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COMMITTEE ON SUSTAINABLE ENERGY

Working Party on Gas

Ad Hoc Group of Experts on the Supply and Use of Gas

**TECHNOLOGICAL AND ECOLOGICAL NORMS REQUIRED FOR THE
DESIGN AND OPERATION OF GAS DISTRIBUTION NETWORKS**

(Replies to the questionnaire prepared by the delegation
of the Russian Federation)

Note by the secretariat: This document is prepared in accordance with the decision of the First session of the Ad Hoc Group of Experts (ENERGY/WP.3/GE.5/2000/2, para 8 (b)), with a view to clarifying some of the questions contained in the questionnaire (ENERGY/WP.3/GE.5/2000/6).

Please review both the questionnaire and the replies reproduced below, complete the questionnaire for your country and send it to the General Rapporteur, Mr. Alexander Gritsenko, General Director, VNIIGAZ, 142 717 Moskovskaya Obl., Leninsky Raion, Pos. Razvilka, Fax: +7-095 399 1677, with a copy to the secretariat, **by 2 October 2000.**

Technological and ecological norms required for the design and operation of gas distribution networks	
COUNTRY:	Russian Federation

1. Design of Gas Distribution Networks

Which documents stipulate the norms for technological design of the gas distribution networks?
HS&R ¹ 2.04.08-87*. Gas supply. HS&R 42-101-96. Design and construction of polyethylene pipe gas pipelines
In the gas supply system, into what categories do you divide pipelines according to the pressure of the gas transported?
0.6 MPa < P ≤ 1.2 MPa – Category I high-pressure gas pipelines 0.3 MPa < P ≤ 0.6 MPa – Category II high-pressure gas pipelines 0.005 MPa < P ≤ 0.3 MPa – Medium-pressure gas pipelines P ≤ 0.005 MPa – Low-pressure gas pipelines
How do you calculate the annual gas consumption for each type of consumer?
To the requirements of HS&R 2.04.08-87*. Gas supply. Chapter 3. Depending on the purpose of the building, the numbers of people or animals, and the heated area.
What is the actual load on distribution lines during summertime?
Depending on the location of the area supplied and the customer's sphere of activity, between 1.5 and 3.0 times less than in winter.
Design requirements for outside (external) gas distribution lines.
Requirements of HS&R 2.04.08-87, Chapter 4 and Spec ² 42-101-96.
What methods do you use in constructing external steel or polyethylene lines?
Steel – underground, above-ground, surface Polyethylene - underground
What are the criteria to decide whether steel or polyethylene tubes and fittings should be used in each particular case?

¹ Health Standard & Rules.

² Specification.

<p>Steel – intra - and extra-settlement pipelines; intra - and extra-compound pipelines at industrial enterprises $1.2 \text{ MPa} \leq P \leq 0.005 \text{ Mpa}$ Polyethylene- intra-settlement pipelines ($P \leq 0.6 \text{ MPa}$); extra-settlement pipelines ($P \leq 0.3 \text{ MPa}$).</p>
Requirements and design solutions with regard to the inlets to buildings.
Requirements of HS&R 2.04.08-87*, Chapter 4, and Spec 42-101-96, Chapter 4
Methods used in water-crossings. Special requirements for steel and polyethylene lines.
Under-water, above-water (aerial), beneath river bed by horizontal directional drilling. Steel– all methods. Polyethylene – under-water and beneath river bed for crossings no more than 25 m long .
Road and railway crossings. Special requirements for steel and polyethylene lines.
Polyethylene – underground only. Steel – underground and above-ground. Underground: open trenches and covered methods (piercing, drilling).
Requirements for preventer (cut-off) equipment.
Requirements of HS&R 2.04.08-87*, Chapter 4, and Spec 42-101-96, Chapter 4.
Methods used for connecting pipes and fitting branch-pipes (steel and polyethylene lines).
Steel – gas and electric-arc welding. Polyethylene – 1) heated element butt welding; 2) sleeves with embedded heaters; 3) saddle branches with embedded heaters.
Methods used for laying underground gas distribution lines (depth and width of trench)
Steel – welding of individual tubes 6-12 m long, maximum depth 0.8 m from top of tube. Width of trench – $D+300 \text{ mm}$. Polyethylene – welding of individual tubes 6-12 m long and of bundles for lengths of up to 400 mm, depending on diameter. Depth – maximum 1.0 m. Width of trench – $D+300 \text{ mm}$.
How wide is the right of way for the laying of gas distribution lines between settlements?
28 m when laying lines in agricultural land. 20 m when laying lines in land unsuitable for farming.
Requirements with regard to design and layout of gas distribution regulating units and equipment
In cubicles, self-contained units or free-standing brick buildings. Single-line with bypass or dual-line.

Gas distribution networks in settlements. Use of “combined” regulators. What pressure is used for gas distribution lines in settlements?
Single-stage (low pressure), two-stage (medium and low pressure, with use of service regulator), combined.
What gas pressure is used in household gas appliances?
Maximum 0.003 MPa (0.0015 – 0.002 MPa).
Environmental regulations applicable to the design of gas distribution networks
To requirements of: GOST ³ 17.2.3.02-78 “Nature protection. Air. Rules for the fixing of- permissible emissions of pollutants”; GD ⁴ 51-10-85. “Guidelines for setting standards for pollutant emissions”; HS&R 2.2.1/2.1.1.567-96 “Health-protection zones”.
Special pipeline-design requirements for specific areas (seismic areas, areas prone to frost-heaving, subsidence, swelling or flooding)
In seismic areas, additional requirements as per HS&R II –7-81* “Construction in seismic areas”. In areas prone to frost-heaving, subsidence or swelling, additional requirements as per HS&R 2.02.01-83 “Foundations of buildings and structures”.
What criteria do you use to choose the type of gas tubes in each particular case?
Diameter – according to the results of hydraulic strength analysis. Tube material – depending on pressure, site, and construction cost.
Do you use reinforced polyethylene lines for gas distribution? If yes, what kind of fittings do you use?
No.
Methods of gas distribution line testing.
Underground lines in all pressure categories and low- and medium-pressure surface lines are air-tested for strength and leaks. Above-ground high-pressure lines are water-tested for strength and leaks, but air-testing is also permitted.
Quality control methods for welded and sleeved joints on steel and polyethylene lines.
The number of joints to be tested is set in HS&R 8.05.02-88* “Gas supply” and HS&R 42-101-96. Steel pipes undergo x-ray and ultrasound testing, as well as mechanical testing. Polyethylene pipes undergo ultrasound and mechanical testing.

³ State Standard.

⁴ Guideline Document.

Economic criteria applied in deciding whether to provide settlements with a piped natural-gas supply.
The project must pay for itself in 5-7 years.

2. Determination of optimum types and sizes of gas distribution lines

How do you determine the inner diameter of pipelines? What criteria do you use?
According to formulae for the drop in the square of the-pressure [HS&R 2.04.08-87* "Gas supply"]: depends on the length of the pipeline, the initial pressure, the constraints on maximum pressure at the end of the pipeline, and the gas flow rate.
Which coefficient (factor) of the roughness of steel and polyethylene pipes do you apply in hydraulic calculations?
Steel pipes = 0.01, polyethylene pipes = 0.002
What relative roughness values are used in designing gas pipelines, and do the values differ for pipes of different grades of polyethylene (PE63, PE80, PE100, PE125)?
The same roughness value is used for all polyethylene pipes.
Is the rate of gas flow in the pipe set in the formula for determining the pressure drop for medium- and high-pressure pipelines or is it determined for each individual pipeline section?
It is determined for each section.
How is the gas flow along the pipe determined: by adding together the hourly maximums or by solving a non-steady-state problem in which the gas flow is not constant over time?
By adding together the hourly maximums.
What is the ratio between maximum and minimum annual gas consumption?
There may be a difference of several hundred per cent, depending on the region.

3. Research work applied in gas distribution projects

In your country/company, what is the percentage of use of archive data in research and engineering?										
0	10	20	30	40	50	60	70	80	90	100
					X					
What percentage would you consider as an optimum one?										
0	10	20	30	40	50	60	70	80	90	100
					X					

Which of the survey methods (engineering and geodesy) listed below would you consider the most efficient?		
Surface survey	X	
Aerial survey	X	
Satellite (remote) survey	X	
Laser scanning	X	
Other methods of survey: surface with GDS.		

Do you think it necessary to conduct engineering and geological surveys using new and emerging geophysical methods and other techniques?	
X	
Same, but without well drilling?	
	X

4. Operation of gas distribution networks

Who is responsible for gas distribution network operation?	
- Gas transportation enterprise	
- Specially established gas distribution organization	X
- Other organization	
What kind of organization is it?	
- State enterprise	
- Private company	
- Under other form of ownership	X
Which types of document regulate gas distribution:	
- Unified normative and technical document, containing instructions and guidelines concerning methods of work, etc. and on the basis of compliance with which gas distributors can be licensed to operate?	
- Separate normative document on rules and standards determining requirements applied to each organization involved?	X
Which of the following are the direct responsibility of the gas-supply system operator:	
- Surveillance and technical maintenance?	X
- Scheduled repair work (routine and major)?	X
- Emergency repair work?	X
- Disconnection of defective gas equipment?	X

What parameters of the gas distribution system are used to determine operators' structure and manpower and equipment requirements?	
Number of kilometres of pipeline (separately for low-, medium- and high-pressure lines, inter-settlement and street lines, lines in towns and villages), number of residential consumers with piped gas supply (separately for towns and villages).	
What is the level of service beyond which it is considered worthwhile establishing a repair and operating unit in any given locality?	
Minimum of 300 km of line and 30,000 residential consumers with piped gas supply.	
Does the gas distribution organization have its own emergency and dispatching units for locating and fixing faults and maintaining normal gas supply, or does it use the services of other specialized professional teams, firms or organizations?	
It has its own such units and calls on other services (fire brigade, Ministry of Emergency Situations) only in particular circumstances.	
What is the time limit for emergency services to reach an emergency site?	
40 minutes.	
What type of system monitoring do you employ:	
- Automatic/remote monitoring giving permanent coverage of entire distribution system?	
- Optimal combination of automatic and visual (regular on-site inspection) checking of the system?	X
How often do you perform fault detection on pipelines?	
During scheduled repair work	
In the event of forced replacement of pipelines, would you prefer:	
- Replacement of steel pipes by steel pipes?	
- Replacement of steel pipes by polyethylene pipes?	
- Tubing ("Phoenix", "U-Liner")?	X
To what extent do you use mobile fault detection?	
No use.	
Do you install portable gas-leakage detectors in residential buildings?	
No.	
How effective are acoustic methods of fault detection in comparison with other methods?	
Acoustic methods are very rarely employed.	
Do you use any special equipment for pipeline operation in high-risk areas (e.g. seismic or subsidence-prone areas)?	
No.	

Do you have an emergency stock of polyethylene pipes? If yes, do you store the pipes in special premises and what is the time limit for storage?	
Generally speaking, no special premises are used: the pipes are buried. Time limit for storage: 2 years.	
For employee training, certification and refresher training, do you use your own centres or existing institutions within your country or abroad? Do you screen potential employees according to any particular criteria?	
Existing centres.	
What rights and competence does the gas distribution organization have in the event of customers': breach of contractual obligations regarding upkeep of equipment or payment for gas; repeated safety violations?	
Disconnection.	
Are gas distribution facilities guarded? If so, who is responsible for protecting them?	
No such service.	
Which types of activity regarding industrial safety are carried out by your organization:	
- Planning and preparation for accident and incident location and repair?	X
- Monitoring during manufacture of compliance with industrial safety requirements?	X
- Technical investigation of causes of accidents and incidents?	X
- Recording of accidents and incidents in the gas distribution system?	X
- Industrial safety assessments?	
- Mandatory liability insurance for damage resulting from operation of the gas distribution system?	
Which means of communication do you use during the operation of gas networks:	
- Telephone?	X
- Radio?	X
- Other?	X

5. Gas appliances and installations

Technical description of household gas installations	
TYPE OF APPLIANCE	RATED HEAT OUTPUT
- Cookers	4-burner. – 6 Mcal/hr oven – 2.9 Mcal/hr
- Instantaneous water heaters	18 – 25 Mcal/hr
- Storage water heaters	3 – 14 Mcal/hr (Model AGV-80)
- Combined boilers	10 – 25 Mcal/hr

- Central heating boilers	6.9 – 19.7 Mcal/hr
- Condensing central heating boilers	
Other	

State the efficiency of each type of household gas appliance	
- Cooker	58%
- Instantaneous water heaters	80 – 82%
- Storage water heaters	85%
- Combined boilers	83%
- Central heating boilers	85%
- Condensing central heating boilers	85-90%

Thermal performance testing and standards
List the normative instruments that regulate testing of the thermal performance of household gas appliances.
<p>State standard GOST 50696-94. "Cookers, gas, domestic. General specifications".</p> <p>State standard GOST 19910-94. "Water heaters, instantaneous, gas, household. General specifications".</p> <p>State standard GOST 11032-80. "Water heaters, storage, gas, household. Specifications". Amendments Nos. 1, 2.</p> <p>State standard GOST 20219-74. "Central-heating devices, gas, household, with the water circuit. Specifications". Amendments Nos. 1-6.</p> <p>Condensing central heating boilers are not covered by any existing standard.</p>
Describe briefly the basics of the thermal testing and of the measurement of environmental performance.
<p>Basically, the thermal efficiency of household of gas appliances is tested by measuring the useful heat generated during water heating and the heat input for combustion of the gas; the ratio of these two values represents the efficiency of the appliance.</p> <p>The environmental performance indicators (the CO and NO_x concentrations) are measured by sampling of the products of combustion (in testing of the thermal efficiency of burners, use is made of a type of extractor hood placed over a test vessel (saucepan) of known dimensions) for subsequent chemical analysis.</p>
List the standard parameters employed in testing.
<p>Temperature and pressure (normal and as prescribed by standard(s));</p> <p>Properties of test gases;</p> <p>Testing conditions: environmental conditions; negative pressure in flue</p>
Name the organizations that carry out official testing and authorize the series production of gas appliances

The term “State test” is no longer used. Products are subjected to preliminary and acceptance testing at the design stage (the results of acceptance testing determine whether the product will be put into production).

Certification testing is carried out at the manufacturing stage and is mandatory for the types of product considered in this questionnaire.

The organizations that carry out testing (including certification testing) of domestic gas appliances are:

Gas equipment and domestic gas appliance testing centre, Giproniigaz Joint-stock Company (410730 Saratov, ulitsa Kirova 54);

Burner and gas-using equipment testing centre, Promgaz Joint-stock Company (subsidiary of the Kamensk Gas-using Equipment Works) (346300 Kamensk –Shakhtinskii, Rostov oblast);

Domestic gas appliance testing centre, Gazoapparat Joint-stock Company (193019 St Petersburg, ulitsa Prof. Kachalova 3)

Test laboratory, Operating-Centre, Samara Main Technical Board (443010 Samara, Galaktionovskaya 14)

The certifying authority for gaseous-, liquid- and solid-fuelled domestic appliances and process equipment is the All-Russian Standardization and Engineering Research Institute Certification Centre ANO (123007 Moscow, ulitsa Shenogina 4). It examines the results of certification testing and issues certificates of conformity authorizing the manufacture of appliances and equipment.

Technical and environmental performance standards

Give the absolute values of the present and proposed future technical and environmental performance standards applicable to household appliances.

Table 1

Standards	Gas cookers
Heat rating, Kw Low Normal High Extra high	Stove-top burners 0.21-1.05 1.05-2.09 2.09-3.14 > 3.14
Efficiency, %	≥58 for stove-top burners with a heat rating of ≥1,05 kW
Content (maximum): (CO) _{a=1} , % vol	Gas for incomplete combustion, maximum flow, each stove-top burner: 0,03. Reference gas, maximum flow, each stove-top burner: 0,01. Ditto, all stove-top burners: 0,01. Oven burner, 0,8 of rated flow: 0,01.
(NO _x) _{a=1} , mg per cubic metre	Reference gas, maximum flow, each stove-top burner: 200. Oven burner, 0,8 of rated flow: 200.

Table 2 Household gas water heaters

Standards	Instantaneous water heaters	Storage water heaters	Central heating devices with water circuit
Rated heat output (kW)	Small: from 8 to 9 Large: from 17 to 18 from 21 to 23 from 26 to 28	Tank capacity: 80 l: 6.980 12 l: 13.956	11.630 17.445 23.260 29.4075
Rated heat output of pilot burner (W), maximum	350	410	410
Temperature of combustion products ($^{\circ}\text{C}$), minimum	110	110	110
Efficiency (%), minimum maximum	80 88	85 -	82 -
Content $(\text{CO})_{a=1}$, % vol, maximum: under normal conditions with reference gas with other gas under special conditions (with covered flue) with reference gas	0.05 0.1 0.2	0.025 0.1 -	0.05 - -

Note: Future values are not given in standards (paragraph 1).

Verification of the thermal efficiency of appliances
<p>Indicate: how and by whom the thermal efficiency of appliances is checked and emission concentrations are measured in service conditions; whether there are any standards or rules for those activities.</p>
<p>Current rules make no provision for testing of the thermal efficiency of appliances or the measurement of emission concentrations under service conditions.</p> <p>Pursuant to GD 243 of the Russian Federation 3.8-94 “Regulations on the servicing of gas equipment in residential and public buildings (Gas Industry State Design and Research Institute)”, as approved by the Ministry of Fuel and Power on 12 May 1994, the main types of servicing are :</p> <ul style="list-style-type: none">Repair at customers' request;Servicing under contract with building proprietor. <p>Servicing entails the performance of a range of mandatory work listed in section 4 of the above-mentioned “Regulations”, including in particular various checks. Section 4.1.5 of the Regulations requires the following:</p> <ul style="list-style-type: none">In the case of household gas appliances and devices with discharge of the combustion products into a flue, checking of the condition of the metal ducts;Checking that there is a draught in the flue and ventilation before and after the appliance is switched on;Checking that the nozzle diameters are appropriate to the type and pressure of the gas to be used;Visual checking of the combustion process by the type of flame (absence of yellow tips) and of flame stability;Checking of the serviceability of household gas appliances and devices and of automatic gas generators, together with cleaning, tuning and adjustment;Checking of the presence of automatic safety devices on furnace-type gas-fired equipment (if there are no such devices, or they cannot be repaired, the equipment must be replaced);Checking that in-flue gas equipment is leak-free;Checking that there is no health risk from burners. <p>Section 4.3.2 of the Regulations requires that gas combustion be checked and adjusted during servicing of instantaneous water heaters. The service engineer must also check that the pilot-burner flame is stable and is not extinguished when the main burner is lit or turned off.</p> <p>Section 4.4 requires that when servicing storage water heaters the swirler (flow extender) be cleaned of soot and other dirt.</p> <p>Section 6, which prescribes the methods for performing the main operations when servicing in-flue gas equipment, makes no provision for the use of measuring devices to check thermal efficiency or emission cleanliness. It must also be said that the above-mentioned visual check is not always carried out.</p>