosive gas atmospheres. Part 26.

	52350.27-2005	Fieldbus intrinsically safe concept (FISCO) and fieldbus non-incentive concept (FNISCO)
24	GOST-R 52350.28-2007	Explosive atmospheres. Part 28. Protection of equipment and transmission systems using optical radiation
25	GOST-R 51330.0-99	Explosion-proof electrical apparatus. Part 0. General requirements
26	GOST-R 51330.1-99	Electrical apparatus for explosive gas atmospheres. Part 1. Construction and verification test of flameproof enclosures of electrical apparatus
27	GOST-R 51330.2-99	Electrical apparatus for explosive gas atmospheres. Part 1. Construction and verification test of flameproof enclosures of electrical apparatus. First supplement. Appendix D. Method of test for ascertainment of maximum experimental safe gap
28	GOST-R 51330.3-99	Explosion protected electrical equipment. Part 2. Filling or purging of the tested pressurized enclosure ‘p’
29	GOST-R 51330.4-99	Electrical apparatus for explosive gas atmospheres. Part 3. Spark-test apparatus for intrinsically-safe circuits
30	GOST-R 51330.5-99	Explosion protected electrical apparatus. Part 4. Method of test for ignition temperature
31	GOST-R 51330.6-99	Electrical apparatus for explosive gas atmospheres. Part 5. Powder filling ‘q’
32	GOST-R 51330.7-99	Explosion-proof electrical apparatus. Part 6. Oil-filled enclosures ‘o’
33	GOST-R 51330.8-99	Explosion-proof electrical apparatus. Part 7. Type of protection ‘e’
34	GOST-R 51330.9-99	Electrical apparatus for explosive gas atmospheres. Part 10. Classification of hazardous areas.
35	GOST-R 51330.10-99	Electrical apparatus for explosive gas atmospheres. Part 11. Intrinsic safety ‘i’
36	GOST-R 51330.11	Explosion protected electrical apparatus. Part 12. Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents
37	GOST-R 51330.12-99	Electrical apparatus for explosive gas atmospheres. Part 13. Construction and use of rooms or buildings protected by pressurization
38	GOST-R 51330.13-99	Explosion protected electrical apparatus. Part 14. Electrical installations in explosive gas atmosphere (other than mines)
39	GOST-R 51330.14-99	Electrical apparatus for explosive gas atmospheres. Part 15. Type of protection ‘n’
40	GOST-R 51330.15-99	Electrical apparatus for explosive gas atmospheres. Part 16. Artificial ventilation for the protection of analyzers houses
41	GOST-R 51330.16-99	Explosion protected electrical apparatus. Part 17. Inspection and maintenance of electrical installations in hazardous areas (other than mines)
42	GOST-R	Explosion protected electrical apparatus. Part 18. Type of

	51330.17-99	protection ‘m’
43	GOST-R 51330.18-99	Electrical apparatus for explosive gas atmospheres. Part 19. Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)
44	GOST-R 51330.19-99	Electrical apparatus for explosive gas atmospheres. Part 20. Data for flammable gases and vapours relating to the use of electrical apparatus
45	GOST-R 51330.20-99	Mining electrical equipment. Insulation, leakage paths and electrical gaps. Technical requirements and methods testing

For hazardous areas’ equipment there are different standards of several series. The latest version has the same numbering as IEC standards (60079) and the earliest versions are of series 51330 and 52350. All of those standards are valid on the territory of Russian Federation and may be used as guidance for the manufacturing of Ex-Machines. As it was mentioned before there are few modifications of Russian standards according to the specific nature of Market and Environment. Analyzing these deviations is useful to understand if these discrepancies are significant for manufacturing process or not.

2.3.1 IEC 60079-0 (GOST-R IEC 60079-0) General requirements, gas environment

IEC 60079-0:2007 “Explosive atmospheres - Part 0: Equipment - General requirements”. This standard is compliant with Russian standard GOST-R IEC 60079-0-2007. As it is mentioned earlier all the modifications are highlighted with italic letters.

1. In electrical equipment with the level of the explosion protection Ma compared with the level of explosion protection Mb must be arranged additional protection according to the standard defining protection types. (page 8, paragraph 3.18.1)
2. In electrical equipment with the level of the explosion protection Mb explosion protection is provided as during normal working hours and when probable damages may appear. These damages are defined by exploitation conditions. Damages of explosion-proof equipment are not taken into consideration for that case. (page 8, paragraph 3.18.2)

3. In electrical equipment with the level of the electrical explosion protection Ga compared with the level of electrical explosion protection Gb must be arranged additional protection according to the standard defining protection types. (page 8, paragraph 3.18.3)
4. In electrical equipment with the level of the explosion protection Gb explosion protection is provided as during normal working hours and when probable damages may appear. These damages are defined be exploitation conditions. Damages of explosion-proof equipment are not taken into consideration for that case. (page 8, paragraph 3.18.4)
5. Electrical equipment works in an explosive atmosphere from the moment of inception of this atmosphere until the moment of disconnection of the grid. (page 8, Paragraph 3.18.5.1)
6. In electrical equipment with level of explosion protection Gc explosion protection is provided only for normal operating mode. (page 9, Paragraph 3.18.5.2)
7. In electrical equipment with the level of the explosion protection Da compared with the level of explosion protection Db must be arranged additional protection according to the standard defining protection types. (page 9, paragraph 3.18.6)
8. In electrical equipment with the level of the explosion protection Db explosion protection is provided as during normal working hours and when probable damages may appear. These damages are defined be exploitation conditions. Damages of explosion-proof equipment are not taken into consideration for that case. (page 9, paragraph 3.18.7)
9. Electrical equipment works in an explosive atmosphere from the moment of inception of this atmosphere until the moment of disconnection of the grid. (page 9, paragraph 3.18.8.1)
10. In electrical equipment with level of explosion protection Dc explosion protection is provided only for normal operating mode. (page 9, paragraph 3.18.8.2)

11. Using of the small elements the temperature of which is exceeding the values established by the classification of explosive mixtures is possible if during the tests these small elements do not ignite tested explosive mix. Moreover, the destruction of these small elements should not lead to damages of explosion protection. (page 15, paragraph 5.3.3)
12. Diameter of bolts, screws and studs for mounting of the Group I electrical equipment components frames must be at least 6 mm. (page 23, paragraph 9.2.2)
13. Diameter of bolts, screws and studs for mounting of details of frame must be at least 5 mm. (page 23, paragraph 9.2.2)
14. Requirements to a minimum diameter of the fixing bolts, screws and studs does not extend to the shell devices for individual use, e.g. if the fasteners are not subject to unscrewing in mine conditions. For example installed on glue or sealed. (page 23, paragraph 9.2.2)
15. Bolts, screws, studs and other fasteners must be able to be secured by way of spontaneous ease with the method described in technical documentation. (page 23, paragraph 9.2.3)
16. The need for a lock should be set by the standards for the certain types of explosion protection for certain types of explosion or electrical device. (page 24, paragraph 10.2)
17. On the cover shell of electrical equipment which has no lock and the tension on which can not be measured removing the cover must be a warning sign "Disconnect from the network before opening" or "Opening in an explosive atmospheres is forbidden," or "Opening in a mine is forbidden". (page 24, paragraph 10.3)
18. Electrical equipment intended for connection to external electric circuits must have connecting contact terminals unless the equipment is made with permanently attached cable. Electrical equipment designed with permanently connected cable must be labeled by sign ‘x’, indicating the need for appropriate adherence of free end of cable. (page 25, paragraph 14.1.1)

19. Contact terminals should be marked if its absence leads to incorrect connection. It is allowed to mark on the clamp, close to it or on to the attached label. (page 25, paragraph 14.1.2)
20. Conductor of the contact terminals must be connected in such a way that an electrical connection at the junction for a long time does not deteriorate due to heat in a variable thermal conditions, changes in the size of the insulation components and vibration. The transfer of the contact pressure on the electrical connections through the insulating materials is forbidden. Except cases when the pressure is transmitted through porcelain or other materials with similar thermal and mechanical properties. (page 25, paragraph 14.3)
21. Conductor of the electrical contact terminals in Group I should be made of corrosion-resistant high conductive materials. Parts of non-conductor clamps may be made of steel. (page 25, paragraph 14.4)
22. In control, monitoring and automation equipment the use of the contact screw with the diameter not less than 6 mm is allowed. For measuring instruments the minimum diameter of contact screws is not standardized. (Page 26, Paragraph 14.5)

As it was mentioned earlier in Russia in parallel are applicable several standards which are analogous to IEC 60079-0. The other one is GOST-R 51330.0-99. It has following deviations from the international standard. The term “explosion protection level of electrical apparatus” has been introduced – a grading of the explosion protection measures of the electrical apparatus under the conditions stipulated in the standard. All explosion protected electrical equipment is split into three groups depending on the extent of the explosion protection level.

2.3.2 IEC 60079-2 (GOST-R 52350.2) Pressurized enclosure Ex p

IEC 60079-2:2007 “Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure ‘p”. This standard is compliant with Russian standard GOST-R 52350.2-2006. In the introduction to the standard it is mentioned that this standard is

absolutely identical to the international standard. It means that there are no modifications or deviations. However, at the same introduction is included following phrase:

"Information about changes to this standard is published in the Information Directory Catalogue of "National Standards". Text of revisions and corrections is published in the monthly published Catalogue. In case of revision, replacement or repeal of the standard appropriate notice will appear in the monthly published Catalogue. Relevant information, notices and texts are published in the information environment of public service at the official website of the Federal Agency of Technical Regulation and Metrology on the Internet". (www.gost.ru)

As we can see the situation with this standard is uncertain. Even though there is said that the standard is absolutely identical with IEC standard there is a chance that in the Information Directory Catalogue will be published changes and modifications. It is available in Russian. As it is mentioned on the website it is possible to book a translation of this catalogue. It is possible to write up an order for Catalogue by following coordinates:

Phone: +7 495 332 45 11, +7 495 660 01 44
E-mail: zakaz@gostinfo.ru

When using such standards it is useful to check reference standards and classifiers on the website of Federal Agency on Technical Regulation and Metrology or in monthly published Information Directory Catalogue "National Standards". If the reference document is replaced or changed then the latest edition of the document must be used. If the reference document is cancelled without replacement then the standard is applied to parts not affecting the link.

2.3.3 IEC 60079-7 (GOST-R 52350.7) Increased safety Ex e

IEC 60079-7:2006 "Explosive atmospheres - Part 7: Equipment protection by increased safety 'e". This standard is compliant with Russian standard GOST-R

52350.7-2005. As it can be seen from the publishing dates of these standards Russian standard has the earlier publishing date than international. It can be explained with the situation that in Russia the project of the standard was received in year 2005 and they approved it at the same year. There are no risks that International and Russian standards will be different because the system of mutual informing works well.

As in the previous case in the introduction is mentioned that this standard is an absolutely identical translation of IEC standard. But as in the previous case there is added the part where is said that all the changes and modifications if they appear will be published in the Information Directory Catalogue of "National Standards".

In my opinion that is a very positive tendency that the standards are fully compliant to each other. On the other hand it is rather dangerous that changes and modification can be published in a separate document. It would be much more challenging and logic to publish those changes as an appendix to an existent standard that every manufacturer could know about them and would not be worried about searching this information in the Internet. The information about changes is published in Russian language. Therefore, it takes a lot of time to prepare translations and use them in technological process. This fact dramatically increases the time spent on working out the electrical equipment that satisfies all the requirements of the GOST standardization system.

2.3.4 IEC 60079-15 (GOST-R 52350.15) Type of protection Ex nA

IEC 60079-15:2005 "Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection 'n' electrical apparatus". This standard is compliant with Russian standard GOST-R 52350.15-2005. This standard is an identical translation of the international standard and therefore there are no deviations or modifications in Russian standard compared to international one. Nevertheless, there is a note about changes to the standard that will be published in the Information Directory Catalogue of "National Standards".

2.3.5 IEC 61241-0 (GOST-R 61241-0) General Requirements, Dust Environment

IEC 61241-0:2004 “Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements”. This standard is compliant with Russian standard GOST-R IEC 61241-0-2007.

As we can see Russian standard refers to the international standard that was published in the year 2004. While in Russia it was published in the year 2007. As it is known IEC standards are republished once in a five years. From that perspective I see the risk in the future. In 2009 will be published modified IEC standard while in Russia will be valid the standard that is compliant with the old edition. I think that in that case will be published modifications of the standard in Information Directory Catalogue of “National Standards”. And manufacturer will follow these modifications not the original text of the standard. Otherwise it will be necessary to publish a new standard compliant with new IEC standard which seems to be senseless lose of money due to existent standard is already in accordance with IEC standard.

Speaking about other characteristics of the standard it is worth to mention that it is an absolutely identical translation of IEC standard.

2.3.6 IEC 61241-1 (GOST-R 61241-1-1) Protection by enclosure Ex tD

IEC 61241-1:2004 “Electrical apparatus for use in the presence of combustible dust - Part 1: Protection by enclosures ‘tD”. Speaking about this standard I must mention that I did not find in Russian standardization system the standard that is compliant with IEC 61241-1:2004. Most probably the work on this project is still in progress. Nevertheless I have found equivalence between other standards: IEC 61241-1-1:1999 and GOST-R IEC 61241-1-1-99. The name of the standard IEC 61241-1-1:1999 is “Electrical apparatus for use in the presence of combustible dust. Part 1-1. Electrical apparatus protected by enclosures and surface temperature limitation. Specification for apparatus”. In Russian standardization system it is compliant with standard GOST-R

IEC 61241-1-1-99. As it is written in the introduction to the standard it is a full authentic translation of international standard. Therefore, there are no deviations between the standards.

2.4 GOST standards for Rotating Electrical Machines

GOST standards for rotating electrical machines are processed by Technical Committee 333 “Rotating Electrical Machines”. This is mirror committee of IEC TC 2 “Rotating Electrical Machines”. TC 333 does not have a webpage in the Internet, but it can be achieved by following coordinates:

Russia, 196084, Saint Petersburg, Moskovsky prospect, 100
Phone: +7 812 298 67 86

The work on harmonization of standards is in progress. Meanwhile there are number of standards which are valid in this field of industry. The list of these standards is in Table 6.

Table 6 GOST Standards for Rotating Electrical Machines

№	GOST	Scope of Standard
1	GOST-R IEC 60034-5-2007	Rotating electrical machines. Part 5. Classification of protection degrees provided by the integral design of rotating electrical machines (IP code)
2	GOST-R IEC 60034-14-2008	Rotating electrical machines. Part 14. Mechanical vibration of certain machines with shaft heights 56 mm and higher. Measurement, evaluation and limits of vibration
3	GOST 4.154-85	System of product-quality indices. Electrical rotating machines with frame number above 56 to 355. Nomenclature of indices
4	GOST 4.167-85	System of product-quality indices. Large electrical rotating machines with frame number above 355. Nomenclature of indices
5	GOST 4.330-85	Low-power rotating electrical machines. Nomenclature of indices
6	GOST 12.2.004.1-75	Occupation safety standards system. Rotating electrical machines. Safety requirements
7	GOST 183-74	Rotating electrical machines. General specification
8	GOST 533-2000	Rotating electrical machines. Turbo-generators. General specifications
9	GOST 609-84	Rotating electrical machines. Synchronous condensers. General

		specifications.
10	GOST 2479-79	Rotating electrical machines. Symbols for types of construction and mounting arrangements
11	GOST 2582-81	Rotating electrical machines for rail and road vehicles. General specifications.
12	GOST 4541-70	Rotating electrical machines. Letter symbols of fixing and overall dimensions
13	GOST 7217-87	Rotating electrical machines. Asynchronous motors. Test methods
14	GOST 8592-79	Rotating electrical machines. Mounting and connecting dimensions. Tolerances and control methods
15	GOST 10159-79	Rotating electrical commutation machines. Test methods
16	GOST 11828-86	Rotating electrical machines. General test methods
17	GOST 11929-87	Rotating electrical machines. General test methods. Noise levels determinations
18	GOST 12139-84	Rotating electrical machines. Ranges of rated output, voltages and frequencies
19	GOST 13267-73	Rotating electrical machines and directly connected nonelectrical parts. Shaft heights and control methods
20	GOST 14191-88	Low-power rotating electrical machines. Motors for tape-recorders. General specifications
21	GOST 16372-93	Rotating electrical machines. Limiting values of noise levels
22	GOST 17494-87	Rotating electrical machines. Classification of degrees of protection provided by enclosures for rotating machines.
23	GOST 18200-90	Rotating electrical machines above 200 kW. Synchronous motors. General specifications
24	GOST 18709-73	Rotating electrical machines of middle sixe. Mounting dimensions
25	GOST 20459-87	Rotating electrical machines. Means of cooling. Symbols
26	GOST 20815-93	Rotating electrical machines. Mechanical vibration of machines with shaft heights 56 mm and higher. Measurement, evaluation and limits of the vibration
27	GOST 20832-75	Rotating electrical machines of mass up to 0.5 kg. Vibration limit
28	GOST 20839-75	Rotating electrical machines with shaft height from 450 to 1000 mm. Mounting dimensions
29	GOST 21099-75	Rotating electrical machines. Brush holders and brackets. Serrations on fixing surface. Shapes and dimensions
30	GOST 22407-85	Rotating electrical machines with frame number from 63 to 355 including. Explicit pole synchronous generators. General specification
31	GOST 24680-81	Rotating electrical machines. Insulating collector plates. Row of thicknesses.
32	GOST 25941-83	Rotating electrical machines. Methods for determining losses and efficiency
33	GOST 26772-85	Rotating electrical machines. Terminal markings and direction

		of rotation
34	GOST 27222-91	Rotating electrical machines. Measurement of the winding resistance of an AC machine without disconnection from network
35	GOST 27223-87	Rotating electrical machines. Asynchronous and synchronous motors. Determination of locked rotor temperature increase according to the time. Test methods
36	GOST 27430-87	Rotating electrical machines. Conventions for description of synchronous machines
37	GOST 27471-87	Rotating electrical machines. Terms and definitions
38	GOST 27888-88	Rotating electrical machines. Embedded thermal protection.
39	GOST 27895-88	Rotating electrical machines. Embedded thermal protection. General rules for thermal protectors used in thermal protection systems
40	GOST 27917-88	Rotating electrical machines. Embedded thermal protection. Thermal detector and control units used in thermal protection systems
41	GOST 28173-89	Rotating electrical machines. Rating and performance
42	GOST 28327-89	Rotating electrical machines. Starting performances of single speed three phase cage induction motors for voltages until 660V
43	GOST 30148-94	Rotating electrical machines. Mounting of large machines. General requirements
44	GOST-R 51689-2000	Rotating electrical machines. Asynchronous motors of power from 0.12 to 400 kW. General requirements
45	GOST-R 52776-2007	Rotating electrical machines. Rating and performance
46	GOST-R 53148-2008	Rotating electrical machines. Noise limits

As it can be seen from the table most standards were published twenty or even thirty years ago. In spite of this fact they are still valid and used by manufacturers of electrical equipment. It may explain why manufacturers of electrical equipment in Russia prefer domestic suppliers of components. Electrical motors manufactured in Russia satisfy the requirements of old standards. Work on harmonization with IEC standards is in progress. All new published standards are of series 60034. Old standards have number of discrepancies from current IEC standards. They are related to measurements, frame sizes, installations. Therefore, it is challenging task to clarify these discrepancies and find a way for modification of electrical motors which are produced according to the modern standards.

2.5 Standardization in CIS

GOST standards are also used in a similar manner in many of the independent countries in the Caspian Sea area and, therefore, are very important for the oil and gas industry. In addition to Kazakhstan, with their GOST-K standards, the other countries making extensive use of GOST standards are Azerbaijan, Uzbekistan, and Turkmenistan. These countries and several others (Ukraine and Belarus) have formed the Euroasian Interstate Council to handle all their standardization matters. Implementation of Ex-Standards on the territory of CIS countries is voluntary. Some countries are developing their own standards for hazardous areas. Others are using common standards enacted by Euroasian Standardization Council (Appendix 1).

In this connection, the experience of CIS countries, which, unlike Russia, are moving more energetically in this direction, has proven to be quite productive. In particular, great success has been achieved by Kazakhstan standardization agencies, which have been able to prepare and enforce, with full support and understanding from authorities and with the employment of easy methodology techniques, a package of national oil and gas equipment standards. Organization responsible for standardization in Kazakhstan is Committee for Standardization, Metrology and Certification (KAZMEMST). (www.memst.kz)

The entire package of Kazakhstan's national standards was developed by using three methods: the "book cover" method when international standards, after high-quality translation, were actually adopted without any changes as national standards; the "modification" method was used in instances when the application of international standards as national ones involved the need for relatively minor changes or additions to the international document; the "basis" method where unique properties of equipment in terms of its designation or operation required the drafting of a new and separate document, which took into account national specifics but did not contradict international practice. (Kershenbaum, 2009)

This approach is characterized by coherence and simplicity and already today has considerably facilitated work for Kazakhstan producers of oil equipment in modern conditions of the market economy.

Organization responsible for technical regulation in Belarus is The State Committee for Standardization of the Republic of Belarus (Gosstandart). At present Gosstandart is the republican public authority carrying out a common governmental policy in technical regulation, standardization, metrology, conformity assessment, energy efficiency, on implementation of surveillance in construction and compliance of projects and estimates with regulations and standards, as well as supervision of rational use of fuel, electric and heat energy. (www.mgs.gosstandart.gov.by) In Belarus are applicable GOST standards and STB standards – State Standards of the Republic of Belarus. There are standards for explosion-proof equipment which are harmonized with IEC standards. (www.belgiss.org.by)

In Ukraine the function of technical regulating is provided by The State Committee of Ukraine for Technical regulation and consumer policy. It is called Derzhspozhyvstandart of Ukraine (DSSU). One of the main priorities of the organization is introduction in Ukraine of international and regional standards and observance of international and European rules and procedures of standardization. There is no open access to the State standards. (www.dssu.gov.ua)

State Agency on Standardization, Metrology and Patents of Azerbaijan Republic (AZSTAND) is responsible for technical regulation in this country. According to mutual agreements there are widely used GOST standards as well as AZS standards – State standards of Republic of Azerbaijan. The Agency is the central executive body, forming and executing the state policy in the field of standardization, metrology, certification and protection of industrial property objects. One of the main tasks of the Agency is harmonization of State standardization system of Azerbaijan Republic with international and regional advanced standardization systems of foreign countries. The other goal is improvement of fund of national normative documents on standardization

in the ground of the application of international, regional standards as well as national standards of foreign countries. (www.azstand.gov.az/)

2.6 Conclusions

The issue of standardization in machine-building has been an area of close attention paid by oil and gas equipment producers for many decades. Some specialists mention insufficient flexibility of standardization system in Russia, cumbersome nature and low rate of update for regulatory documents. Most standards that are still valid in Russia were published approximately 20 years ago. For that period the scientific and technical progress was seen to contribute to the pile-up of a large number of innovations, which regulatory documents failed to reflect. In fact, standards turned into a stumbling block for the production of new-generation equipment.

It is self-evident that there exists a close relationship between the competitiveness of products and the degree of their standards sophistication. It can be said with confidence that the level of standards harmonization with international practice is a major indicator of their sophistication.

While many of the requirements of the IEC standards are compatible with those of the equivalent GOST standards, there are some major differences that have important consequences on the choice of equipment. In many cases, some modifications must be made to standard IEC equipment in order to enable it to obtain GOST-R certification.

The standards in Russia today for explosion-proof equipment for hazardous areas are voluntary. That means that every oil company has its own standards and requirements for the equipment they would wish to use on their projects. Hopefully, very soon the situation is turning to the best way and problem of uncertainty with standards will achieve a solution. Therefore, manufacturers will have straightforward guidance for the manufacturing process.

The problem is connected to the funding support of the development and translation of standards. In most cases only oil companies and manufacturers of the Ex-Equipment are interested in this process while government doesn't really have sources for these cases.

In Russian standardization system there are number of standards which refer to the same international standard. It means that two Russian standards with different numbers may be referred to the one IEC standard. It may happen when one of the Russian standard was published earlier and due to now an active procedure of standardization in Russia is in progress it is easier to make a new version of standard than to renew and republish the previous one. Both of standards are valid. And now comes up the question which of the standards to follow? As I have received advice from the experts of Federal Agency of Technical Regulation and Metrology it is always preferable to follow the latest one version. It is a positive aspect due to the newest standards are absolutely identical translations to the IEC standards according to which is produced electrical equipment in ABB.

As it can be seen from this chapter Standards for Electrical equipment for explosive gas atmospheres are harmonized with IEC standards. Therefore, Ex-Equipment that is manufactured according to IEC standards will satisfy requirements of GOST-R standards. On the other hand there are a lot of other standards which are not harmonized with IEC standards. These standards define dimensions, sizes and other characteristics of motors. And there may appear significant discrepancies which do not allow using motors manufactured according to the IEC standards on the plants with equipment designed according to the GOST-R standards. Thus it seems to be challenging to understand those deviations between motors designed according to different standardization systems and make corrections in the design of motors to satisfy the requirements of these segment customers.

One of the disadvantages of the Russian standardization system is publishing of standards only in Russian language. There are organizations that provide official translation of the standards.

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Phone: +7 (495) 236-54-49
Internet: http://www.interstandard.ru
E-mail: vkirillov@gost.ru

FGUP “Standardinform”
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E-mail: endpoint@gostinfo.ru

One of the most remarkable details within the “classic” set of GOST standards is the provisions for three different levels of safety, suitable for use in different levels of hazardous situations, e.g. zones. For the types of protection ‘i’ and ‘e’ there are three categories a, b and c. For other types of protection according to the level of safety different requirements apply for the installation of warning or automatic disconnecting drives. Also combinations of two types of protection to increase the level of safety are within the scope. GOST-standards are brought step by step in line with IEC. The Russian national electrical committee has already prepared and issued new standards on the basis of IEC publications for the types of protection ‘d’, ‘i’, ‘p’, ‘m’, ‘q’, ‘e’, ‘n’, ‘o’. These new standards are mainly taken from IEC. Only some national deviations have been left to provide a suitable transition period for the Russian industry. Also in other fields the structures need some adoption to meet the requirements of IECEx.

3 APPROVAL PROCESS FOR Ex-MACHINES

3.1 Certification of Ex-Machines in Russia

Russia is world's second largest producer and exporter of oil. It is an attractive area for global investments and exporters of COG equipment. Products imported into Russia are liable to national certifications and permitting systems. They must be approved by the relevant authorities in terms of compliance with national standards and rules. These standards are focusing on safety characteristics. Even if a product is well-known and recognized as safe in the Europe Union, manufacturer has to prove that it complies with Russian requirements. If a product is already certified according to some certification systems it may facilitate the procedure of obtaining the appropriate Russian certificates. But this one certificate does not allow to cross the Russian border or to supply the equipment on the territory of Russian Federation. (Ovcharov, 2009)

To operate the hazardous area equipment the Rostechnadzor Permit of Use is required. The industrial safety approval system in Russia has been regulated by a number of federal laws. One of them is Federal Law "On Technical Regulation" No. 184-FZ, enacted Dec. 27, 2002. And the other one is Federal Law "On Industrial Safety of Hazardous Industrial Facilities" No. 116-FZ, enacted July 21, 1997. Permitting, inspection and supervising functions are implemented by the Federal Agency for Environmental, Technological and Nuclear Supervision. It is abbreviated as Rostechnadzor. After the presidential election in Russia in May 2008 and the following administrative reform Rostechnadzor is under the jurisdiction of the Ministry of National Resources and Environment.

Rostechnadzor is controlling and supervising the safe use of natural resources, industrial safety, safe use of nuclear power, safety of power and heat installations and networks, safety of hydraulic engineering, and safety of explosive materials production, their storage and industrial usage. Russia's oil upstream is one of the

biggest sectors supervised by Rostechnadzor, Figure 8. Russian authorities pay huge attention to equipment supplied for this sector. (Ovcharov, 2009)

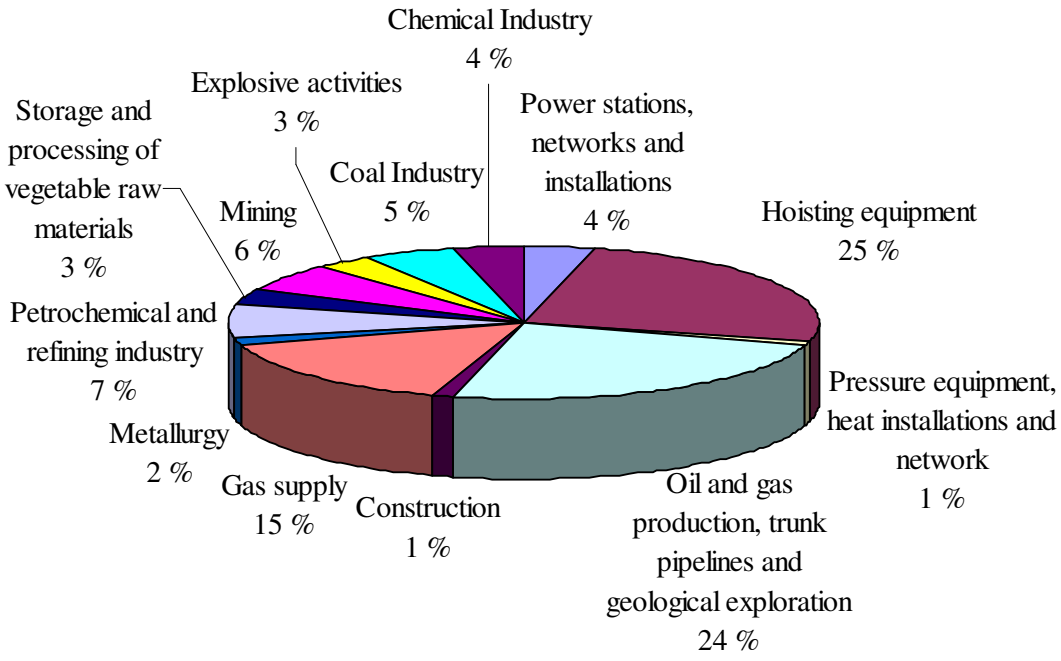

Figure 8 Approximate rates in Rostechnadzor supervising areas

One of the Rostechnadzor management tools is the procedure established for all technical devices to be operated in hazardous industrial sites and for hazardous equipment. Operation may be implemented only after mandatory Industrial Safety Expertise assessment resulting in a Permit of Use. This document is required at the time of commissioning and throughout the service life of the equipment. It is proving that the device is operating within required safety parameters. There are three types of Permit of Use:

- A permit for one technical device is issued if one piece of equipment is supplied to a customer in Russia. This permit is valid for the entire operation period of the device.
- A permit for one consignment is issued when a few technical devices are supplied within one shipment to a specific Russian customer. This permit is valid for the entire operation period of the consignment.

- A permit for a line of technical devices is issued when “homogenous equipment” is sold to more than one customer on the territory of Russian Federation. Homogenous equipment is technical devices with a single-application scope and design approach, similar materials and production technologies. Such a permit is valid for five years. (www.gosnadzor.ru)

It is worth to mention that a complex industrial installation requires a single permit certifying that each of its components meets industrial safety requirements before commissioning. Due to a lack of information and misunderstanding of Russian laws it often happens that each supplier of component is obliged by the project contractor to obtain a Permit of Use for his device. In this case the certification process is duplicated due to a Permit of Use for the entire plant needs to be obtained.

The procedure of obtaining Permit of Use is described in the Administrative Directive of Rostechnadzor in the part about issuance of Permits of Use for specific types of technical devices operated at hazardous production sites.

To obtain a Permit of Use a documentation provided by applicant is reviewed by a Rostechnadzor licensed expert organization. Applicant may be a designer of equipment, manufacturer, supplier or operator. The list of documents includes drawings, the operating manual, strength calculations, test reports and available international and Russian certificates. This procedure is called Industrial Safety Expertise review. Its purpose is to approve conformity of the equipment to Russian safety norms relevant for specific application fields.

To specify the applicable safety requirements the product type is supposed to be identified in accordance with Russian coding system. The Russian Product Classification (OKP) was created in Soviet times. It is operating currently and it is not harmonized with any international system. The number of product categories of OKP is approximately 37,000. Since 1991 OKP has coexisted with the Foreign Trade Classification (TNVED). This classification is basis for the Russian customs tariffs.

OKP system is used for identification of the standards to apply inside Russian Federation. All export-import operations are subject to TNVED classification. It is used during customs clearance of imported goods.

The Expert Conclusion is a result of the Industrial Safety Expertise review by the expert organization. If the device satisfies the relevant Russian norms and standards the Expert Conclusion is directed to Rostechnadzor. This organization issues the Permit of Use. If the equipment does not fully comply with required standards the Permit of Use is issued with specified conditions of the use. Permit of Use for imported goods can be issued only by Rostechnadzor headquarters in Moscow. The Permit of Use is drafted on Rostechnadzor template and signed by an agency deputy head.

Before applying for a Permit of Use a number of certificates for some products must be obtained. The list of documents to Rostechnadzor includes the GOST-R Certificate of Conformity. If the product does not belong to the list of goods subject to mandatory GOST-R certification an official exemption letter is provided. The GOST-R certification system applies to most industrial equipment in COG industry. GOST-R certificates are issued by Certification Bodies accredited by Rostechregulirovanije (the Federal Agency for Technical Regulation and Metrology of Russia).

For electrical explosion-proof equipment the GOST-R Ex-Proof Certificate of Conformity have to be obtained. It is issued by certification bodies that are accredited by Rostechregulirovanije. If equipment has already been certified according to other standards such as ATEX or the Canadian Standards Association the verification process to obtain a Russian Ex-Proof Certificate can be limited to the review of documentation, without additional laboratory tests. If a range of Ex-Equipment is supplied for a specific project, all those devices may be grouped by application scope. In this case only one Ex-Proof Certificate must be obtained for the entire group.

Many procedures in the Russian certification system were copied from the Europe Union. As it was mentioned earlier there are various discrepancies between standardization system in Russia and in Europe. The most striking instance of such discrepancies can be found in following sectors:

- Machine-building and construction designs and specifications
- Denomination, grading and classification of steels, alloys, plastic materials and rubbers
- Non-Destructive Testing methods
- Methods of material testing, strength, stability and oscillation analysis.

For some products Russia has more severe requirements than in Europe for verifying product safety. It can be explained with specific geographical location and climatic conditions of Russian Federation. On the other hand it can be explained with the fact that many Russian standards have not been changed since Soviet times. Testing procedures in Europe and in USA are not compliant with Russian procedures. For example transformers have to be tested at – 40 ^{o}C while in Europe – 20 ^{o}C is enough. According to Russian safety norms 100 % of joints have to be tested with Non-Destructive Testing methods. And it is not needed according to ASME due to different welding control methods.

Russian law provides some exceptions for equipment manufactured outside of Russia. In this case Expert Conclusion directed to Rostechnadzor must include detailed list of recommendations on additional activities required to afford a high equipment safety. The design of certain import equipment may be changed slightly to comply with Russian standards of safety rules.

Conformity assessment always requires investment. The cost of Industrial Safety Expertise services in Russia vary from 1 % to 4 % of either the equipment price or total project value. Therefore, expenses for relevant certificates and Permit of Use must be planned ahead and included into the bidding price. (www.gost.sgs.com)

The time required for the draft an Expert Conclusion depends on the product's complexity. It shouldn't exceed three months after the full set of document is provided. Further procession of the Expert Conclusion and registration of the Permit of Use in Rostechnadzor takes two months. In some cases the process of issuing the Permit of Use may take approximately one year. It is related to ability of an applicant to prepare the internal documents needed for verification. The other factor affecting the process is the number and complexity of required tests. The number of certificates to be obtained before applying for Permit of Use must be taken into account too. All the documents submitted to Rostechnadzor must be in Russian. Therefore, provisions for translation of required documents including operating and maintenance manuals have to be made.

Today in Russia is more than 2,000 expert organizations licensed to perform Industrial Safety Expertise reviews in Russia. Not more than 700 of them provide high-quality and objective expertise according to Rostechnadzor information. And less than 100 of those deal with imported equipment and installations. (Ovcharov, 2009)

3.2 Certification Scheme of Ex-Equipment in Russia

In Russia, the procedure for certification of explosion protected electrical equipment is defined in the document "The rules of certification of electrical equipment for explosive environments". These rules form the fundamental document of the Certification Scheme for Ex-Equipment (CSEx). CSEx is harmonized with International Certification Scheme for Ex-Equipment (IECEx Scheme). The structure of CSEx includes several organizations, Figure 9. (www.ccve.ru)

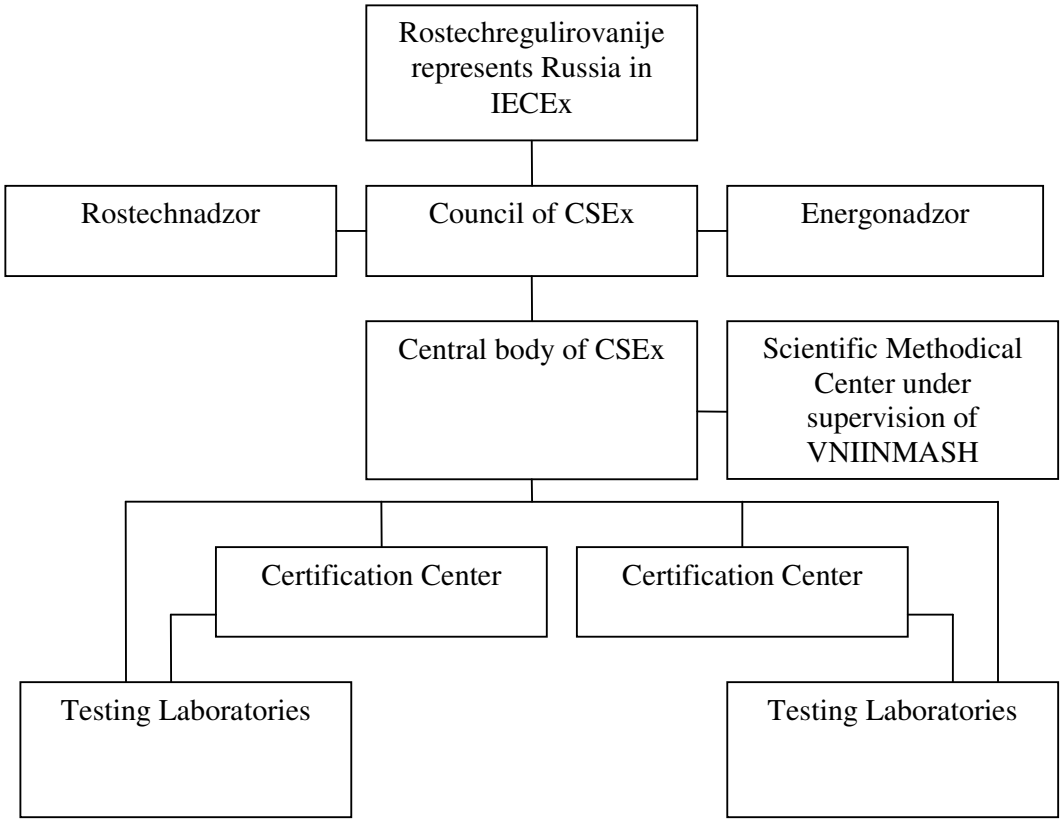

Figure 9 Organizational Structure of CSEx

The National Authority for participation in the IECEx Scheme – Rostechregulirovanije. Council of CSEx which includes representatives of Rostechregulirovanije, Rostechnadzor, Scientific Methodical center, certification bodies, testing laboratories, manufacturers and consumers of Ex-Equipment. Scientific Methodical Center is under the overall supervision of VNIINMASH. Certification Centers must be accredited by Rostechregulirovanije and Rostechnadzor. Scientific Methodical Center develops proposals for harmonization of national standards with IEC standards for explosion areas.

Certification scheme is determined by the certification center. It is based on the potential dangers of Ex-Equipment and conditions of its applications. It must take into account the proposals of the applicant. The most commonly certifications schemes are listed in Table 7.

Table 7 Certification schemes for Ex-Equipment

Scheme number	Test in accredited testing laboratories and other means of conformity proof	Inspection of production (quality system)	Surveillance audit of the certified products (quality system, production)
1a	Sample test	Analysis of the state of production	-
3a	Type test	Analysis of the state of production	Test of samples taken from the manufacturer. Analysis of the state of production
5	Type test	Certification of production or certification of quality system	Supervision of certified quality system (production). Test of samples taken from the manufacturer.
7.	Batch test	-	-
8.	Test of each sample	-	-

Certification Schemes are fully compliant with the recommendations of IEC.

- Scheme 1a consists of test of sample form shipment in accredited laboratory. It is applied to complex equipment. It includes analysis of production. This scheme is useful for short-term supply.
- Scheme 3a consists of the type test and analysis of production prior to the issuance of a certificate. Inspection control must be arranged under the frames of this type of scheme. This scheme is suitable for production with high level of stability.
- Scheme 5 consists of a test type, verification of production through the certification system for quality assurance or certification of the production. More strict inspection control is implemented. This scheme is appropriate when stringent stability characteristics are required.
- Scheme 7 is a test of consignment. Test of sample from the shipment is provided in accredited laboratory. Inspection control is not carried out.
- Scheme 8 is a test of each product. Schemes 7 and 8 are suitable when certifying a single shipment or single product.

3.3 Procedure of obtaining certificates and permits in Russia

For Ex-Motors in Russian Federation following documents are required:

- GOST-R Certificate of Conformity
- GOST-R Ex-Proof Certificate of Conformity
- Rostechnadzor Permit of Use

There are number of other certificates which may be requested by customers of Ex-Motors. But each of them is required in certain cases. Below I describe the procedure of obtaining those certificates and required documents. These certificates are:

- Fire Safety Certificate
- Sanitary Epidemiological (Hygienic) Certificate
- Metrology Pattern Approval Certificate

Fire safety certificate is required for fire detection equipment and electrical cables and wires. Hygienic Certificate is requested when the OEM is producing water pumps. And Metrology Certificate is required when the measurement equipment is sold on the territory of Russian Federation.

3.3.1 GOST-R Certificate of Conformity.

Certification of Ex-Equipment includes following stages:

- Application for certification (Appendix 2)
- Decision on the application for certification including the most appropriate scheme
- Selection of samples for testing
- Identification of samples
- Assessment of the design of samples. Testing of samples. Design evaluation and testing protocols.
- Assessment of the production and certification of quality system
- Review of the technical documentation

- Analysis of the obtained results. Making a decision on the possibility of issuing a Certificate of Conformity
- Issuing a Certificate of Conformity
- Inspection control of the certified products according to the scheme of certification
- Corrective actions when incorrect use of the Ex-Equipment is performed
- Information on the results of certification

Expertise of technical documentation is provided by independent testing laboratory. Certificate of Conformity is issued based on decision of testing laboratory. The certificate is registered in the State Register. Certificate is valid only if it has a registration number of State Register. The certificate includes information about all documents which are the basis for issuing a certificate according to the certification scheme. An example of typical Certificate of Conformity is on the Figure 10.

Supervising authority: Rostechregulirovanije.
Certificates of Conformity are issued by Certification Bodies accredited by Rostechregulirovanije to act on its behalf.

When needed: Customs clearance, Point of sales, RTN approval

Evaluation procedure:

- Evaluation of technical documentation
- Surveillance visits
- Sampling analysis
- Type testing in accredited laboratories
- Factory audits

Certification of quality management system

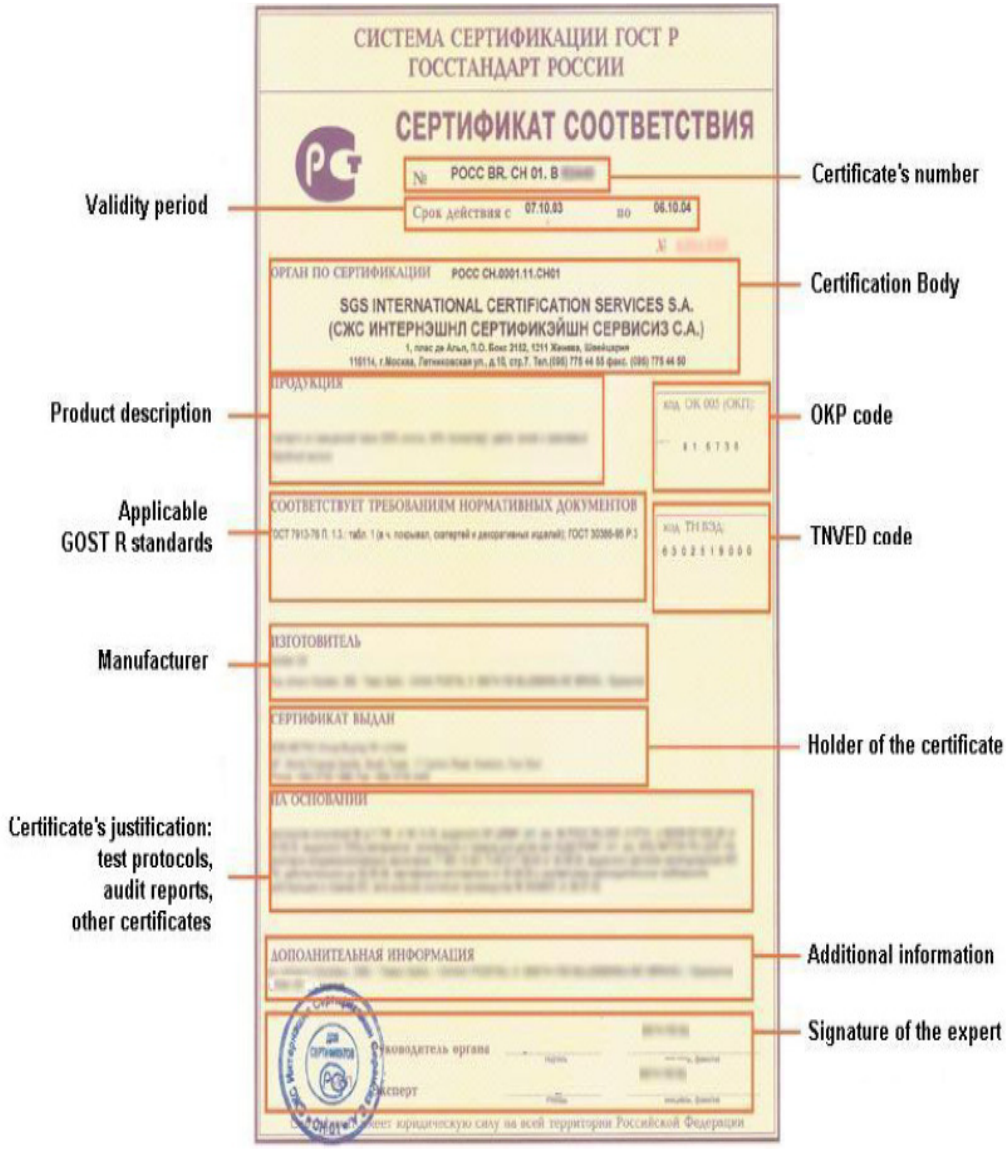

Figure 10 GOST-R Certificate of Conformity

Required documents:

- The data of the manufacturer (the address, phone, a fax, bank account).
- The exact name of certifying production, including types and models
- The catalogue of production
- Technical documentation and manuals, specifications
- Photos of equipment with explosion marking on it

- Drawings of equipment and components with specifications, principal diagram and connection scheme. These documents must represent the parameters of explosion protection, marking of explosion protection and warning inscriptions. Moreover here must be mentioned insulating materials and air gap
- Technical conditions and standards according to which is manufactured electrical equipment
- Earlier obtained certificates or test reports (ISO, West certificates)
- In addition to the above mentioned documents, the motor documentation has to include a GOST Technical Passport (Appendix 3). Technical Passport is a motor specific document, prepared by manufacturers, and follows the whole lifetime of the motor. Technical Passport includes among others: motor technical specification, warranty information, claim record and periodic verification record.
- Testing laboratory may require additional technical materials from applicant

3.3.2 GOST-R Ex-Proof Certificate of Conformity

On the Figure 11 and 12 are shown Ex-Proof Certificates of Conformity.

Supervising authority:
Rostechregulirovanije, Rostechnadzor

Certificates of Conformity are issued by Certification Bodies accredited by Rostechregulirovanije to act on its behalf.

When needed: Customs clearance, RTN approval, Commissioning

Evaluation procedure:

- Expertise of technical documentation
- Testing of samples in accredited laboratories
- Factory audits and surveillance visits.

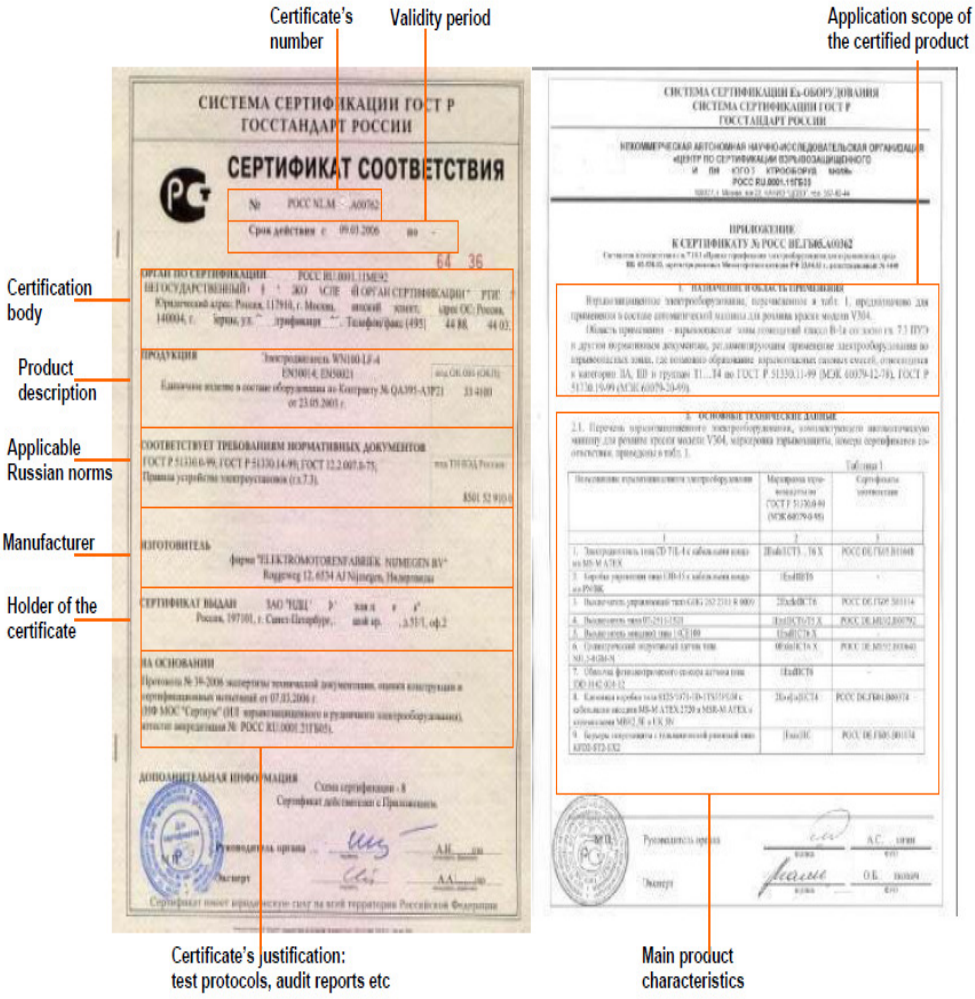

Figure 11 GOST-R Ex-Certificate of Conformity, Page 1

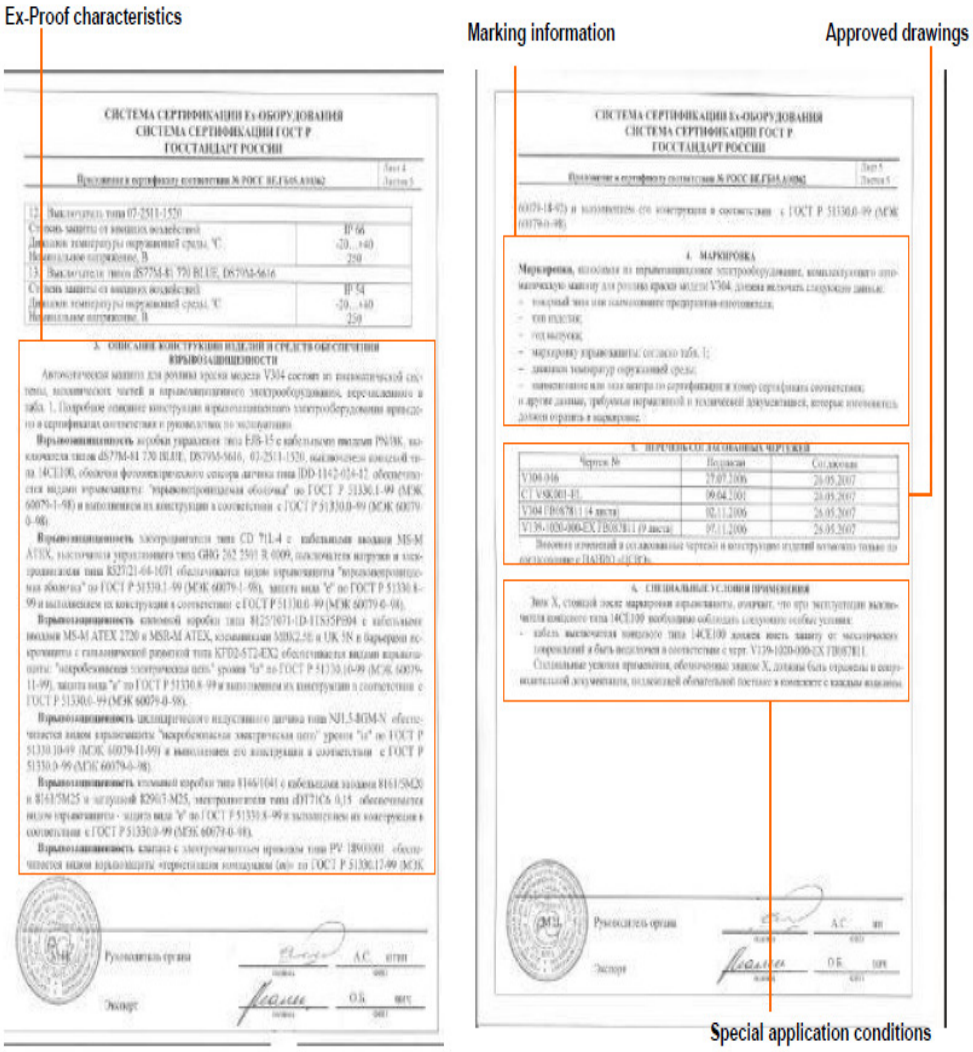

Figure 12 GOST-R Ex-Certificate of Conformity, Page 2

Required documents:

- Application form (Appendix 4)
- Technical description, including wiring diagrams
- Applied standards
- National (ATEX, NEC, CE code/CSA) Ex-Proof certificates
- Operating manual
- Photos or drawing of the equipment with proper marking.
- Other documents may be requested by the certification body. In case the equipment is certified according to ATEX, UL, FM or CSA the verification process to obtain the GOST-R Ex-Proof Certificate of Conformity can be limited to document review with no additional laboratory testing. Then the applicant will have to present:
    - Technical description of equipment, including wiring diagrams
    - Copy of the available Ex-Proof certificate, test reports.

In the part for additional information of Ex-Proof Certificate of Conformity must be mentioned following information:

- Appointment and scope of Ex-Equipment
- Main technical characteristics
- Description of construction and methods of explosion protection
- Marking
- Special conditions for the application
- A list of drawings adjusted by certification center

3.3.3 Rostechnadzor Permit of Use (RTN Permit of Use)

Figure 13 shows the typical Permit of Use with explanation of main fields of the document. (www.gost.sgs.com)

Figure 13 Rostechnadzor Permit of Use

Supervising authority: Rostechnadzor

RTN Permit of Use can be issued exclusively by Rostechnadzor quarters in Moscow

When needed: Commissioning and Exploitation

Evaluation procedure:

- Documentation review and execution of industrial safety expertise carried out by agency licensed by Rostechnadzor. Main areas of review cover:
    - Design safety – check of design, materials and calculations

    - Operational safety – maintenance and repair instructions, control systems, hydraulics, etc
    - Environmental safety – control of leakage, potential explosions, electrical safety, ventilation and soundproofing
- Results of the review are compiled into a document called Expert Conclusion
- Positive Expert Conclusion – the equipment conforms to the relevant norms and standards, the document is submitted to the Rostechnadzor headquarters with the application for permit issuance
- If the equipment is found not to conform to the relevant norms and standards, a permit may still be issued, specifying restrictions for the use of the device. This decision is still the discretion of Rostechnadzor
- Duration of expertise depends on the product complexity but should not exceed 3 months starting from the provision of the full set of documents
- Processing of the Expert Conclusion and registration of the permit in Rostechnadzor is maximum 2 months

<u>Required documents:</u>

- The application to Rostechnadzor on reception of the Sanction (Appendix 5)
- A copy of documents about the registration of the company-manufacturer in home country
- The information about structure and primary activity of the company-manufacturer
- The specification of the equipment with the instruction
- Registration certification
- Equipment drawings, technical documentation
- Reports of production tests, the certificate of acceptance tests
- A copy of the Certificate ISO 9001, Copies of other available Certificates
- A copy of the Certificate of Conformity to GOST-R

3.3.4 Fire Safety Certificate

- Products and services are certified for fire safety with the purpose of conforming their compliance with the fire safety requirements in accordance with the legislation of the Russian Federation. A Fire Safety Certificate (Figure 14 and 15) is an integral part of Certificate of Compliance with GOST-R. A certification procedure is determined by the State Fire Service upon consultation with the Committee for Standardization, Metrology and Certification.

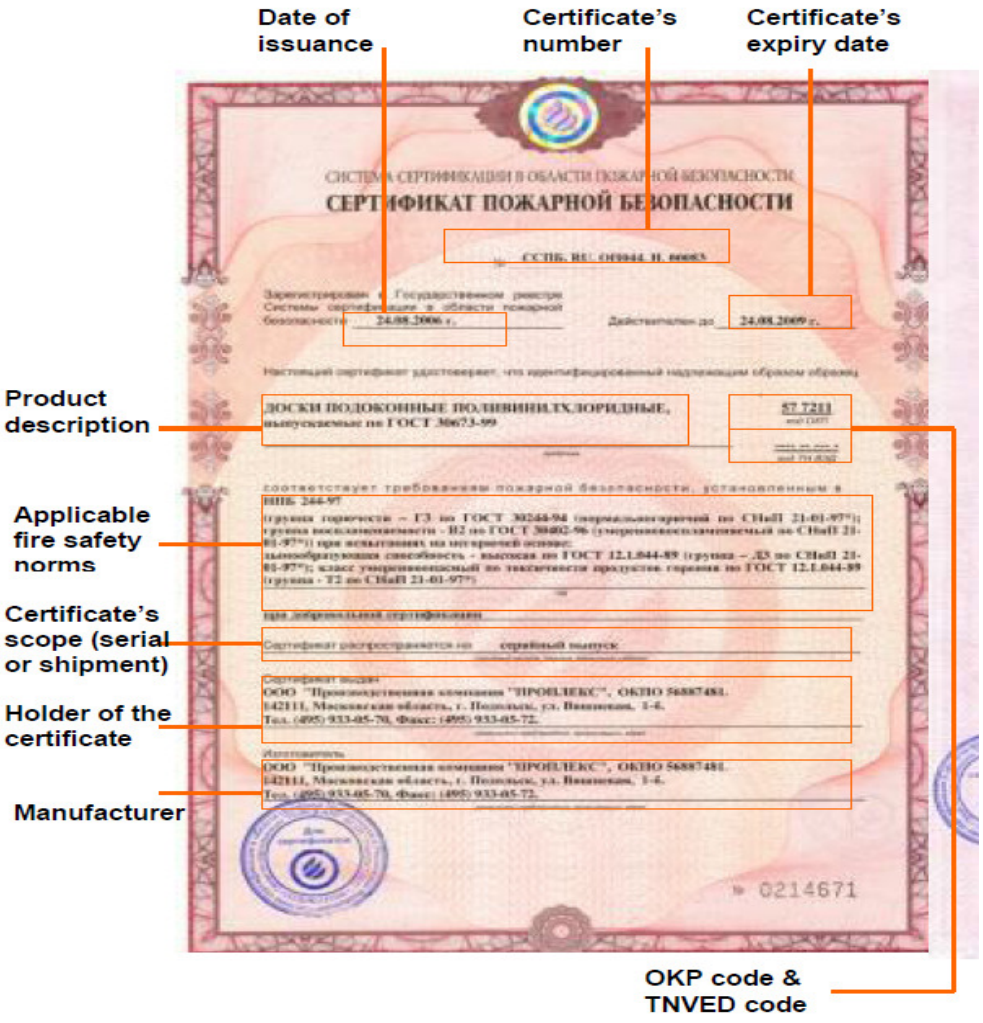

Figure 14 Fire Safety Certificate, Page 1

Mandatory Fire Safety Certification is required for the following:

- Fire detection, protection and extinguishing equipment and systems
- Flammable building materials and structures – wall-paper, floor tiles, carpets, cable ducts, doors
- Electrical products – cables, fridges
- Heat production products – gas ovens, gas generators

Figure 15 Fire Safety Certificate, Page 2

There are two available Certification Schemes. First is Single Shipment Certificate – or The Consignment Fire Safety Certificate is a trade document valid for one consignment only. A proof – contract or invoice – of customer or importer in Russia is needed to be issued a certificate. And the second – Certificate of Serial Production is a trade document valid from 12 months to 3 years depending on the nature of the products.

Supervising authority: State Fire Supervising Department – Gospozhnadzor. Fire Safety Certificates are issued by Certification bodies accredited by Gospozhnadzor to act on its behalf.

When needed: GOST-R Certification

Evaluation procedure:

- Evaluation of the technical documentation
- Surveillance visits
- Sampling, analysis, type testing (with regard to fire resistance and toxic emissions in fire situation)
- Factory audits

Required Documents:

- The document confirming the status of the legal person of the applicant
- Contract
- The appendix to the contract or the specification
- Test reports on parameters of fire safety
- Product samples
- The exact name certifying production, including types and models
- Earlier received certificates or test reports it (is desirable)
- The data on the manufacturer (the address, phone, a fax)

3.3.5 Sanitary-Epidemiological (Hygienic) Certificate

The Sanitary-Epidemiological Conclusion Certificate (Hygienic Certificate) confirms that products, activities or technical conditions conform to applicable hygienic standards and sanitary regulations in Russia, Figure 16 and 17. It is a pre-requisite for obtaining a GOST-R Certificate of Conformity. Hygienic Certificate is required for Food stuff and beverages, materials and equipment that are in direct contact with food or skin or whose vapors can be inhaled, for example, chemical and petrochemical products for industrial applications. There are different Certification Schemes for product, type of activity and technical solutions.

Figure 16 Sanitary-Epidemiological Certificate, Page 1

Certification for technical solutions confirms that the product to be distributed within Russian Federation is in compliance with Russian hygienic and sanitary standards. Manufacturing conditions, quality control with regards to raw materials and technological processes and also safety and sanitary parameters of the final goods must be the focus of inspection in terms of obtaining Hygienic Certificate.

Figure 17 Sanitary-Epidemiological Certificate, Page 2

Hygienic Certificates are only issued by the Russian Federal Service for Supervision in the Area of Consumer Rights and Welfare Protection or Rospotrebnadzor. Two independent organizations, both parts of Rospotrebnadzor, are involved in issuing

Hygienic Certification. One of them is Center of Hygiene and Epidemiology. This Center provides test protocol analysis and other documentation analysis. And the second is Territorial Office of Rospotrebnadzor. This organization issues final certificates based on the expert conclusion drawn by the Center of Hygiene and Epidemiology provided that the product conforms the compliance of the goods to the Russian Hygienic Standard.

The nature of the Product and the validity period of the certification define the depth of the technical review and the duration of testing methods. A Hygienic Certificate is valid for 1 to 5 years depending on type of product and associated risks to human health, shelf life and validity of previous Hygienic Certificates.

Supervising authority: Rospotrebnadzor

When needed: GOST-R Certification, customs clearance and point of sale

Required Documents:

- The data of the manufacturer (the address, phone, a fax)
- The Firm's post properties
- The Firm's Bank properties
- The exact name of certifying production, including types and models
- The catalogue of production
- Technical documentation
- Earlier received certificates or test reports it (is desirable)
- The engineering specifications
- Tests of produced goods
- ISO, West certifications

3.3.6 Metrology Pattern Approval Certificate

Pattern Approval Certificate for Measuring Instruments (Metrology Certificate) testifies that the particular pattern of measuring instruments conforms to applicable standards and is approved for the use in the Russian Territory, Figure 18. Metrology Certificate is a pre-requisite to obtain GOST-R Certificate of Conformity and Rostechnadzor Permit of Use when applicable. Metrology Certificate is required for products that fall under different fields, among which can be found following related to Ex-Equipment industries:

- Testing and control of product quality aiming at identification conformity with Russian state standards
- Mandatory Certification of products
- Manufacture of products supplied for state purposes

Figure 18 Metrology Pattern Approval Certificate

Metrological Certificates are issued by the Federal Agency for Technical Regulation and Metrology. Mandatory testing is first done to the measuring instrument in a State Scientific Metrological Centre accredited by Rostechregulirovanije before the Metrological Certificate can be issued. Approved pattern of measuring instruments is registered in the State Record of Measuring Instruments managed by Rostechregulirovanije. The measuring instrument of an approved pattern and its operational documents are to be properly marked.

Supervising authority: Rostechregulirovanije

When needed: GOST-R Certification, Rostechnadzor approval

Required Documents:

- The data of the manufacturer (the address, phone, a fax)
- The Firm's post properties
- The Firm's Bank properties
- The exact name of certifying production, including types and models
- Technical documentation

3.4 Certification in CIS

The main document that determines the certification procedure in Commonwealth of Independent States is "Agreement on realization of coherent policy in the field of standardization, metrology and certification" enacted March 13, 1992. This document coordinates the activity of Interstate Council in the field of standardization, metrology and certification. Certification procedures are implemented according to the "Procedure Rules of the Interstate Council for Standardization, Metrology and Certification". According to the Agreement Commonwealth countries form a national certification scheme in accordance with ISO/IEC Guides and achieved in this field experience. Certification in each CIS country is similar and list of required documents is the same. But in each case there are different specifics for each country.

3.4.1 Certification in Ukraine

State Committee on Technical Regulation and Consumer Policy of Ukraine is Derzhspozhyvstandard (Gospotrebstandart). The main task of this organization is providing of realization of State policy in the sphere of consumer's right protection, standardization, metrology and certification.

Product conformity assessment is one of State technical policy components. Conformity assessment is used on premarket stage of introduction the products into the market. It can be performed by the manufacturer or with the involvement of the third party - certification body. State Committee on Technical Regulation and Consumer Policy and accredited Certification Bodies are legally authorized to perform work on mandatory certification.

Derzhspozhyvstandard of Ukraine has established a National system for product certification – UkrSEPRO. Under the supervision of this organization more than one hundred Certification Bodies perform work on certification. Product certification in the system of UkrSEPRO is performed according to confirmed Rules for certification of homogeneous kinds of products. International Certificates or Certificates issued by other countries (IECEx, GOST-R) are not valid on the territory of Ukraine. But they can be taken into consideration as a positive aspect.

Certificates of Conformity for Ex-Equipment are issued by Testing Certification Centre of Explosion protected and mining Electrical Equipment (TCCExEE). TCCExEE is accredited in UkrSEPRO system as a testing laboratory and certification body. TCCExEE is located to the address:

Ukraine, 83052, Donetsk, 50-ty Gvardeysky divizii str., l7
Internet: www.tccexee.org
E-mail: Pog@iscve.donetsk.ua

Organization responsible for the definition of safety requirements, of industrial norms and their applications in Ukraine is Committee of the Supervision of Labour Safety

(Gosgorpromnadzor). It is in charge for accreditation of testing laboratories and certification bodies which issue certificates approving safety of production. Gosgorpromnadzor is located to the address:

Ukraine, 02023, Kiev, Esplanadna str. 8/10
The chairman of the Committee – Dr. Sergey A. Storchak
Phone: 044 226-20-83, 226-55-24
Internet: http://dnop.kiev.ua/eng/index.htm
E-mail: dnop@dnop.kiev.ua, tsurik@dnop.kiev.ua

For Ex-Equipment in Ukraine following documents are required:

- UkrSEPRO Certificate of Conformity
- Permission of Gosgorpromnadzor of Ukraine

3.4.1.1 UkrSEPRO Certificate of Conformity

Supervising authority: Derzhspozhyvstandard

When needed: Customs clearance, Point of sales

Evaluation procedure:

- Evaluation of technical documentation
- Surveillance visits, factory audits
- Sampling, analysis, type testing in accredited laboratories
- Certification of quality management system

Required documents:

- Application Form (Appendix 6)
- Technical description, operation and installation guide of the product
- Drawing of Electrical Equipment

Certificate of Conformity is required for customs clearance at the Ukrainian border as well as for sale and marketing within the country. For products not subject to mandatory certification according to the Ukrainian law, voluntary certification scheme may be applied. Figure 19 shows an example of UkrSEPRO Certificate of Conformity.

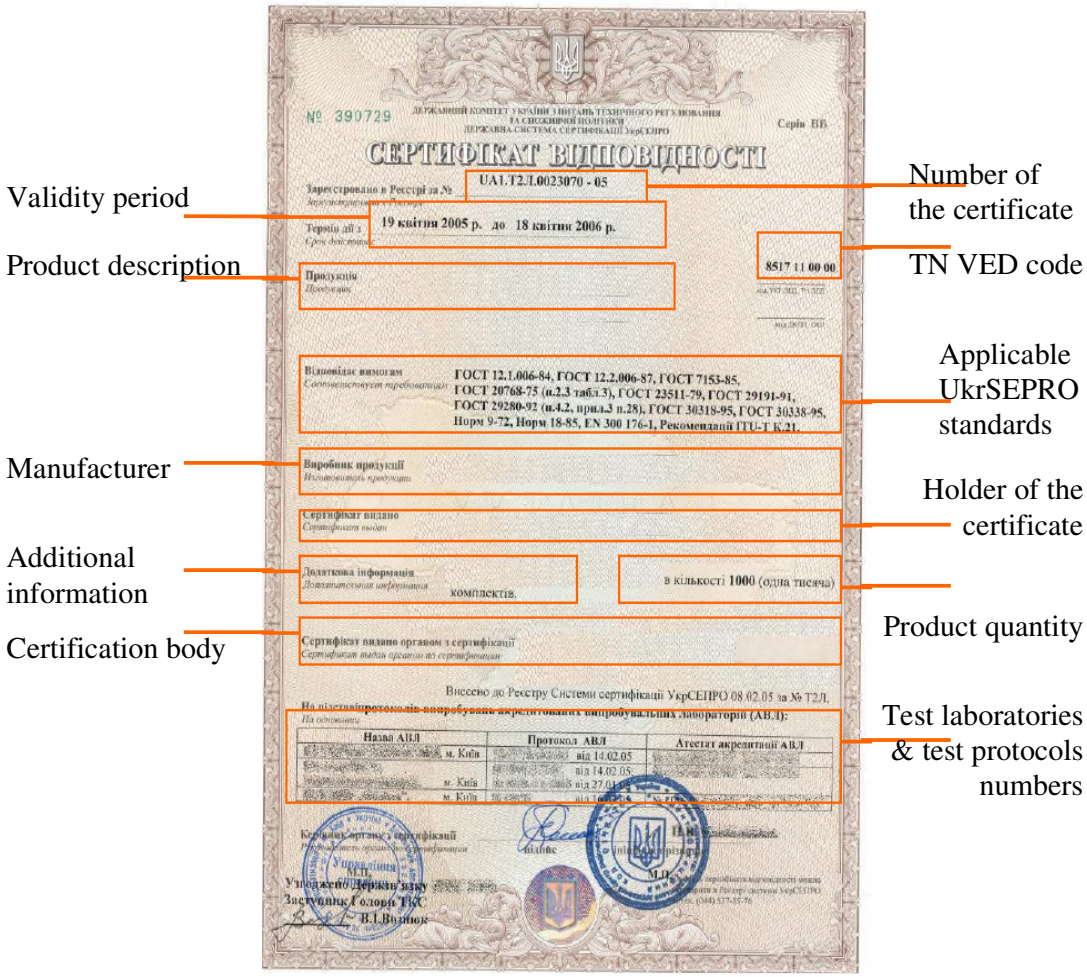

Figure 19 UkrSEPRO Certificate of Conformity

There are different schemes for certification of products in Ukraine. The certification may be implemented for single shipment of for serial products.

- Single Shipment Certificates - The Consignment Certificate of Conformity is a trade document valid for 1 year and for one consignment only, i.e. for a certain quantity and type of product. This kind of certificate is advisable if you export to Ukraine sporadically. A proof of who your customer in Ukraine is necessary by means of contract or invoice.
- Certificates for Serial Production – The Serial Production Certificate of Conformity's validity can vary from 12 months to 5 years. It all depends on the nature of the product and certification scheme chosen. Serial Production

Certificate of Conformity is suitable for companies with regular export activities and a wide product range because this document enables them to export unlimited number of times and quantities of goods produced during the certificate's validity period. The Certificate for Serial Production can be issued to a manufacturer only.

- For certificates with 1 year validity, sample testing is needed. Audit of the manufacturing facilities is no longer required. However, this is not applicable to some goods (e.g. food, telecom, etc.)
- For certificates with 2-3 year validity, sample testing is needed. Quality Assessment of the production line is also necessary
- For certificates with 5-year validity, quality management system has to be certified. Sample testing might also be conducted.

3.4.1.2 Permission of Gosgorpromnadzor of Ukraine

Gosgorpromnadzor of Ukraine implements admission of explosion protected electrical apparatus to operation according to Certificates or Conclusions about explosion protection, issued by TCCExEE, on the stipulation that results of their tests are satisfactory.

Supervising authority: Gosgorpromnadzor

When needed: Commissioning and Exploitation

Evaluation procedure:

- Documentation review and execution of industrial safety expertise
- TCCExEE will inspect the production of an electrical equipment for the purpose of confirmation of technological stability of production of explosion protection tools
- TCCExEE will carry out the certification tests of stated electrical equipment
- Issuance of Permission to Use

Required documents:

- Application form
- Technical description, installation an operation guide of the product
- Certificate of conformity to the safe requirements, issued by the National testing organization
- Drawing of the Electrical Equipment in the similar extent as presented to the National testing organization
- Report of product tests, which were the reason for certificate of conformity issue
- All materials except for the description or operation manual can be given in English

3.4.2 Certification in Belarus

Certification procedure in Belarus for Ex-Equipment is different compared with other CIS countries. This type of equipment does not belong to the List of Products which are subject to mandatory conformity approval in the Republic of Belarus. For equipment to be allowed operate on the territory of Belarus the Permit of Use for hazardous areas is required. This Permit of Use is issued by Ministry on Emergency Situations of Republic Belarus (Gospromnadzor). The main objectives of Gospromnadzor are:

- Implementation of state supervision in the field of industrial safety
- Supervision of legislation execution in the field of industrial safety, transportation of dangerous goods, control over the implementation of legislation for the protection and rational use of natural resources
- Preventing of accidents on the hazardous industrial facilities

Permit of Use of Gospromnadzor is on the Figure 20.

Figure 20 Permit of Use of Gospromnadzor

Supervising authority: Gospromnadzor

When needed: Commissioning and Exploitation

Evaluation procedure:

- Documentation review and execution of industrial safety expertise
- Expert survey of the factory which includes:
  - General information about the company
  - Raw material control
  - Qualification and certification of personnel
  - Monitoring of quality control in accordance with the technological process and instructions
  - Monitoring of maintenance procedures

- Measuring Tools
- Packing and storage

- Issuance of Permit of Use

Required documents:

- Application form to the Ministry of Emergency situations of Republic Belarus (Appendix 7)
- Technical documentation for manufacturing equipment, copies of technical passports, operational and maintenance documentation
- Certification of equipment manufactured in the national or international bodies (copies of certificates and certificates for the equipment supplied to the consumers of the Republic of Belarus)
- Catalogue of equipment
- After the positive results of tests a Permit of Use is issued.

The whole procedure of obtaining this document takes approximately two months. Permit is valid three years. Organizations that are providing the service of certification are:

EasyGOST Service Limited & Co. KG
Dülkenstr. 9, D-51143, Cologne, Germany
Phone: +49 221 45 44 200
E-Mail: info@easygost.com
Internet: www.easygost.com

BELLIS
The Republic of Belarus, Krasnaya str., 8, Minsk, 220029
Phone: +37 517 288 16 41
Internet: www.bellis.by

3.4.3 Certification in Kazakhstan

The import regulation rules of Kazakhstan are principally the same as the standards of Russian Federation, but there are still some differences in details. The GOST-K

certificate is Kazakhstan counterpart to the GOST-R certificate. The Kazakh certification process is similar to the Russian.

For Ex-Equipment following documents are required:

- GOST-K Certificate of Conformity
- Permit of Use of Ministry of Emergency Situations of the Republic of Kazakhstan

The process of certification is more complicated in Kazakhstan compared to Russian Federation. Another important difference is the procedural method of the testing facilities. The expert of the facilities is conducting operations locally in the manufacturing company. This means usually they must travel to the enterprise which makes the procedure more cost-intensive. Republic of Kazakhstan does not recognize foreign certificates and reports of tests for production manufactured not in the certificate issuing company. Therefore, if the product is not certified according to the requirements of Kazakhstan legislation there is no difference what is the country of supply: Russia or Finland. Certification procedure will necessarily include a testing of equipment.

Following organizations are accredited for Certification of Ex-Equipment and providing procedures for obtaining Permit of Use:

Sapa Consulting Group-NS
E-mail: Elena_standart@mail.ru

FEV Service Company
Kazakhstan, Almaty, 6th Mikrorajon, 56, 22
Phone: +7 727 298-26-89
e-mail: fevservice@mail.ru

SAPA Intersystem
Kazakhstan, Almaty, Rajymbeka st., 365-367
Phone: +7 727 263 74 87
E-mail: sapais@mail.ru

3.4.3.1 GOST-K Certificate of Conformity

This document is issued by Committee on Technical Regulating and Metrology of Ministry of Industry and Trade of Kazakhstan Republic (Gosstandart). Certificate is valid for one year or for three years depending on Certification Scheme. There are two Schemes appropriate for Certification of imported goods. In first case is implemented Type Certification (Scheme 3). This certificate is valid for one year and may be renewed after expiry date. In the second case are implemented Type Certification and Quality Management Certification (Scheme 6). This Certificate is valid for three years, Figure 21.

Supervising authority: Gosstandart

When needed: Customs clearance, Permit of Use of Ministry of Emergency Situations of the Republic of Kazakhstan, commissioning

Evaluation procedure:

- Evaluation of technical documentation
- Surveillance visits (3 days for each factory)
- Sampling, analysis, type testing by accredited Certification Companies
- Factory audits
- Certification of quality management system
- Issuing of Certificate (1 month after application)

Required documents:

- Data on the manufacturer (postal address and bank details)
- The exact name of the certified products, including types and models
- Product catalogue, technical documentation
- Previously obtained Certificates and Reports of Technical Laboratories
- Specifications and Technical Passport
- Drawings, electrical circuits, photos of equipment
- ISO, IECEx certificates if available

- Contract or invoice if shipment is according to the contract
- All documentation is provided in Russian

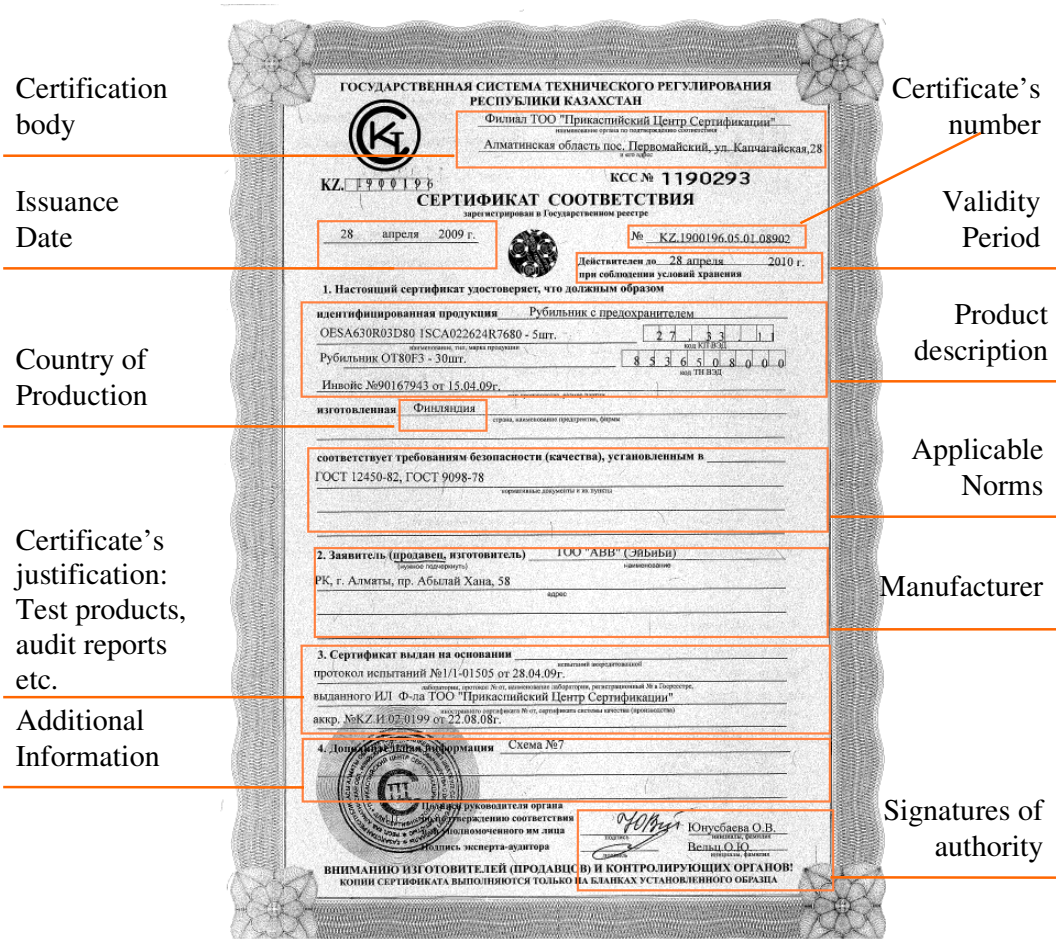

Figure 21 Certificate of Conformity GOST-K

3.4.3.2 Permit of Use of Ministry of Emergency Situations of the Republic of Kazakhstan

This document is required for operating in COG Industry. The procedure of obtaining this permit is evaluated in two stages – Expert advice and Decision of Ministry of Emergency Situations of the Republic of Kazakhstan in Astana. Expert advice is executed by accredited Certification Companies. The same company arranges sending

of application and negotiations in Astana, Figure 22. This document does not have an expiration date.

Figure 22 Permit of Use of Ministry of Emergency Situations of Republic of Kazakhstan

Supervising authority: Ministry of Emergency Situations of the Republic of Kazakhstan. Permit of Use is issued in Astana

When needed: Commissioning, for installation and operation of equipment in COG Environment

Evaluation procedure:

- Evaluation of technical documents
- Surveillance visits
- Sampling, analysis, type testing by accredited Certification Companies
- Factory audits
- Certification of quality management system
- Obtaining of Permit of Use (approximately in 2 months)

Required documents:

- Application Form to Ministry of Emergency Situations of the Republic of Kazakhstan (Appendix 8)
- Copy of Manufacturer Registration Documents in home country
- Information about structure and main activities of the Manufacturer, including information about staffing, testing and production units of the company
- Specification of equipment with indication of components
- The list of standards, rules and regulations in compliance to which is produced equipment
- Technical documentation, including information on the application of equipment, technical characteristics, technical conditions and estimated life-time
- Information about raw materials and reliability of equipment
- Technical description
- Technical passport including information about application, scope, consistence of equipment, certificate of acceptance with a list of standards according to which this equipment is produced
- Drawings
- Reports of Facility Tests, program and methods of acceptance tests
- Copy of the Certificate of Quality System ISO 9001
- Copy of the Certificate of Conformity (GOST-K)
- All documentation is provided in Russian

3.4.4 Certification in Azerbaijan

The State Agency on Standardization, Metrology and Patents has been established by the Decree No. 623 of December 27, 2001 of Azerbaijan Republic President. The Agency is the central executive body, forming and executing the state policy in the field of standardization, metrology, certification and protection of industrial property objects. It is located on the address:

Azerbaijan, Baku, 124, Mardanov Sardashlary str., AZ1147
Phone – 994 12 449 99 59
Internet – www.azstand.gov.az
E-mail – azs@azstand.gov.az

Azerbaijan is the member of the Euroasian Interstate Council for Standardization, Metrology and Certification that form CIS countries. Therefore in terms of Certification are applicable EASC standards for Ex-Equipment (Appendix 1).

According to the information of Euroasian Interstate Council organization accredited in Azerbaijan for Certification is "Azstandartservice". But as I found information in Internet this organization does not exist anymore. Many other companies may provide certification procedure in this country but it is not common for them. That is why on proposal about clarifying the situation about certification they responded me that in each case the question must be considered individually. Here are coordinates of international companies which mention on their web pages that they implement certification procedures in each country of CIS:

SGS Group
Finland, FI-00210, Helsinki, Särkiniementie 3
Phone: +358 9 696 36 66
Internet: www.gost.sgs.com
E-mail: nina_pihlman@sgs.com

EasyGOST Service Limited & Co. KG
Dülkenstr. 9, D-51143, Cologne, Germany
Phone: +49 221 45 44 200
Fax: +49 221 45 44 209
E-Mail: info@easygost.com
Internet: www.easygost.com

3.5 Conclusions

Several private companies have accreditation of Rostechregulirovanije and Rostechnadzor to provide high-quality certification services. These companies have a good experience of collaborating with foreign manufacturers. Such certification organizations are familiar with the technical requirements and Russian legislation.

Certification is a very expensive and time consuming process. Certificates obtained by one of the countries associated with Eurasian Interstate Council do not match to any of other countries. The certification procedure must be repeated for each country in which electrical equipment will operate. For example, if equipment is used in both countries Russia and Kazakhstan certificates of both countries are required. Self-evidently this fact duplicates the costs.

The other difficulty in the certification procedure is related to language barriers. GOST standards and other official documentation have no official English translations. Some of the documents have courtesy translations but these translations do not have legal value. Therefore to be sure that equipment is compliant with GOST standards and satisfies all the requirements of Certification bodies a huge amount of work must be implemented. When applying for certificates all the documentation must be submitted in Russian. These documents include type test results, technical characteristics and drawings. Other additional information must be submitted in Russian too. For most equipment this means translation of many documents. All discussions with local authorities are conducted in Russian.

Due to compliance with local regulations and standards required by law much up-front work is required by companies which are intending to act on a Russian Market. These companies must understand what the influence of these standards and regulations is on the design of their equipment. Failure in understanding requirements and certification and approval process will lead to long delays in deliveries of equipment.

One of the main goals of my work was to describe approval procedure in different countries of Commonwealth of Independent States. During this work I was using information of open sources in Internet and consultations of Certification Managers of ABB offices in these countries. As I found out in different offices approval procedure is implemented in different ways.

For example in Russian office there is a special person who is responsible for Certification. While in Belarus and Ukraine the certification procedure is provided by consulting companies unlike Kazakhstan and Azerbaijan. In those countries approval procedure is provided by sales managers and consulting agencies.

The certification procedure in CIS countries is implemented according to the "Procedure Rules of the Interstate Council for Standardization, Metrology and Certification". Russian certificates are not valid for CIS countries. It is explained that equipment is produced in Finland not in the country that issued the certificate. Therefore, to be able to supply equipment on the territory of CIS countries the certificate of each country is required. Most CIS countries have mutual agreements on acceptance of certificates and results of Test Laboratories. But those can be used only if equipment is manufactured on the territory of the country where certificates are issued. Availability of other certificates can help but those certificates are not used in terms of installation and commissioning of equipment. The procedure is similar in each country. The list of required documents is the same. Therefore it is easy to familiarize with certification in different cases. Even though the certification procedure is similar each country has its own specifics which must be taken into consideration when dealing with certification of Ex-Equipment.

In the process of Certification GOST-K quite often certification bodies are referred to Russian standards or Soviet Union GOST standards. But nevertheless even with the Russian certificate of conformity manufacturer must sill obtain Kazakhstan certificate of conformity for the equipment that is subjected to mandatory certification. Positive moment is the fact that all the required documents – letters and translations of

technical documentation must be delivered in Russian language even though the official language is Kazakh.

Technical requirements of designing and test methods of explosion protected electrical equipment, specifications on its maintenance and repair, rules of the device for electrical installation and the principles of a classification of explosive zones, order of admittance to maintenance in the various countries sometimes essentially differ. Therefore, for example, in the countries of the EU do not valid admitting documents produced by test organizations of Ukraine, Russia and on the contrary, EU explosion protected electrical equipment in these countries is exposed to retest.

4 COG MACHINES MARKET IN RUSSIA

4.1 Ex-Machines Market Potential

Russia has a wide natural resource base including major deposits of oil, natural gas, coal, many strategic minerals and timber. COG Industry is playing significant role in the economical structure of the country. Russia has huge potential for sustained high growth in petrochemicals in the long term. Hydrocarbons output is set to rise substantially over the medium term, providing a firm basis for investments in the Russian COG Industry. (CIA, 2009)

Russia lags behind EU states in terms of the economical structure and has an average score of market risk. The main weakness for investment into COG Industry is the absence of an industrial policy and a legislative framework aimed at protecting this sector. There is also a lack of foreign investments and management expertise. These facts are limiting the perspectives of growth. (BusinessWeek, 2009)

Russia slips into recession together with petrochemical contracts. According to the financial forecasts lags on most current petrochemical projects will continue approximately one year. However, some projects nearing completion are still kept working. These include Omskkhimprom's plant in Omsk and Salavatnefteorgsintez's local high-density polyethylene (HDPE) plant in Salavat, which are likely to come online in 2009 and 2010. Despite the expected delays in these plants, by 2013 Russia should have total polymer production capacity of around 6.03 millions tones a year and ethylene capacity of 5.23 millions tones a year, representing increases of 129 % and 41 % respectively compared to 2008 levels. According to the annual reports of Lukoil there are a number of key projects in COG industry for the following five years. These are:

- Khauzak, Uzbekistan, 2007
- Juzhno-Hylchujusjoje, 2008 Russia
- Korchagina, 2009, Russia

- Kandym, 2011, Uzbekistan
- Philanovskogo, 2013, Russia (Lukoil, 2009)

There is a number of coming investment projects in COG Industry on the territory of Azerbaijan and Kazakhstan. In spite of difficult economical situation foreign companies keep investing into these regions, Figure 23. (Hazel, 2004)

Figure 23 Tank farm. Tengiz oil field in Kazakhstan

It is of utmost importance in the current situation to be oriented not only on large projects but also on small ones. Projects have to be selected and pursued with high intensity. The low oil prices continue to drive the COG Industry towards implementing new concepts for efficient operations, maintenance and modifications. These new concepts add requirements to traditional automation, safety and telecom systems.

There are a number of factors that will influence output trends over the short-to-medium term. One of the main forces behind Russia's downturn is the fall in oil and gas prices. Another determinant is the value of the ruble. By January 2009, the ruble had been devalued twice by the Central Bank of Russia. This could be of benefit to the petrochemical industry, since depreciation does not affect raw material costs due to Russia's self-sufficiency in feedstock. Russian petrochemicals will become cheaper in the Euro zone, while imports will become more expensive. Even given these factors, the steep decline in the construction and automotive sectors will outweigh the advantages in terms of the exchange rate and feedstock pricing. (Kershenbaum, 2009)

Extraction of oil from oil wells is decreasing and new sources should be found if the production level should remain at the present level or increase slightly in the future. The tendency is, however, towards the widening of the oil industry that is challenging for Producers of COG Machines. World must increase 75% of cross oil production capacity during next 20 years. This is six times the current capacity of Saudi Arabia, just to meet demand growth and counter decline. Thus making strong long-term investments to response the increasing demand and declining capacity from existing fields would be challenging in current situation. (Swansea, 2009)

Our society is heavily embedded in an oil powered economy. Mobility, agriculture, distribution of food, etc., are all dependent on plentiful and reliable oil supplies.

4.2 Competitors overview

Main competitors of ABB on the market of COG Machines are represented by Siemens-Loher Company and Chinese competitors. Speaking about Siemens-Loher typically their strategy is to offer large bundled packages (full electrical and mechanical packages) for the major project by their non-product specialized front-end sales. One of their advantages is global sales network and wide (horizontal and vertical) product range. Other advantage is strong promotion of large compressor drivers. The disadvantages of Siemens-Loher are inflexibility for modifications and

engineering chances. Figure 24 shows the global shares of Induction Machine manufacturers in COG Industry. As it can be seen ABB, by its 26 % share, has a very strong position compared to other companies. (www.abb.com)

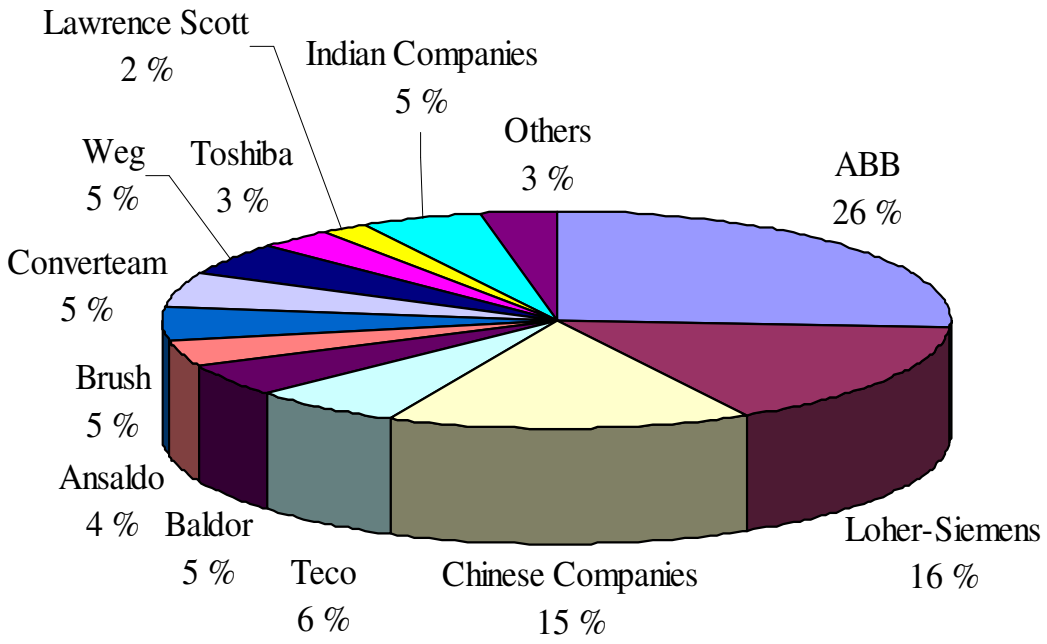

Figure 24 Market Share for Induction Machines in the world
Source: Jussi Rautee, 2009

Chinese competitors have very strong position as domestic suppliers in their home market due to political reasons. The disadvantages of Chinese manufacturers may be listed as low level of reliability and absence of direct export. Other competitors are regional or product-wise niche players. These companies have attacking strategy of competition. Such companies are WEG, Converteam and other US Manufacturers. WEG is involved with Petrobas, PEMEX and other US projects. Therefore they are not able to be active elsewhere. One of the strongest features of the company is large factory capacity investments in Brazil, China and India. Converteam is mostly active in medium voltage drives profiling themselves as a VSD package provider. US manufacturers are mostly focused on Canadian National Electrical Manufacturers

Association (NEMA) market in Calgary. New investments by TECO are concentrated on building factories in Vietnam & Saudi Arabia. (Rautee, 2009)

ABB has a long and well-known history in Russia. In 1893 ASEA opened its first office in St. Petersburg. ABB in Russia has a reputation of reliable and professional partner, acting both as a producer and supplier. Company has a number of core competencies in contrast with other foreign suppliers. For example it has a good knowledge of Russian market, especially technical requirements of customers. Compared to Russian manufacturers ABB has a significant technical, scientific and technological experience. Moreover ABB offers integrated complex solutions for customers' businesses. Such approach includes the product design stage, production, supply, turnkey operation, after-sales service and customer training. (www.abb.com)

Despite all of these advantages for customers ABB has a lot of competitors in Russia. These competitors can be divided in two groups – the first one and the biggest represents Russian companies producing electrical machines and equipment. The second group is represented by foreign companies that sell their production on the territory of Russia. Those companies produce their equipment abroad or on the territory of country using their license and technologies.

The economic system in modern Russia has changed radically compared to Soviet Union Period. Since the 1990s the country is living according to the rules of market economy. Russia is intended to be a full-fledged member of the International Market of COG equipment. However this process is retarded by the fact that few Russian enterprises are certified according to ISO 9000 Systems of Quality Management. Moreover very few Russian industrial products have undergone the certification by international or internationally recognized systems (IECEx, API and others). Considering this situation, on the initiative of the Russian Union of Industrialists and Entrepreneurs, and with the support of the Federal Agency for Technical Regulation, Rosneft and Gazprom, an Interdepartmental Council for Standardization in the Oil and Gas Complex was established at the Russian Union of Industrialists and Entrepreneurs.

Its goal, among other things, is to prepare in advance national standards in the oil and gas sector. (Kershenbaum, 2009)

Government of the Russian Federation has policy of supporting domestic manufacturers. They set the subsidiaries for the local companies, increase custom duties for imported goods in several industries. Due to weak position of Russian currency prices of Ex-Equipment from Europe are higher compared to the prices suggested by domestic manufacturers.

Foreign manufacturers are represented by global companies (Siemens and Schneider Electric). These companies have aggressive pricing on the territory of the Russian Federation. They try to cut down the prices as much as possible for the purpose of occupying stable market share in a specific field of industry. Moreover there is a close-fought battle for large projects between competitors. That is of utmost importance to act as comprehensive as possible developing the quality of manufactured products achieving new heights of Russian business. (Rautee, 2009)

The main competitors of ABB on Russian market are Ruselprom, Elektrosila, Elsib, Privod, Siemens and Siemens. These companies have a significant market shares in sales of Induction Machines for COG Industry. In the product list of these companies is a wide range of Electrical Machines that satisfy all the requirements of customers in different fields of Industry. All of these companies are located in different parts of Russian Federation that decreases transportation costs and delivery of Ex-Equipment to the customers, Figure 25. (Zverev, 2009)

Safonovo Electric Machine Plant (SEZ) is specialized in production of synchronous and asynchronous motors. Company has a powerful industrial and technological base for development of new types of electric vehicles. Special attention is paid to explosion-proof generators.

Figure 25 Location of Russian Competitors of ABB
Source: Viljo Mettälä

Leningradsky Electromachinostroitelny Zavod (LEZ, Novaja Sila) produces equipment for metal, cement, pulp and paper and COG Industries. This company has a wide distribution network all over the world.

Privod is considered to be one of Russia's largest production facilities for the manufacturing of power electrical equipment. This company offers a wide range of asynchronous motors. It has a stable demand in Russia and abroad. Regular customers are the largest companies in COG, pulp and paper and energy industries.

ELSIB is the only major power engineering company on the territory of Siberia and Far East. It has a strong position in design and production of generators for steam, gas and hydraulic turbines of high power and high power asynchronous motors.

Elektrosila is a part of Power Machines Group. Power Machines is the leading Russian manufacturer and supplier of complex decisions in the field of power engineering including production, supply, maintenance and modernization of equipment for

thermal, nuclear and gas-turbine plants. At the present day main shareholder of Power Machines (Highstat Limited Company) together with its strategic partner Siemens Company develop new strategy of Power Machines which is an essential part of development strategy of all Russian power engineering complex.

Table 8 lists the Electrical Machines which are produced by the main competitors of ABB.

Table 8 Main competitors' product portfolio

Company	**Location**	**Products**
SEZ	Safonovo, Smolensk region	Induction machines 55 kW – 1.6 MW Synchronous generators 50 kW – 1 MW Synchronous machines 132 kW – 1 MW Now have 2-pole machines No Ex-Machines
LEZ	St. Petersburg	Induction squirrel cage motors 200 – 5,600 kW Induction slip rings motors 200 – 5,600 kW Synchronous motors up to 8 MW Hydro- and turbogenerators up to 4,000 kW
Privod	Lysva, Ural	Turbogenerators 630 kW – 160 MW Synchronous turbo machines 630 kW – 31,5 MW Induction Machines 13 kW – 2 MW Traction generators 1.05 – 2.8 MW Submersible Motors 11 – 700 kW Full range, active in new products (high speed), active against ELSIB
ELSIB	Novosibirsk	Turbogenerators 6 – 500 MW Hydrogenerators – vertical shaft synchronous generators 5 – 200 MW Induction 2-pole 315…8,000 kW Induction Ex 250…5,000 kW Induction 2-speed 315…3,150 kW Induction vertical
Elektrosila	St. Petersburg	Hydrogenerators 4 – 720 MW Turbogenerators 1.5 – 1,200 MW Induction motors up to 2.5 MW Synchronous motors slow speed up to 22 MW DC motors, Traction motors

4.3 Purchasing Process for Ex-Machines

Original Equipment Manufacturers are the key customers for Ex-Motors. Contractors and End Users also play a very important role in sales process. Figure 26 illustrates the structure of the supply chain.

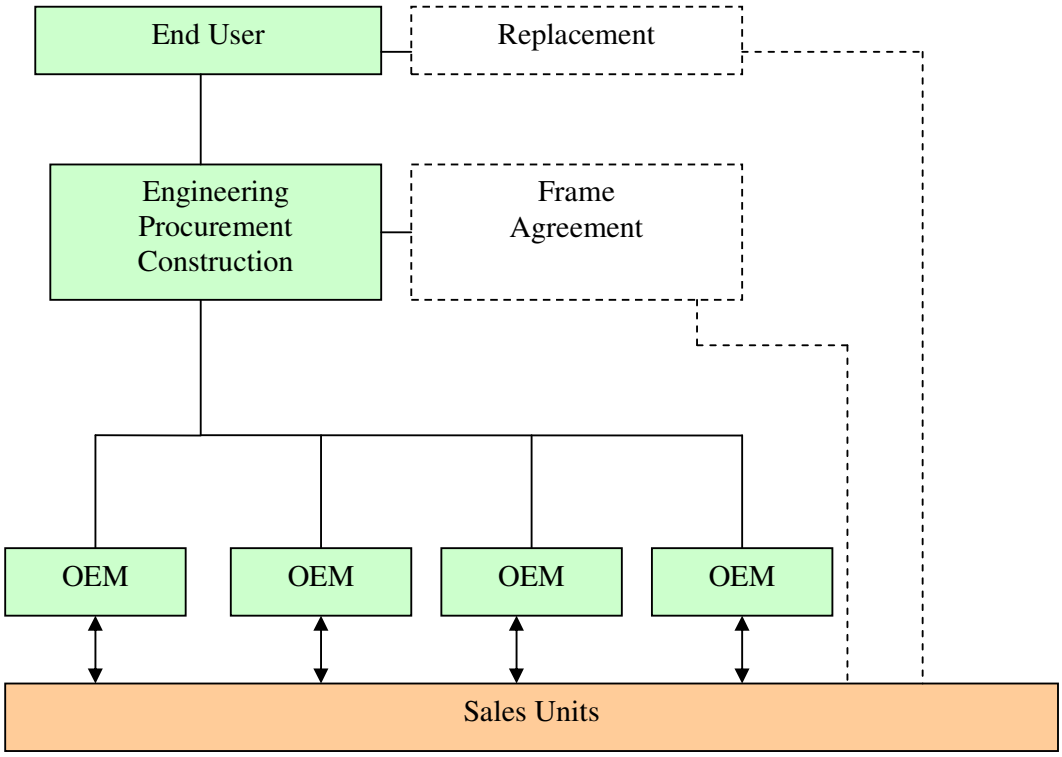

Figure 26 Supply chain for Ex-Machines
Source: Jussi Rautee, 2009

In COG Industry the main opportunities for Sales Units are concentrated on partnership with local Original Equipment Manufacturers in their country. OEMs are represented by huge amount of big and small companies. That is of utmost importance to have good partnership with OEMs due to it allows being always in touch with the situation on Ex-Machines market. It is much easier to know through the OEMs that one of End Customers is arranging a tender for subcontractors. (Rautee, 2009)

In markets with End Users and process plant, also replacements can constitute a source for business. Replacement is used when e.g. on the plant of End User one of machines had broken down. In that case company may contact not to original equipment manufacturer but directly to the manufacturer of broken component. In some cases it is advisably for both parties of such a contract. (Mettälä, 2009)

Other opportunity of Sales Channel is Frame Agreement. It can be offered by Contractors which may implement the whole project not just the part of it. This kind of sales channel is the most desirable due to it gives more opportunities and freedom of action. Moreover it is much easier for customer due to all the components match to each other. And customers do not have to take care on maintenance and technical support. (Rautee, 2009)

In each individual case of Sales Channel purchasing process may vary. But in general it consists of the following stages. Firstly End User decides to create a project and makes the list of required equipment for implementation of this project. He is choosing Subcontractor who will deliver him appropriate equipment. Subcontractors are choosing vendors who will deliver them components for manufacturing satisfied equipment. I said that the purchasing process may vary due to some of the segments of the chain may be excluded and therefore it leads to the changes in the organization of the interaction between the elements. The process may be shorter if only End User and manufacturer are included or longer if OEM uses number of suppliers. (Rylskiy, 2009)

Let us consider the simplest purchasing process closer. The End User has decided to start extraction of oil. For that purpose he requires a drilling unit. He is making tender between manufacturers of such equipment and chooses the most appropriate supplier. This company is OEM. Now it has an order and has to decide which companies will be delivering them components. They are making another tender between vendors and among those companies may choose supplier who is able to deliver the most satisfactory components. Sometimes OEMs are operating with different suppliers. In other cases they may choose one supplier under the frames of Frame Agreement. This

alternative is more desirable and challenging for both parties OEM and Supplier. But sometimes it is hard to find a company that is producing all the parts of entire equipment.

When an OEM has an order it sends a request to the sales department of Ex-Machines Manufacturer. In this request he is indicating which brand he is expecting to use, technical requirements. According to these technical requirements Sales Unit is trying to pick up the most appropriate device from the list of available equipment. After detailed inspection of the case depending on its complexity sales department is making a decision. If they have equipment that satisfies all the requirements of Customer they inform them about this decision. If there is no such equipment, Sales Department is sending a request to the technical department.

Technical department is trying to solve the problem with their own methods. They are making calculations and measurements of new equipment with costs of components and expected delivery dates. After that this draft is sent back to the Sales Department which in turn sends this proposal to the customer.

If the customer is satisfied with the offer and its price then a contract for delivery of new equipment is signed. According to this agreement required equipment will be delivered to the customer in stipulated date. In contracts between customer and supplier must be prescribed following terms: delivery dates, payment, terms of the claims in case of failure of the project.

Technical Requirements is the most important document which is the guidance for the manufacturer of equipment for customer. These requirements are worked out by technical specialists from the Customer's technical department. In this document are described in details their expectations from the supplier. In this documents are described all the parameters of the machine physical, mechanical and even the color of the shell. After Technical Requirements are worked out they are sent to the Manufacturer of the components. Designers, technologists and other departments of

the factory are carefully studying this document. Then there are two options: either to suggest an existing Ex-Machine if it satisfies all the requirements, or develop a new device.

The last alternative takes place rather seldom because it leads to a very expensive and long process. Manufacturers can use it if they are sure that the development of new equipment is promising on the market or if it supposed to have a growing demand in the visible future. But most obviously a project that requires a development of totally new equipment will be rejected. Quite often manufacturers are trying to modernize already established early motor.

Technical Conditions is a special document that is worked out by each OEM. You can find an example of Technical Conditions for Asynchronous Motors in Appendix 9. The document describes all the details of construction and usage of devices, additional information about hazardous areas and maintenance. In general this document is describing all the issues and questions that may arise during the operation activity of the equipment. Together with Technical Conditions equipment is provided by technical passport. It gives common information about the Ex-Machine. As a result I would like to mention that Technical Requirements and Technical Conditions are different documents. The specification – Technical Requirements is a desire of customer. Technical Conditions is a response of the factory to this desire, something that they can offer. (Zverev, 2009)

The last and important thing that I would like to add to the description of purchasing process is the role of Design Institutes. These authorities play a very significant role in a supply of the product. The main specialization of Design Institutes is providing Research and Development in manufacturing of electrical equipment. If the Ex-Machine is not in the product list of the factory, it may be developed by the Design Institute. A lot of Manufacturers of Ex-Equipment are using services of Design Institutes. The problem is that these Institutes are not inspirited in developing of totally new equipment. Therefore, they are trying to use existent drawings of Electrical

Equipment and calculations of the installation. These drawings are rather old and based on old type of components. Thus it seems to be challenging to influence the opinion of the Institutes and explain them all the opportunities and virtues of including in these projects Ex-Machines designed by ABB.

Decision criteria vary according to customer type. Globally, the motors are typically directly bought by the OEM (75%), through Frame Agreement (15%) or directly by End User (10%). The decision principle varies at different level of process. For End Users important features are reliability, safety, reputation, after sales services, competence and compliance and support. For Contractors much more important are specification compliance, local support, documentation reputation, project management and on time delivery. And if we speak about OEMs' objectives they are price, delivery time, on time delivery, smooth project management and documentation quality. Order flow and decision power are not linear, Figure 27. (Rautee, 2009)

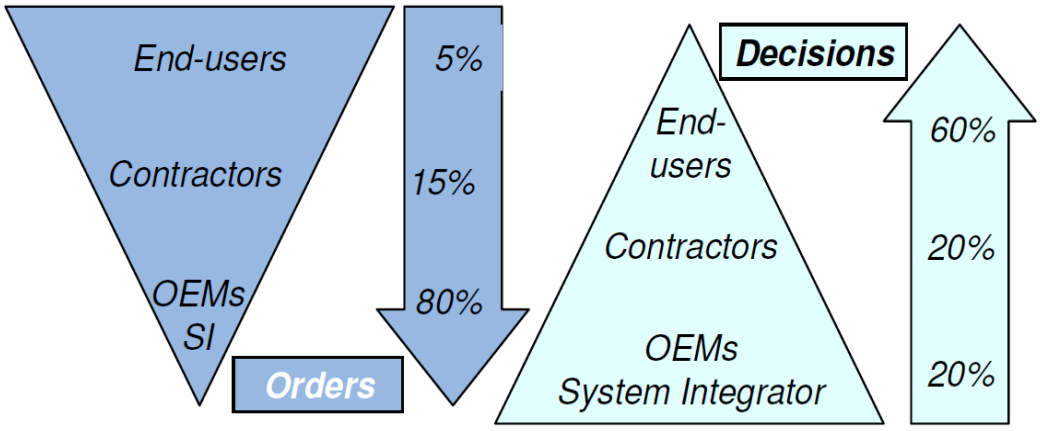

Figure 27 Types of order flows for Business Unit machines
Source: Jussi Rautee, 2009

The decision chain is controlled by End Users and Contractors (80%). ABB has good contacts to OEM customers but contacts between contractor and End Users are weak. The project is most of the time at Contractors', Consultants' or End Users' hands.

When the Vendor's list and specifications are done, there is no influence to the project during that time due to OEM centric organization. (Mettälä, 2009)

Speaking about Russian Market of Ex-Machines we can see the same situation. Depending on the project, decision can be made on different levels. In large projects most often End Users define which suppliers they would like to see as main partners. When we speak about small companies and projects then OEMs may decide by themselves about collaboration with companies – which one is more desirable for them. (Zverev, 2009)

Other important thing that has influence on the decision maker is connected with the purchasing process. When the End Customer e.g. GAZPROM is organizing a tender for suppliers for one of those projects decision is made on two stages. Firstly, technical department is choosing a vendor which offers equipment that satisfies all the requirements. After that the financial department is choosing the vendor that has the most appropriate price. In big companies for each decision are responsible whole departments, unlike in small companies decisions are made by one person. In most cases in Russian companies Technical Director is responsible for choosing an appropriate supplier of components.

The biggest problem for Russian Market research would be the fact that most companies are not ready to share information about their decision makers easily. Therefore, I have only one advice that in each case individual approach is required. What is working in one company is not necessarily successful decision for the another company.

4.4 General Content of Customers' Specifications

More and more investments are flown to the Oil and Gas businesses in Russia. According to the financial forecasts this tendency will extend over the next years. Neither financial crisis nor uncertain political situation will play a significant role in

the destination of Oil and Gas investments. Therefore, perspectives of the Ex-Machines Market development look like very optimistic. ABB has a number of customers of Explosion-proof Asynchronous Machines. Some of these companies are well-known world wide corporations like LUKOIL, ROSNEFT or GAZPROM. Others are small domestic OEMs. The main goal of ABB in Russia is strengthening its position on Market, spreading involvement in challenging projects, collaboration with increasingly developing companies.

Main customers are divided into different sectors in accordance with fields of implementation of Ex-Machines. ABB has customers among End User and OEMs which produce pumps, fans, blowers, compressors, drilling equipment and power generators. ABB has strong relations with OEMs in different parts of country. Whenever developing of partnership with End Users is a challenging goal for local representations of company.

Customers are using specifications according to which they design their equipment for hazardous areas. According to the information from sales managers of Russian office ABB and according to the interviews with managers of customers in each case specification is different. Most often Technical Requirements depend on the size and power of manufactured equipment. But the main requirement for each company is compliance with Russian Standards and presence of Permit of Use. All other questions and disputable points may be discussed during negotiations between vendors and customers as it usually happens in practice.

As a result of several interviews I knew that very few customers in Russia know that ABB is producing large machines. According to these experts ABB is well known as a manufacturer of high-quality equipment of small dimensions, such as controllers, switches, fuses. Undoubtedly it is a huge advantage in my opinion. It is important that the company has a positive reputation among customers. On the other hand, at the moment it is very important to prove in the market as a manufacturer of high quality

reliable equipment. With this end in view would help a lot large projects related to construction of new power plants, water utilities, pipelines and oil extraction units.

Currently the company competitors are quite aggressive with their pricing policies. Large companies such as Siemens can afford it. It should be noted that the positive reputation of the company should not be based on the discounts and special offers but it is also based on the talent of Sales Managers. Therefore, it is very important to find a balance between the desire to sell goods with an appropriate price for both parties and the desire to interest customers for with new products.

In COG applications safety must always come first. ABB motors are designed and manufactured in accordance with all major national and international standards, including IEC, ISO, ATEX, NEMA, CSA and GOST.

Company specific design and manufacturing guidelines are completed in collaboration with clients, and the guidelines are mutually agreed upon between ABB and the clients. A few examples of the increasing numbers of company specifications which ABB supports are Shell DEP, Saudi Aramco, API 541, API 547, ExxonMobil, Chevron Texaco, ADNOC, Borealis, Repsol, SABIC, SINOPEC, Qatar Petroleum, PETRONAS, Kuwait Oil Company, KNPC, Engineers India Limited, DOW, BASF, BP, ConocoPhillips, NesteOil etc.

A number of company specific design and manufacturing specifications are taken into account to match local engineering practices and requirements. Deviation and clarification lists are prepared and approved in advance for a major proportion of existing specifications in order to streamline the technical ordering procedures. Figure 28 shows the differentiation by compliance to COG specifications.

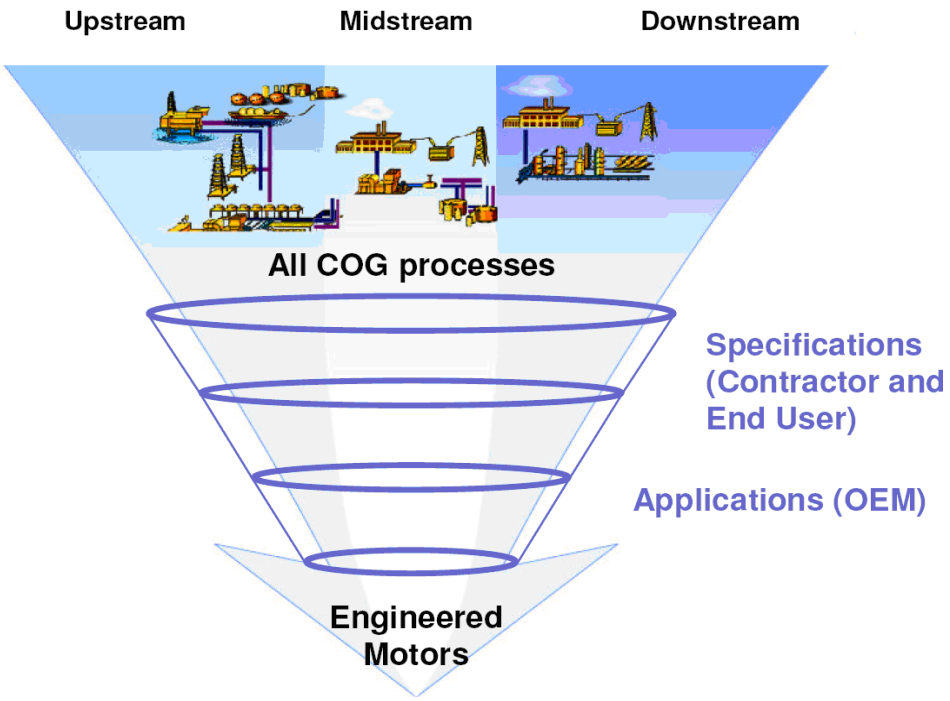

Figure 28 Induction Machines' differentiation among different stages

Source: Jussi Rautee, 2009

Ex-Motors must satisfy all the specifications and requirements of different fields of COG industry. Specifications are the critical success factor to COG customers. This document includes customer or project specific information prepared by Contractors or End Users. Top priority of the specification is to ensure reliability of motor. Finally the product must be in compliance with specifications. The procedure of creation a specification allows to increase support and more focus to Contractors and End Users.

According to the words of Manager who is responsible for sales of BU Machines each customer has individual specifications depending on the project and company. The main criterion of these specifications is that equipment has to be produced according to the GOST-R requirements and it has to be designed in compliance with the Electrical Installation Regulations (PUE). Other important option of specification is defining of sizes and power of estimated machine.

Basing on these characteristics the customer is preparing an official document that is called Technical Requirements. This document contains information about required sizes, capacitances, drafting and other electrical requirements. Thus the manufacturer is supposed to use this document in the process of production of an electrical machine. In Appendix 10 you can find an example of Technical Requirement represented by one of the ABB customers. These requirements are for Asynchronous Motor.

As I may summarize all the mentioned above Russian customers do not have special specifications but they have Technical Requirements for each individual case. One of the characteristics of doing business in Russia is difficulties in getting any information from companies. Information about Technical Requirements is not available in open sources. It is not available either for any curious person. Anyway, it is worth to mention that all of these Technical Requirements do not include any unusual information that is typical for Ex-Machines segment for example. The main requirement is that Machine is designed according to Russian standards and has all required permits and certificates.

4.5 Market limitations and special requirements

The most significant market limitations are connected with Government regulations. It means that in Russia it is possible to use only equipment that has all required certificates and permits. As it was mentioned in the previous chapter Ex-Equipment must have GOST-R Certificate of Compliance and Permit of Use of Rostechnadzor. Electrical equipment must be designed according to Electrical Installation Regulations. If all these formalities are observed customer is able to buy an Ex-Machine. Otherwise it is forbidden.

One of the main market limitations that is mentioned by all the sales managers that during recent period the Government of Russian Federation has a strong support policy of domestic manufacturer. There are different subsidiaries and equalizing tax

implications for local manufacturers. Moreover, it is common that most Government projects are intended to attract and support Russian Manufacturers of Ex-Machines.

On the other hand current rate of currency on the market is influencing on the decision of customers a lot. If we compare the situation that was one year ago when ratio of currencies were lower foreign equipment were more attractive and comprehensible than it is now compared with Russian equipment.

Other weakening side is connected with custom duties. Situation with legislation in custom authorities is very uncertain in Russia. It is really hard to forecast on which field of industry will be directed to support following accepted law. It may happen that custom duties will increase so high that the price of imported to Russia equipment will become inadequately high.

Speaking about other limitations there are a couple of distinctive features that are worth to mention. A range of – 20 °C ... + 40 °C is specified as the normal ambient temperature range both in the Russian Standards and in the International Standards. On the other hand, temperatures down to – 40 °C may occur in the wintertime in moderate latitudes in Russia, temperatures down to – 50 °C may occur in the northern territories with temperatures as low as even – 55 °C possibly occurring in these northern areas. Consequently, the test certificate for apparatus scheduled for use outdoors or use in unheated rooms must specify the ambient temperature range in which operation is possible. (Ovcharov, 2009)

And the last point that I would refer to the market limitations would be lack of foresight in doing business among Russian interpreters. They are still more interested in high margin with low committed facilities then in providing of high quality equipment.

What are the customers waiting from the manufacturer? What are their expectations? How to satisfy and guess all the requirements they have in their minds? These are the

most important questions that must be answered during the supply procedure. Answers given to those questions will define if the company would be successful on the certain market or not. Therefore, it is of utmost importance to learn market environment as detailed as it is possible. COG Machines market customers' expectations are shown on the Figure 29.

Figure 29 Customers' Expectations about COG Machines

Speaking about Russian Market those features are important. Undoubtedly there are some modifications due to historical evolution or geographical location. But in general all the requirements are the same. Customers are expecting high quality and reliable equipment with reasonable price.

Historically, Russian companies have the habit of buying equipment from the former Soviet Union manufacturers. They have old partnerships that they do not want to interfere. On the other hand some of the factories still use old equipment. This

equipment was manufactured thirty or forty years ago. Therefore, new modern components are not appropriate for them. These customers wish to purchase electrical machines that are manufactured according to the special size requirements. These customers are not interested in modification or modernization of the business and technological processes. (Khodyakova, 2009)

On the other hand there is a trend that many customers are increasingly investing in their business. The main goal of these companies is increasing of production efficiency. Money is invested in production development. Companies realize that it is more profitable to buy high quality equipment rather than lose for permanent repairs, maintenance and replacement of components.

4.6 Conclusions

Russian market is unpredictable and complicated. Sometimes it is hard to understand what the motivation for decision makers is. OEMs have strong historical and psychological preferences when they search suppliers of equipment. High quality and reliability still do not play the most important role when we speak about the machine features. Much more important are low prices and high margin. This characteristic is more indicative for Russian manufacturers of equipment.

There is another wide sector of Ex-Machines. It is represented by End Users of equipment. COG Industry in Russia is developing intensively. There are huge amounts of projects in upstream, midstream and downstream stages of oil processing. Some of these projects have been already operating others will start in the coming years. This segment attracts foreign investments actively. From this perspective ABB has a high potential of collaborating with End Users. Foreign companies have always given a preference to high quality equipment and sustainable development of partnership relationships. Concentrating attention on this aspect and active behavior in trade creation is a challenging goal towards the achievement of strong positions on Russian Market.

Speaking about Russian Market it is mistakenly not to take into consideration the potential of Market in CIS countries. Historically Russia and CIS countries have strong interrelations. Many OEM factories were built in Soviet Union under the frames of industrialization policy. Today these factories keep operating and supply equipment to Russia and inside CIS. This is related to mentality and strong partnership between Heads of the factories which come from the period of Soviet Union. Most CIS countries have big reserves of natural sources of oil and gas. These countries attract foreign investments intensively. There is a number of coming projects on the shore of Caspian Sea, in Kazakhstan, in Azerbaijan and Uzbekistan. Countries which are not rich in natural sources may become an important market for Ex-Machines e.g. through the territory of Ukraine the gas is transported to Europe. There are a number of projects of constructing new pipelines through other countries in the nearest future.

The other important segment of COG Industry is companies which invest into replacement of equipment. These companies may be found among End Users and OEMs. The key element of these companies is the fact that they keep operating with machines which were designed and manufactured twenty or thirty years ago. This preference can be explained with the fact that these companies are not ready yet to modernization of the production. They find subcontractors among Russian and CIS manufacturers which can supply them equipment that satisfies their requirements on dimensions, sizes, installation and other characteristic of the machine. Therefore if to understand what are the core differences between equipment manufactured according to IEC standards and GOST standards it might be easy to achieve the market of replacement. Evidently the construction of European equipment must be modified. The question is how significant is amount of those modifications.

The weak side of competitors on Russian and CIS market is the fact that most enterprises are not certified according to Quality Management Certification System and their products are not certified according to international standards. Therefore, these companies do not have strong positions in achieving contacts in international big projects. And this fact is positive for ABB.

Undoubtedly there is a wide market potential for Ex-Machines in Russia and CIS countries. Active behavior in accessing new projects and aggressive price policy in conjunction with strong position and solid reputation of ABB in COG Industry can help in achieving highest rates in presence of company on the market.

CONCLUSION

Ex-Motor is an irreplaceable part of production process in COG Industry. It is involved in oil extraction, transportation and supply to the customers. Each stage of industrial processes must be safe and reliable. These features are secured by standards developed for explosion-proof equipment. In Europe manufacturers follow standards created by International Electrical Committee for Explosion-proof Equipment. In Russia COG Machines must confirm requirements of Certification Scheme for Ex-Equipment.

Standardization procedure is similar in Europe and Russia. Standards for Ex-Equipment are highly harmonized and have few discrepancies which are related to specific of Russian Market. There are additional indicators in marking of Ex-Equipment in Russia which show the level of explosion protection. The level of explosion protection is not related with Zones of hazardous areas and is nothing more but tribute to the Electrical Installation Code that have been existed long time before Standards for Hazardous Areas.

Certification procedure of Ex-Equipment in Russia is straightforward and logic. To be eligible for sales, distribution and operating of motors for hazardous areas are required following documents – Certificate of Conformity with COST-R certification System, Explosion-proof Certificate of Conformity and Permit of Use issued by the Federal Agency for Environmental, Technological and Nuclear Supervision. Certification in CIS Countries is similar to the Russian Certification Procedure. In spite of mutual agreements and deep partnership of the Members of CIS countries Certificates issued in Russia are not valid on their territory. Therefore, in each case Certification is implemented according to the requirements of country where the Ex-Motor is supplied.

Russia and CIS countries have a wide potential for COG Machines market. Deep knowledge of Russian manufacturers' requirements and successful partnership with OEMs and End Users of Ex-Equipment will provide a bright future for ABB Automation Products in COG Industry of Russia and CIS countries.

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Appendix 1 Standards applied for Ex-Equipment in CIS countries according to Euroasian Interstate Council

GOST	**Scope of standard**
GOST 12.2.020-76	Occupational safety standards system. Explosion-proof electrical apparatus. Terms and definitions. Classification. Marking
GOST 22782.3-77	Explosion-proof electrical apparatus. Special construction. Technical requirements and methods of testing
GOST 24786-81	Explosion protected light devices for mines. General specifications
GOST 27294-87	Explosion-proof mine low-voltage automatic switches. Technical requirements. Test methods
GOST 27307-87	Explosion-proof mine low-voltage complete control devices up to 1140 V. Technical requirements and test methods
GOST 30852.0-2002 (IEC 60079-0:1998)	Explosion-proof electrical apparatus. Part 0. General requirements
GOST 30852.1-2002 (IEC 60079-1:1998)	Electrical apparatus for explosive gas atmospheres. Part 1. Construction and verification test of flameproof enclosures of electrical apparatus
GOST 30852.2-2002 (IEC 60079-1A:1975)	Electrical apparatus for explosive gas atmospheres. Part 1. Construction and verification test of flameproof enclosures of electrical apparatus. First supplement. Appendix D. Method of test for ascertainment of maximum experimental safe gap
GOST 30852.3-2002	Explosion protected electrical equipment. Part 2. Filling or purging of the pressurized enclosure P
GOST 30852.4-2002 (IEC 60079-3:1990)	Electrical apparatus for explosive gas atmospheres. Part 3. Spark-test apparatus for intrinsically-safe circuits
GOST 30852.5-2002 (IEC 60079-4:1975)	Explosion protected electrical apparatus. Part 4. Method of test for ignition temperature
GOST 30852.6-2002 (IEC 60079-5:1997)	Electrical apparatus for explosive gas atmospheres. Part 5. Powder filling q
GOST 30852.7-2002 (IEC 60079-6:1995)	Explosion-proof electrical apparatus. Part 6. Oil-filled enclosures o
GOST 30852.8-2002	Explosion-proof electrical apparatus. Part 7. Type of protection e
GOST 30852.9-2002 (IEC 60079-10:1995)	Electrical apparatus for explosive gas atmospheres. Part 10. Classification of hazardous areas
GOST 30852.10-2002 (IEC 60079-11:1999)	Electrical apparatus for explosive gas atmospheres. Part 11. Intrinsic safety i
GOST 30852.11-2002 (IEC 60079-12:1978)	Explosion protected electrical apparatus. Part 12. Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents
GOST 30852.12-2002	Electrical apparatus for explosive gas atmospheres. Part 13.

GOST	Scope of standard
(IEC 60079-13:1982)	Construction and use of rooms or buildings protected by pressurization
GOST 30852.13-2002 (IEC 60079-14:1996)	Explosion protected electrical apparatus. Part 14. Electrical installations in explosive gas atmospheres (other than mines)
GOST 30852.14-2002	Electrical apparatus for explosive gas atmospheres. Part 15. Type of protection n
GOST 30852.15-2002 (IEC 60079-16:1990)	Electrical apparatus for explosive gas atmospheres. Part 16. Artificial ventilation for the protection of analyzer(s) houses
GOST 30852.16-2002 (IEC 60079-17:1996)	Explosion protected electrical apparatus. Part 17. Inspection and maintenance of electrical installations in hazardous areas (other than mines)
GOST 30852.17-2002 (IEC 60079-18:1992)	Explosion protected electrical apparatus. Part 18. Type of protection (m)
GOST 30852.18-2002 (IEC 60079-19:1993)	Electrical apparatus for explosive gas atmospheres. Part 19. Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)
GOST 30852.19-2002 (IEC 60079-20:1996)	Electrical apparatus for explosive gas atmospheres. Part 20. Data for flammable gases and vapours relating to the use of electrical apparatus

Appendix 2 Application for certification of imported product in Russia

The body of certification of machines and the equipment for an oil-and-gas complex, electric machines, raw material Open Company “TECHNONEFTEGAZ”

APPLICATION
for certification of imported product
in “GOST-R Certification System”

1. _____
(name of manufacturer, hereinafter referred to as the APPLICANT)
Juridical address_____
Telephone_____ fax_____ telex_____
declares that_____
(name of product)
code TNV VED_____
is manufactured serially by_____
(name of the company)
in accordance with_____,
(documentation of the manufacturer: standard, etc.)
and requests in his own name (under the commission of the manufacturer)_____
_____
(date and number of the commission)
to bold the certification of the above product to verify if it meets the requirements stated in Russian standards according to the following scheme_____
(№ of the scheme of certification)

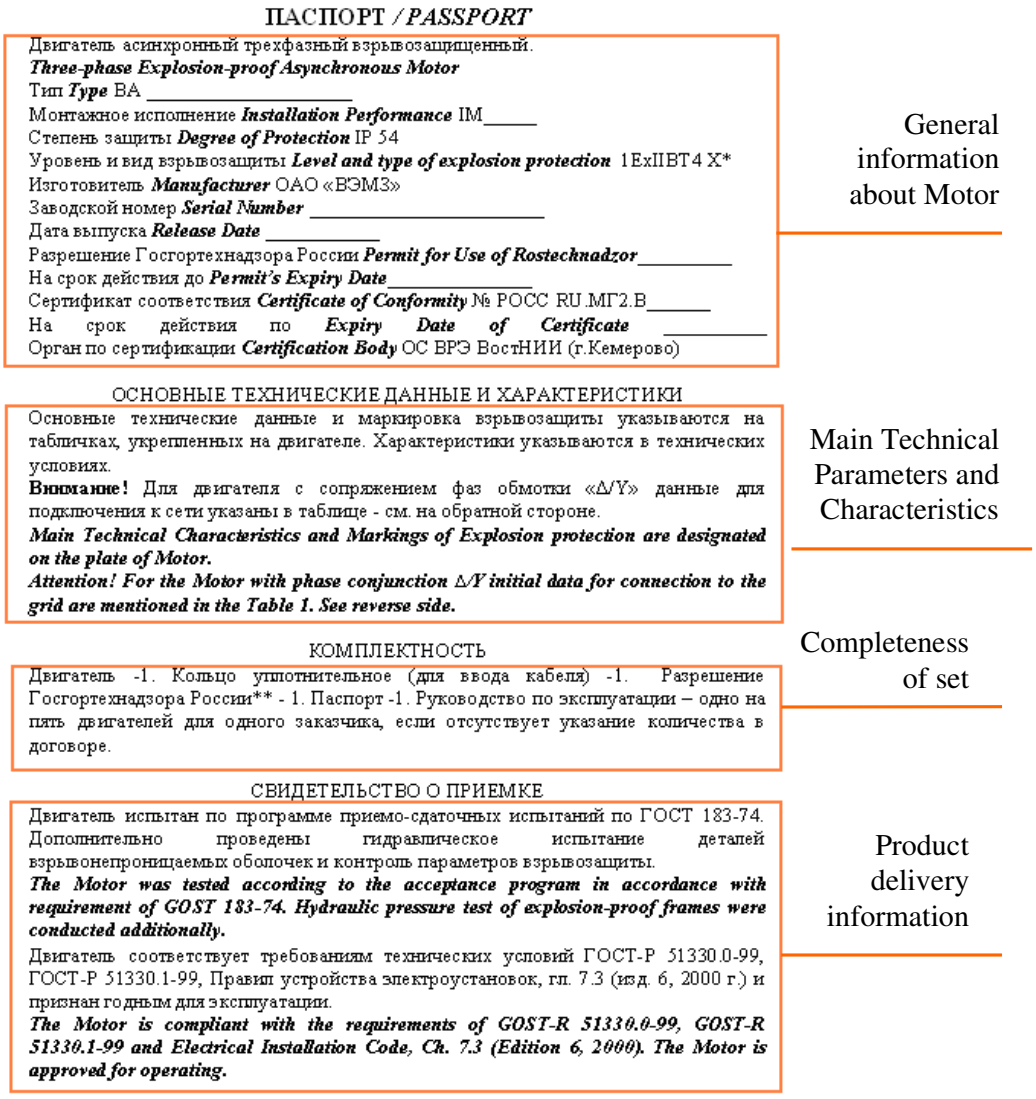
2. Applicant takes duties as follows:
- to observe all the conditions of certification;
- to ensure the stability of certification parameters of the product marked with the sign of conformity;
- to cover all expenditures related to the process of certification

3. Additional information_____
_____

For the Applicant_____
(Signature, full name of)

Seal Date_____

Appendix 3 GOST Technical Passport



ПАСПОРТ / *PASSPORT*

Двигатель асинхронный трехфазный взрывозащищенный.
Three-phase Explosion-proof Asynchronous Motor
Тип ***Type*** ВА _____
Монтажное исполнение ***Installation Performance*** IM_____
Степень защиты ***Degree of Protection*** IP 54
Уровень и вид взрывозащиты ***Level and type of explosion protection*** 1ExIIBT4 X*
Изготовитель ***Manufacturer*** ОАО «ВЭМЗ»
Заводской номер ***Serial Number*** _____
Дата выпуска ***Release Date*** _____
Разрешение Госгортехнадзора России ***Permit for Use of Rostechnadzor***_____
На срок действия до ***Permit's Expiry Date*** _____
Сертификат соответствия ***Certificate of Conformity*** № РОСС RU.МГ2.В_____
На срок действия по ***Expiry Date of Certificate*** _____
Орган по сертификации ***Certification Body*** ОС ВРЭ ВостНИИ (г.Кемерово)

General information about Motor

ОСНОВНЫЕ ТЕХНИЧЕСКИЕ ДАННЫЕ И ХАРАКТЕРИСТИКИ

Основные технические данные и маркировка взрывозащиты указываются на табличках, укрепленных на двигателе. Характеристики указываются в технических условиях.
Внимание! Для двигателя с сопряжением фаз обмотки «Δ/Y» данные для подключения к сети указаны в таблице - см. на обратной стороне.
Main Technical Characteristics and Markings of Explosion protection are designated on the plate of Motor.
Attention! For the Motor with phase conjunction Δ/Y initial data for connection to the grid are mentioned in the Table 1. See reverse side.

Main Technical Parameters and Characteristics

КОМПЛЕКТНОСТЬ

Двигатель -1. Кольцо уплотнительное (для ввода кабеля) -1. Разрешение Госгортехнадзора России** - 1. Паспорт -1. Руководство по эксплуатации – одно на пять двигателей для одного заказчика, если отсутствует указание количества в договоре.

Completeness of set

СВИДЕТЕЛЬСТВО О ПРИЕМКЕ

Двигатель испытан по программе приемо-сдаточных испытаний по ГОСТ 183-74. Дополнительно проведены гидравлическое испытание деталей взрывонепроницаемых оболочек и контроль параметров взрывозащиты.
The Motor was tested according to the acceptance program in accordance with requirement of GOST 183-74. Hydraulic pressure test of explosion-proof frames were conducted additionally.
Двигатель соответствует требованиям технических условий ГОСТ-Р 51330.0-99, ГОСТ-Р 51330.1-99, Правил устройства электроустановок, гл. 7.3 (изд. 6, 2000 г.) и признан годным для эксплуатации.
The Motor is compliant with the requirements of GOST-R 51330.0-99, GOST-R 51330.1-99 and Electrical Installation Code, Ch. 7.3 (Edition 6, 2000). The Motor is approved for operating.

Product delivery information

Личные подписи должностных лиц, ответственных за приемку ***Personal signature of officials responsible for receiving of the Motor*** _____ М.П. ***STAMP***

ГАРАНТИИ ИЗГОТОВИТЕЛЯ

Manufacturer's Warranty

Гарантийный срок 2 года со дня начала эксплуатации двигателя при гарантийной наработке 10000 ч.
Warranty Period is two years from the date of the Motor start or 10,000 hours.

СВИДЕТЕЛЬСТВО О КОНСЕРВАЦИИ И УПАКОВКЕ

Information about Preservation and Packing

Двигатели законсервированы и упакованы согласно технической документации. Дата консервации_____ Дата упаковывания _____Срок консервации 3 года Упаковывание произвел_____ Консервацию произвел_____ Изделие после упаковывания принял ____ Изделие после консервации принял_____

Motor Operation Data

Данные двигателя							
Сопряжение фаз обмотки статора	Δ/Y						На
Сочетание напряжений, В	380 660	400 690	220 380	230 400	240 415	220 380	табличке
Частота, Гц	50					60	
Схема соединения обмотки статора	Δ		Y				В состоянии поставки для
Напряжение, В	380	400	380	400	415	380	подключения
Частота, Гц	50					60	к сети
Схема соединения обмотки статора	Y		Δ				Для подключения
Напряжение, В	660	690	220	230	240	220	на другую
Частота, Гц	50					60	сеть

Для подключения двигателя к сети на другое напряжение необходимо снять коробку выводов и изменить соединение обмотки статора. Табличка со схемами соединения обмотки размещена на крышке коробки выводов.
For connection of the Motor to the grid with other required voltage please take away the terminal box and change the connection of stator windings. The plate with winding circuit is placed on the lid of the terminal box.
* На двигателе нанесена маркировка взрывозащиты со знаком «X» с указанием диапазона температур окружающей среды. Знак «X» означает, что потребитель должен при установке двигателя (кроме случая трубной подводки кабелей) предусмотреть меры по закреплению кабелей.
The Motor is marked with sign 'X' indicating the range of ambient temperatures. 'X' means that consumer must provide actions for fastening of cables.
** Поставляется по требованию заказчика.
On the request of supplier
*** Заполняется при индивидуальном упаковывании.
Filled during individual packing

Appendix 4 Application for Certification of Ex-Equipment

Руководителю Органа по сертификации
взрывозащищенного и рудничного
электрооборудования
Серову В.И. / ***To V.I. Serov***
Head of Certification Centre
of Explosion –Proof and Mine Electrical Equipment

109377, г. Москва, а/я 22
НАНИО «ЦСВЭ» / ***NANIO "CCVE"***
109377, Москва, P.O. Box 22

ЗАЯВКА
НА ПРОВЕДЕНИЕ СЕРТИФИКАЦИИ Ex-ОБОРУДОВАНИЯ

APPLICATION
FOR CERTIFICATION OF Ex EQUIPMENT

Заявитель (Applicant: the company):

Наименование предприятия-изготовителя, продавца (далее заявитель) ***(name of manufacturer, seller (hereinafter referred to as the Applicant)***

Юридический адрес ***(Legal address)***

Банковские реквизиты ***(Bank details)***: _____

телефон ***(Telephone)*** _____ факс ***(Fax)*** _____ _____телекс ***(Telex)*** _____

в лице ***(in the person of)*** _

фамилия, имя, отчество, руководителя ***(name and surname of Director)***

Изготовитель ***(Manufacturer):***

заявляет, что ***(claims that)***

наименование вида продукции, коды ОКП и ТН ВЭД, маркировка взрывозащиты ***(designation of product type, OKP and TN VED codes, explosion-proof marking)***

выпускается серийно или партия (каждое изделие при единичном производстве) ***(is (are) produced in quantity /as a batch /(every product in case of individual production))***
выпускаемая * по ***(according to)***
наименование и реквизиты документации изготовителя (ТУ, стандарт) ***(designation of manufacturer's documentation (specifications (TU) , standards)***

соответствует требованиям ***(meet(s) the requirements of***

наименование и обозначение стандартов и НД ***(designation and description of standards, normative documents)***

и просит провести сертификацию данной продукции на соответствие требованиям нормативной документации по схеме ***(and so applies for this product certification to the requirements of the normative documents according to Scheme):*** ___

2. Заявитель обязуется:
- выполнять все условия сертификации
- обеспечить предоставление образцов (проб) должным образом идентифицированной продукции
- обеспечивать соответствие реализуемой продукции требованиям согласованной технической документации и нормативных документов, на соответствие которым она была сертифицирована
- маркировать знаком соответствия только ту продукцию, которая соответствует требованиям нормативных документов, на которые распространяется действие сертификата
- при установлении несоответствия продукции требованию нормативных документов принимать меры по недопущению реализации этой продукции
- немедленно сообщать о любых изменениях, вносимых в техническую документацию и касающихся средств взрывозащиты или безопасности применения
- оплатить все расходы по проведению сертификации и осуществлению периодического инспекционного контроля за выпуском продукции в течение срока действия сертификата

2. The Applicant undertakes:
- ***to fulfill all the terms of certification***
- ***to provide samples of duly marked products***
- ***to provide conformity of the products to be sold with the requirements of the approved technical documentation and normative documents to which they have been certified***
- ***to only apply the Conformity Mark to the products that meet the requirements of normative documents specified in the Certificate***
- ***in case non-conformity of the product to the requirements of normative documents is identified to take measures so as to prevent selling of these products***
- ***to provide without delay information on any changes made in the technical documentation and relating to explosion protection means and safe use of the product***
- ***to pay all costs of certification and periodical production surveillance during the period of the Certificate validity***

3. Дополнительные сведения ***(Additional information)*** _____
_____

Руководитель организации ***(Director)*** _____

подпись, инициалы, фамилия ***(signature, initials, name)***

Главный бухгалтер ***(Chief accountant)*** _____
подпись, инициалы, фамилия ***(signature, initials, name)***

Печать ***(Stamp)*** Дата ***(Date)***

Appendix 5 Application for Permit of Use to the Rostechnadzor

В Федеральную службу по экологическому,
технологическому и атомному надзору/
(to the Federal Ecological, Technological
and Atomic Supervision Service)

ЗАЯВЛЕНИЕ/***APPLICATION***

Прошу выдать разрешение на применение/ ***Please grant the Permit of Use for***

_____

*(наименование технического устройства)****(designation of device)***

Данное техническое устройство предназначено для применения на ***/This device is intended for use at***

_____

(приводится краткая характеристика опасных производственных объектов) ***(give short description of hazardous production facilities)***

Сообщаю данные об организации-заявителе/***Information on the organization-applicant***

Полное и сокращенное наименование организации ***/ Full and short name of the organization***

_____

Юридический адрес/***Legal address***_____

Почтовый адрес/***Mailing address***_____

Идентификационный номер/***Identification number*** _____

Контактные телефоны, факс и адрес электронной почты/***Contact phones, faxes, e-mail***

_____

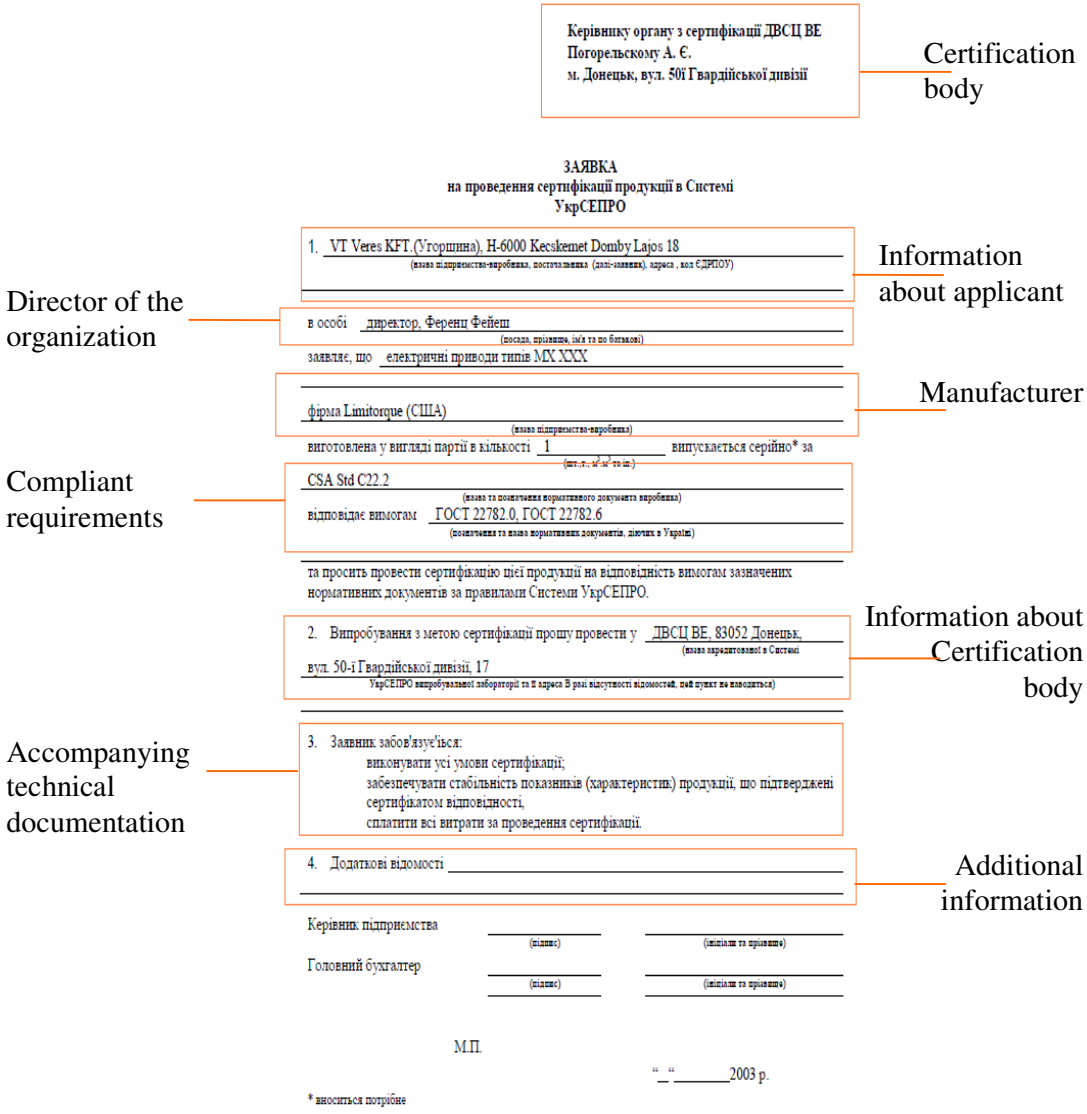
К заявлению прилагается следующая сопроводительная техническая документация в соответствии с пунктом 2.1. Положения о порядке выдачи разрешений на применение технических устройств на опасных производственных объектах (РД-03-485-02): / ***The following accompanying technical documentation in accordance with p.2.1. of the Instruction on the issue of Permits for use of devices at hazardous production facilities (RD-03-485-02) is attached:***

_____

Дата ***/Date***

Подпись руководителя
организации-заявителя
(заверяется печатью)/
Signature of the Director of the organization-applicant
(stamp)

Appendix 6 Application for UkrSEPRO Certificate of Conformity



Керівнику органу з сертифікації ДВСЦ ВЕ
Погорельскому А. Є.
м. Донецьк, вул. 50ї Гвардійської дивізії

Certification body

ЗАЯВКА
на проведення сертифікації продукції в Системі
УкрСЕПРО

1. VT Veres KFT.(Угоршина), H-6000 Kecskemet Domby Lajos 18
(назва підприємства-виробника, поштальйона (далі-заявник), адреса , код ЄДРПОУ)

Information about applicant

Director of the organization

в особі директор, Ференц Фейеш
(посада, прізвище, ім'я та по батькові)

заявляє, що електричні приводи типів MX XXX

фірма Limitorque (США)
(назва підприємства-виробника)

Manufacturer

виготовлена у вигляді партії в кількості 1 (шт.; т.; м²; м³ та ін.) випускається серійно* за

Compliant requirements

CSA Std C22.2
(назва та позначення нормативного документа виробника)

відповідає вимогам ГОСТ 22782.0, ГОСТ 22782.6
(позначення та назва нормативних документів, діючих в Україні)

та просить провести сертифікацію цієї продукції на відповідність вимогам зазначених нормативних документів за правилами Системи УкрСЕПРО.

2. Випробування з метою сертифікації прошу провести у ДВСЦ ВЕ, 83052 Донецьк, (назва акредитованої в Системі
вул. 50-ї Гвардійської дивізії, 17
УкрСЕПРО випробувальної лабораторії та її адреса В разі відсутності відомостей, цей пункт не виводиться)

Information about Certification body

3. Заявник забов'язує'ься:
виконувати усі умови сертифікації;
забезпечувати стабільність показників (характеристик) продукції, що підтверджені сертифікатом відповідності,
сплатити всі витрати за проведення сертифікації.

Accompanying technical documentation

4. Додаткові відомості

Additional information

Керівник підприємства _____ (підпис) _____ (ініціали та прізвище)

Головний бухгалтер _____ (підпис) _____ (ініціали та прізвище)

М.П.

"_"_____2003 р.

* вноситься потрібне

Appendix 7 Application form to the Ministry of Emergency situations of Republic Belarus

В Министерство по Чрезвычайным
Ситуациям Республики Беларусь
To the Ministry of Emergency Situations
of the Republic of Belarus

З А Я В Л Е Н И Е / ***A P P L I C A T I O N***

Прошу выдать разрешение на применение ***(Please grant the Permit of Use for)***

_____

(наименование технического устройства ***/ designation of device****)*

Указанный вид устройства будет применяться в строгом соответствии с действующим законодательством, нормативно-правовыми актами и техническими нормативными правовыми актами по технической безопасности и другими условиями выдачи разрешения.
(This kind of equipment will be implemented in strict accordance with current legislation, regulations and technical normative legal acts on safety and other conditions of the authorization)

Сообщаю данные об организации-заявителе ***(Information on the organization-applicant)***
Полное и сокращенное наименование организации ***(Full and short name of the organization)***_____

_____

Юридический адрес ***(Legal address)***_____

Почтовый адрес ***(Mailing address)***_____
Идентификационный номер ***(Identification number)***_____
Контактные телефоны, факс и адрес электронной почты ***(Contact phones, faxes, e-mail)***

_____

К заявлению прилагается следующая сопроводительная техническая документация: ***/ The following accompanying technical documentation is attached:***

Дата
(Date)

Подпись руководителя
организации-заявителя
(заверяется печатью)
(Signature of the Director
of the organization-applicant
(Stamp))

Appendix 8 Application form for Permit of Use from Ministry of Emergency Situations of the Republic of Kazakhstan

В Министерство по Чрезвычайным
Ситуациям Республики Казахстан
To the Ministry of Emergency Situations of the Republic of Kazakhstan

З А Я В Л Е Н И Е / ***A P P L I C A T I O N***

Прошу выдать разрешение на применение ***(Please grant the Permit of Use for)***

_____

(наименование технического устройства ***/ designation of device****)*

Данное техническое устройство предназначено для применения во взрывоопасных зонах помещений и наружных установок в Республике Казахстан.

(This device is intended for use at hazardous production facilities and external devices in Republic of Kazakhstan)

Сообщаю данные об организации-заявителе ***(Information on the organization-applicant)***

Полное и сокращенное наименование организации ***(Full and short name of the organization)***_____

Юридический адрес ***(Legal address)***_____

Почтовый адрес ***(Mailing address)***_____

Идентификационный номер ***(Identification number)***_____

Контактные телефоны, факс и адрес электронной почты ***(Contact phones, faxes, e-mail)***

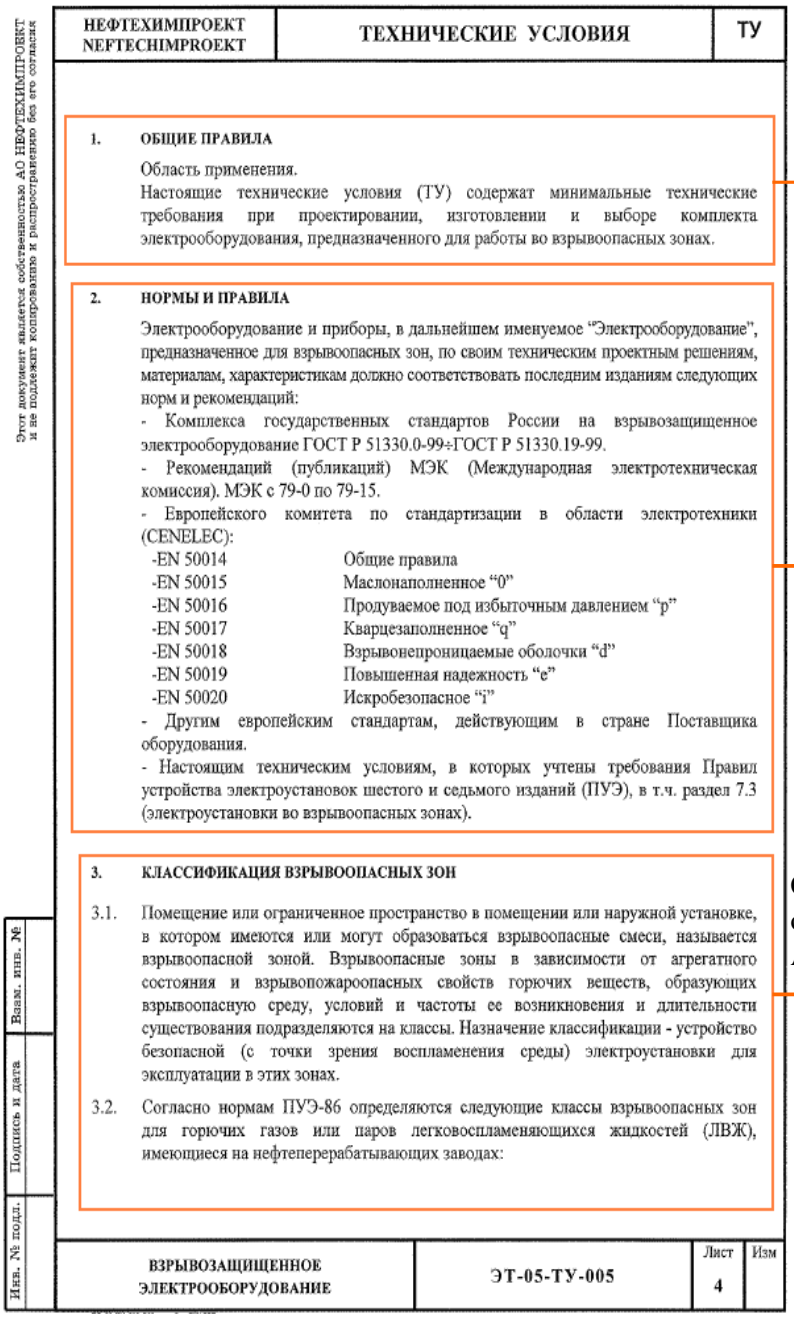
_____

К заявлению прилагается следующая сопроводительная техническая документация: ***/ The following accompanying technical documentation is attached:***

Дата
(Date)

Подпись руководителя
организации-заявителя
(заверяется печатью)
(Signature of the Director of the organization-applicant (Stamp))

Appendix 9 Technical Conditions for explosion-proof Electrical Equipment



НЕФТЕХИМПРОЕКТ
NEFTECHIMPROEKT

ТЕХНИЧЕСКИЕ УСЛОВИЯ

ТУ

Этот документ является собственностью АО НЕФТЕХИМПРОЕКТ и не подлежит копированию и распространению без его согласия

1. ОБЩИЕ ПРАВИЛА

Область применения.
Настоящие технические условия (ТУ) содержат минимальные технические требования при проектировании, изготовлении и выборе комплекта электрооборудования, предназначенного для работы во взрывоопасных зонах.

General requirements

2. НОРМЫ И ПРАВИЛА

Электрооборудование и приборы, в дальнейшем именуемое "Электрооборудование", предназначенное для взрывоопасных зон, по своим техническим проектным решениям, материалам, характеристикам должно соответствовать последним изданиям следующих норм и рекомендаций:

- Комплекса государственных стандартов России на взрывозащищенное электрооборудование ГОСТ Р 51330.0-99÷ГОСТ Р 51330.19-99.
- Рекомендаций (публикаций) МЭК (Международная электротехническая комиссия). МЭК с 79-0 по 79-15.
- Европейского комитета по стандартизации в области электротехники (CENELEC):

-EN 50014	Общие правила
-EN 50015	Маслонаполненное "0"
-EN 50016	Продуваемое под избыточным давлением "p"
-EN 50017	Кварцезаполненное "q"
-EN 50018	Взрывонепроницаемые оболочки "d"
-EN 50019	Повышенная надежность "e"
-EN 50020	Искробезопасное "i"

- Другим европейским стандартам, действующим в стране Поставщика оборудования.
- Настоящим техническим условиям, в которых учтены требования Правил устройства электроустановок шестого и седьмого изданий (ПУЭ), в т.ч. раздел 7.3 (электроустановки во взрывоопасных зонах).

Rules and guidelines

3. КЛАССИФИКАЦИЯ ВЗРЫВООПАСНЫХ ЗОН

3.1. Помещение или ограниченное пространство в помещении или наружной установке, в котором имеются или могут образоваться взрывоопасные смеси, называется взрывоопасной зоной. Взрывоопасные зоны в зависимости от агрегатного состояния и взрывопожароопасных свойств горючих веществ, образующих взрывоопасную среду, условий и частоты ее возникновения и длительности существования подразделяются на классы. Назначение классификации - устройство безопасной (с точки зрения воспламенения среды) электроустановки для эксплуатации в этих зонах.

3.2. Согласно нормам ПУЭ-86 определяются следующие классы взрывоопасных зон для горючих газов или паров легковоспламеняющихся жидкостей (ЛВЖ), имеющиеся на нефтеперерабатывающих заводах:

Classification of Hazardous Areas

Взам. инв. №

Подпись и дата

Инв. № подл.

ВЗРЫВОЗАЩИЩЕННОЕ ЭЛЕКТРООБОРУДОВАНИЕ	ЭТ-05-ТУ-005	Лист 4	Изм

Этот документ является собственностью АО НЕФТЕХИМПРОЕКТ и не подлежит копированию и распространению без его согласия

- Класс B-Ia

Зоны класса B-Ia - зоны, расположенные в помещениях, в которых при нормальной эксплуатации взрывоопасные смеси горючих газов (независимо от нижнего концентрационного предела воспламенения) или паров ЛВЖ с воздухом не образуются, а возможны только в результате неисправностей.

- Класс B-Iг

Пространства у наружных установок, содержащих горючие газы или ЛВЖ, надземных и подземных резервуаров с ЛВЖ или горючими газами (газгольдеры), эстакад слива и налива ЛВЖ, открытых нефтеловушек, прудов-отстойников с плавающей нефтяной пленкой и т.д. К зонам класса B-Iг также относятся пространства:

- у проемов за наружными ограждающими конструкциями помещений со взрывоопасными зонами классов B-Ia (исключение - проемы окон с заполнением стеклоблоками);
- у устройств для выброса воздуха из систем вытяжной вентиляции помещений со взрывоопасными зонами любого класса;
- у предохранительных и дыхательных клапанов емкостей и технологических аппаратов с горючими газами и ЛВЖ.

Classification of Hazardous Areas

3.3. Согласно нормам МЭК 79-10 взрывоопасные зоны горючих газов и паров горючих жидкостей классифицируются:

- Зона 0

Это зона, в которой взрывоопасная газовая среда присутствует постоянно или в течение длительного времени. (Газовая фаза внутри закрытой емкости составляет зону 0);

- Зона 1

Это зона, в которой взрывоопасная газовая среда может образоваться при нормальном режиме работы установки;

- Зона 2

Это зона, в которой газовая взрывоопасная среда не может образоваться при нормальной работе, а образуется только в ненормальных (аварийных) условиях эксплуатации (утечки и пр.).

3.4. Сопоставление определений взрывоопасных зон по ПУЭ и по МЭК 79-10 позволяет сделать вывод:
Зоне 1 по МЭК 79-10 соответствует зона класса B-I по определению ПУЭ.
Зоне 2 по МЭК 79-10 соответствуют зоны классов B-Ia и B-Iг по определению ПУЭ.

4. ТИП ЭЛЕКТРООБОРУДОВАНИЯ В ЗАВИСИМОСТИ ОТ ЕГО РАСПОЛОЖЕНИЯ

Type of Ex-Equipment considering the location of equipment

Взрывозащищенное оборудование (в том числе аппараты и приборы связи, пожарной сигнализации, автоматики и управления) должно быть поставлено в соответствии с таблицей, приведенной в приложении 1.

5. ЗАВОДСКИЕ ИСПЫТАНИЯ

Facility tests

5.1. Проверка соответствия документации с документацией, указанной в заказной спецификации.

5.2. Проверка количества и качества согласно техническим условиям, действующим нормам и прочим правилам конструирования.

Взам. инв. № | Подпись и дата | Инв. № подл.

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5.3. Проверка соответствия прототипу, подверженному типовым испытаниям.

5.4. Диэлектрические испытания оборудования с рабочим напряжением больше или равным 600 В.

6. ТЕХНИЧЕСКАЯ ДОКУМЕНТАЦИЯ

6.1. Техническая документация и чертежи оформляются:
- текстовая техническая документация - на русском или английском языках;
- чертежи - на английском языке с подстрочным русским.

6.2. Окончательная документация, передаваемая Поставщиком, должна включать следующие документы:
- монтажный чертеж с указанием габаритных размеров и веса оборудования;
- технический паспорт;
- сертификат о взрывозащите, выданный национальной лабораторией, признанной CENELEC или любой другой организацией, согласованной Покупателем, и включающий:
a) стандарт на изготовление;
b) метод защиты;
c) маркировку защиты;
d) характеристику взрывоопасной среды, в которой устанавливается оборудование изготовителя;
- инструкцию по монтажу и эксплуатации, включающую:
a) общий вид и техническое описание оборудования;
b) данные по монтажу, демонтажу, установке, регулировке, настройке оборудования;
c) данные по функционированию оборудования, возможным неисправностям и способам их устранения;
- принципиальные и монтажные электрические схемы (с указанием присоединений);
- чертеж уплотнительного сальникового ввода с сертификатом согласования;
- протокол испытаний на взрывозащиту;
- протокол испытаний на нагрев, с указанием максимальной температуры, соответствующей классу защиты.

Technical Documentation

Этот документ является собственностью АО НЕФТЕХИМПРОЕКТ и не подлежит копированию и распространению без его согласия

7. **ПРИЛОЖЕНИЕ 1**

Наиболее распространенные виды взрывозащиты электрического оборудования для взрывоопасных зон.

Электрооборудование	Вид взрывозащиты		Уровень Взрывозащиты
	Внутри помещения	Снаружи помещения	
	Зона класса B-Ia (2)	Зона класса B-Ir (2)	
Асинхронный или синхронный электродвигатель	Exd Exp Exe	Exd Exp Exe	Повышенной надежности против взрыва
Стационарное оборудование (в т.ч. аппараты и приборы связи, пожарной сигнализации, автоматики и управления), искрящее или достигающее температуры поверхности выше 80°C при нормальной работе.	Exd Exp Exi Exo Exs	Exd Exp Exi Exo Exs	Повышенной надежности против взрыва
Стационарное оборудование (в том числе аппараты и приборы связи, пожарной сигнализации, автоматики и управления), не искрящее и не достигающее температуры поверхности выше 80°C при нормальной работе. (Максимальные требования).	IP54 (Exd) (Exp) (Exi) (Exo) (Exs)	IP54 (Exd) (Exp) (Exi) (Exo) (Exs)	Без средств взрывозащиты (Повышенной надежности против взрыва)
Передвижное оборудование	Exd Exi Exe Exs	Exd Exi Exe Exs	Для класса B-Ia- взрывобезопасное Для класса B-Ir- повышенной надежности против взрыва
Светильники стационарные	Exd Exe	Exd Exe	Повышенной надежности против взрыва
Светильники переносные	Exd	Exd	Для класса B-Ia- взрывобезопасное Для класса B-Ir- повышенной надежности против взрыва
Кабели	Бронирование двумя стальными лентами. Внешняя оболочка стойкая к углеводородам и не поддерживает горение.		

Appendix 1 including information about the most commonly encountered protection types of Ex-Equipment

Appendix 10 Technical Requirements for Asynchronous Motor

ООО «Инженерный центр»	ОКАД -777 ТТ	Лист 1

СОГЛАСОВАНО:

УТВЕРЖДАЮ:
Генеральный директор
ООО "Инженерный центр"

_____ _____В.Т.Никора

_____ _____

Двигатель асинхронный
типа АД-315-10-10У3
ТЕХНИЧЕСКИЕ ТРЕБОВАНИЯ

1 Значения основных параметров двигателей, должны соответствовать указаным в таблице 1.

Таблица 1

Наименование параметров	Ед. изм.	Значение
Мощность	кВт	315
Напряжение	В	10000
Ток лин. статора	А	26,1
Частота тока	Гц	50
Синхрон. частота вращения	об/мин	600
КПД	%	92,8
cos φ	-	0,75
Кратность:		
- пускового момента	о.е.	1,4
- макс. момента	о.е.	2,6
- пускового тока	о.е	6,5
Скольжение	%	1,0
Допустимый момент инерции механизма	кгм^2	2000
Режим работы		S1
Масса	кг	3670

Table 1 includes desirable general quantities of Asynchronous Motor

2 Конструктивное исполнение двигателей:

2.1 Климатическое исполнение и категория размещения У3.

2.2 Степень защиты двигателя IP23, коробки выводов – IP55.

2.3 Подшипниковые узлы выполнены на подшипниках качения с консистентной смазкой; конструкция узлов позволяет пополнять и удалять смазку на ходу.

2.4 В подшипниковых узлах для контроля температуры установлены 2шт. термопреобразователей сопротивления типа ТСМ 1388 с НСХ 50М. Выводные концы термопреобразователей размещены на блоке зажимов в

Alternate design of Asynchronous Motor

ООО «Инженерный	ОКАД -777 ТТ	Лист 1
ООО «Инженерный центр»	ОКАД -777 ТТ	Лист 2

2.5 Контроль температуры обмотки и железа статора выполняется 6 шт. (по 2 шт. на фазу) термопреобразователями сопротивления с НСХ 50М. Выводные концы термопреобразователей размещены на блоке зажимов в кожухе и соединены по двухпроводной схеме.

2.6 Все коробки: статора, термопреобразователей располагаются на одной стороне – справа. Иное расположение оговорить при заказе.

2.7 Способ охлаждения двигателя IC01.

2.8 Окружающая среда неогнеопасная, невзрывоопасная, не содержащая токопроводящей пыли, агрессивных газов и паров в концентрациях, разрушающих металлы и изоляцию. Тип атмосферы II ГОСТ 15150. Концентрация инертной пыли не более 2,0 мг/м^3.

2.9 Монтажное исполнение IM1001.

2.10 Изоляция обмоток термореактивная типа Монолит-2. Схема соединения обмоток – Y; в коробку выводов выведено 6 выводов, размещенных на четырех изоляторах.

2.11 Максимальный уровень звуковой мощности, корректированный по характеристике А не должен превышать 99 дБ(А).

2.12 Максимальное среднее квадратическое значение виброскорости подшипниковых опор не должно превышать 2,8 мм/с.

2.13 Пуск двигателя прямой от полного напряжения сети и обеспечивается как при номинальном напряжении, так и при снижении напряжения сети за время пуска до 0,8 Uн, при среднем статическом моменте сопротивлений за время пуска 0,3 Мном. Двигатель должен допускать не более 2-х пусков из холодного состояния с интервалом 5 мин или 1-го пуска из горячего состояния. Каждый последующий пуск допускается с интервалом не менее, чем через 3 часа.

2.14 Двигатель должен допускать не более 500 пусков в год и 10000 пусков за срок службы.

2.15 Двигатель должен допускать как правое, так и левое вращение. Изменение направления вращения только из состояния покоя. Направление вращения оговорить при заказе.

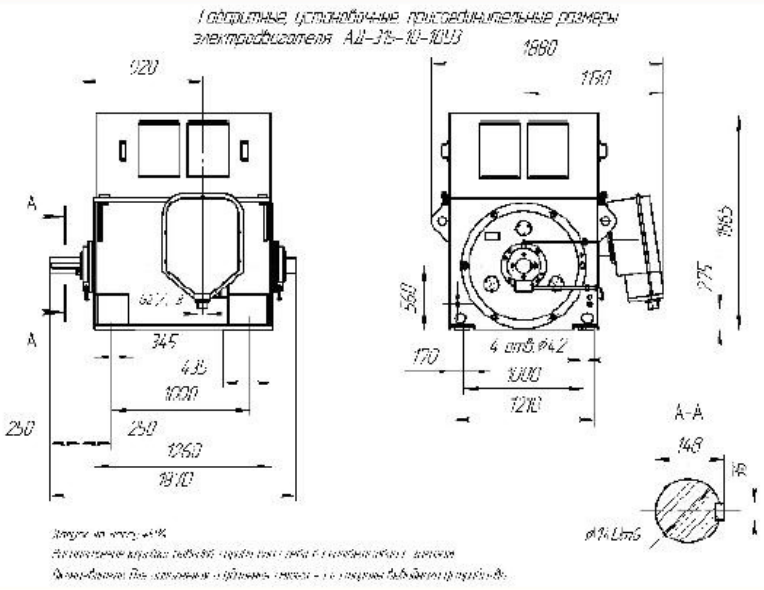
2.16 Комплектность поставки оговаривается в договоре.

2.17 Установочные, присоединительные и габаритные размеры указаны на рисунке 1.

Alternate design of Asynchronous Motor

ООО «Инженерный центр»	ОКАД -777 ТТ	Лист 3

Рис.1



Installation, connection and dimension parameters of Asynchronous Motor

Во всем неоговоренном двигатели соответствуют требованиям ГОСТ 183, ГОСТ 9630.

In other not described issues Motor is compliant with standards GOST 183 and GOST 9630

РАЗРАБОТАНО:

Ведущий инженер-конструктор _____ В.А.Дариенко

Инженер-конструктор I кат. _____ Н.К.Крейдун

Ведущий инженер-конструктор _____ Л.П.Варенник

Начальник КО-1 _____ Д.П.Гаргалык