

# **HYDRODYNAMIC FUEL EMULSIFER TRGA-3G**

**TRGA-3G-04S**

## **INSTALLATION, OPERATION, MAINTENANCE MANUAL**



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### **Attention!**

**The first time you start the device (in the fuel line or in-line fuel recycling in the feed tank) some time there may be a black smoke from the chimney. This is due to an increase of combustion temperature and increased of flame transparency that leads to the burning of soot and unburned fuel residues on the heat exchangers. At this time, increasing the amount of black carbon emissions, solid residue particles, SO<sub>2</sub> and CO.**

**Time burnout residues depends from the purity of heat exchange surfaces and the boiler walls, burnout time has range from 1 up to 6 hours.**

# 1. PURPOSE AND RANGE OF APPLICATION

**Attention! The staff shall study the equipment certificate and this manual thoroughly before installation and operation.**

**No reclamations shall be accepted in the event of the equipment's integrity damage. The warranty certificate is made in duplicate: one copy for the purchaser and another for the seller (manufacturer).**

**1.1. In fuel industry and power engineering TRGA–3 devices are purposed for :**

- fuels and blended fuels emulsification and homogenization (fuel oil, watered fuel oil, by-product-coking fuel, substandard fuel and other liquid fuel), directly before supply to the boiler unit atomizers (**activator-homogenizer**);
- previous emulsification and homogenization of comparable density blended liquid fuels in supply tanks and storage tanks (**emulsifier - homogenizer**);
- introduction of additional liquids into the main flow – additives and other liquid fuel components (**blender-homogenizer**).

**1.2. TRGA-3G purpose:**

- fuel and blended fuel complete burning improvement;
- boiler units efficiency upgrading;
- physical under burning reduction, less fuel residues and products of combustion sedimentation on the boiler heat-exchanging surfaces;
- reduction of liquid stove fuel density;
- fine water-fuel oil emulsions production; watered fuel and blended fuel burning, including any type of water (condensate, residual water after tanks steam-treatment);
- ash content and solid particles content reduction in fuel; improved service life before atomizers contamination (carburizing);
- reduction of harmful emissions by boilers;
- reduction of exhaust gases smoking, toxicity and output temperature.

**1.3. The devices have a standard structure, and their design is different for their:**

- treated medium type (diesel fuel, admiralty fuel oil, light and heavy fuel oil, bunker fuel oil, by-product-coking fuel and other liquid fuel);
- output (m<sup>3</sup>/h);
- purpose (emulsification, activation and blending);
- type and material of execution (standard execution – steel or other heavy-duty, wear-resistant and/or corrosion-resistant materials).

The device are installed in the liquid fuel boiler units and normally provide 2% of fuel minimal saving. The device require neither structural changes nor boiler unit parameter chart amendments. Other use of devices shall be previously approved by manufacturer.

## 2. GENERAL TECHNICAL DESCRIPTION

**2.0. TRGA-3G** is made of hardened and working-medium-abrasion-resistant ferrous metal (carbon steel).

**2.1 TRGA-3G** devices are undismountable and include no adjustment units. The adjustment is performed by pressure pump selection and/or by adjusting valve on the pump unit bypass line. **TRGA-3** series devices implement **the passive principle of operation; they are powered from the normal pressure pump, though they can be used together with a separate pressure pump and/or premixer, acting thus as a separate unit** for treatment of fuel or other liquids.

**2.2. TRGA-3G** devices include no electrical and movable assemblies. The equipment includes no internal seals, enabling them for treatment of the fluids and blends corrosive for gaskets and rubber seals, and thus - enlarges considerably the devices reliability and service life.

### 2.4. TECHNICAL SPECIFICATIONS

See Table 1 for **TRGA-3G-04S** basic parameters:

Table 1.

Basic parameters	TRGA-3G-04S
1. Rated capacity, liter/h	4000 liter/h, for fuel oil M-100 up to 50 C.
2. Operating pressure, MPa	0,1 – 3.5
3. Optimum output range, liter/h	80-90% from the rated capacity, for TRGA-3G-08, for example, from 3200 up to 3600 l/h
4. Operating temperature range, °C	Depending on the fuel nature: from -10° up to +250°C;
5. Weight, kg, max.	Not more 12 kg. ( netto ). Not more 20 kg. ( brutto ).
6. Direct steam treatment availability	Yes steam blowing or flame cleaning temperature 400 °C max.
7. Expected useful life	8800-14 000 hours at maximum output in proper filtration

Do not use with fluids containing acids and abrasive inclusions.

Max. diameter of solid particles in liquid - not more than 2.5 mm (briefly) a large particle can cause a fatal blockage.

The equipment can be operated in the environmental conditions as follows: temperature from -20° up to +250°C, max. relative humidity 100%.

In the event of outdoor temperature below zero the device and piping shall be provided with heat insulation. Possibility of customizing with working pressure 5-6 MPa.

Includes connecting flanges, may include a preliminary one-or multi-component hydrodynamic mixer.

### 3. DELIVERY SET

#### The set includes:

- |   |                   |
|---|-------------------|
| 1. <b>TRGA-3G-04</b>                              | - <b>1 pc.</b>    |
| 2. Pre-mixer                                      | - 1 pc.*          |
| 3. Mounting flanges                               | - 2 pcs (4 pcs.)* |
| 4. Passport and Warranty Certificate              | - 1 pc.           |
| 5. Installation, operation and maintenance Manual | - 1 pc.           |
| 6. Copies of Equipment Certificate                |                   |

### 4. INSTALLATION

4.1 **TRGA-3G** installation made in accordance with the selected installation diagram that the customer receives from the manufacturer in the form of the installation scheme after engineering site survey of the customer or after providing the questionnaire and schemes of fuel lines. Schematic diagram of the installation is shown below. Assembly diagram for specific homogenizer is agreed between the manufacturer and the customer separately.

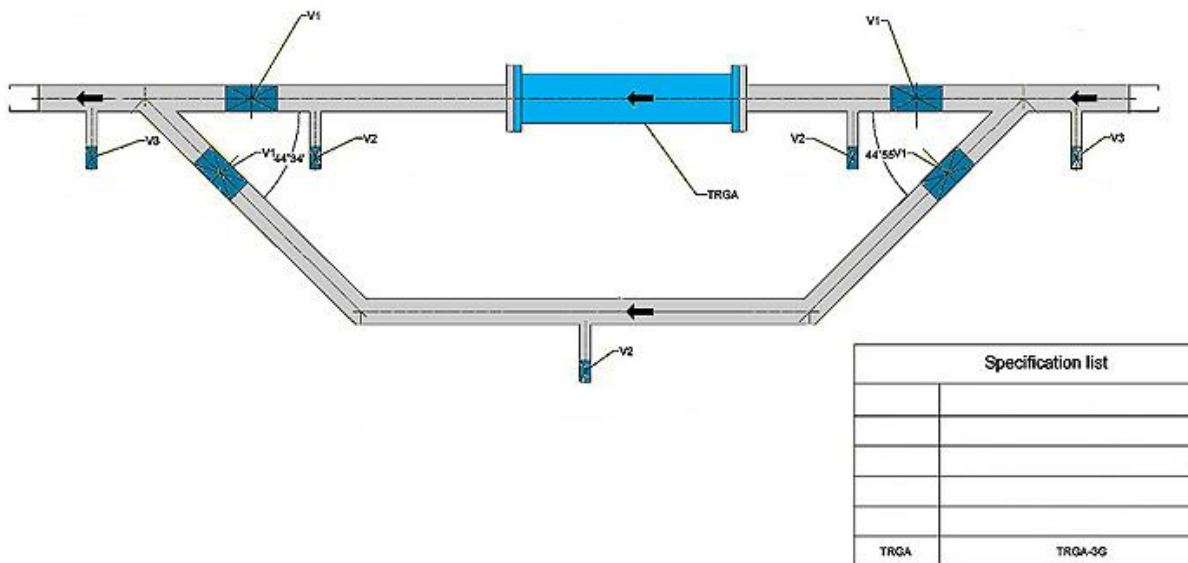
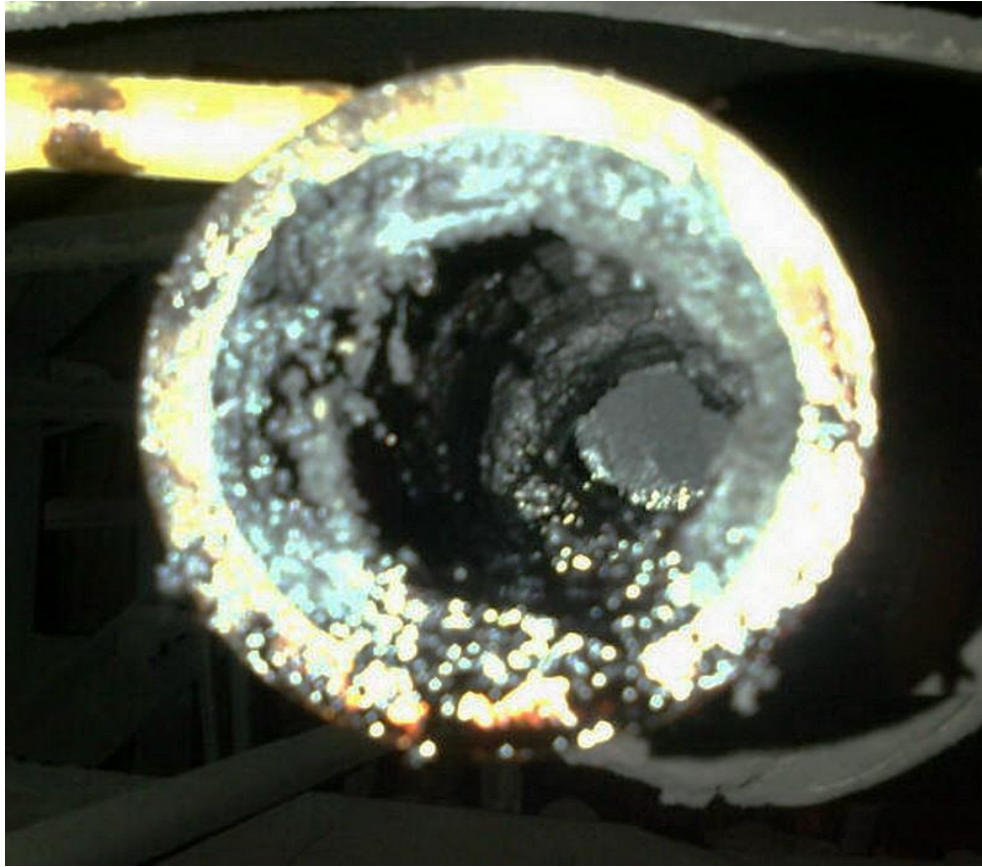
4.2 **TRGA-3G** is installed on the pipe line, with bypass, in horizontal/vertical/inclined position (if the mounting position is not strictly stipulated in the Equipment Certificate, this Manual of installation diagram, item 4.1), providing the due access for the purpose of thread connection tightening control and for test pressure gauges readings. For the devices installation, both for **TRGA-3G** and for greater output the additional holder is required on the housing for fixing to the piping bearing structures. It is recommended (for the devices from TRGA-3G-10) to use small tools and equipment (pulley blocks and winches) to lift and hold the devices at their coupling with the counter flanges and bearing structures. All safety measures shall be strictly observed installation. The device weight may vary between 10 kg (starting from TRGA-3G-05) and 140kg (TRGA-3G-50), what requires two installers at least for the devices mounting and dismantling.

4.3. Both at input to **TRGA-3G** and downstream after the test pressure gauges shall be installed, the readings of which are required for the operation mode evaluation and eventual clogging grade evaluation. For M-100 fuel oil the typical pressure drop in the fuel oil supply line to is about **0.1-0.4 MPa**. If this value is essentially higher, this means the high viscosity of the fuel and desirable temperature rise or else the clogging (i.e. the device shall be cleaned)

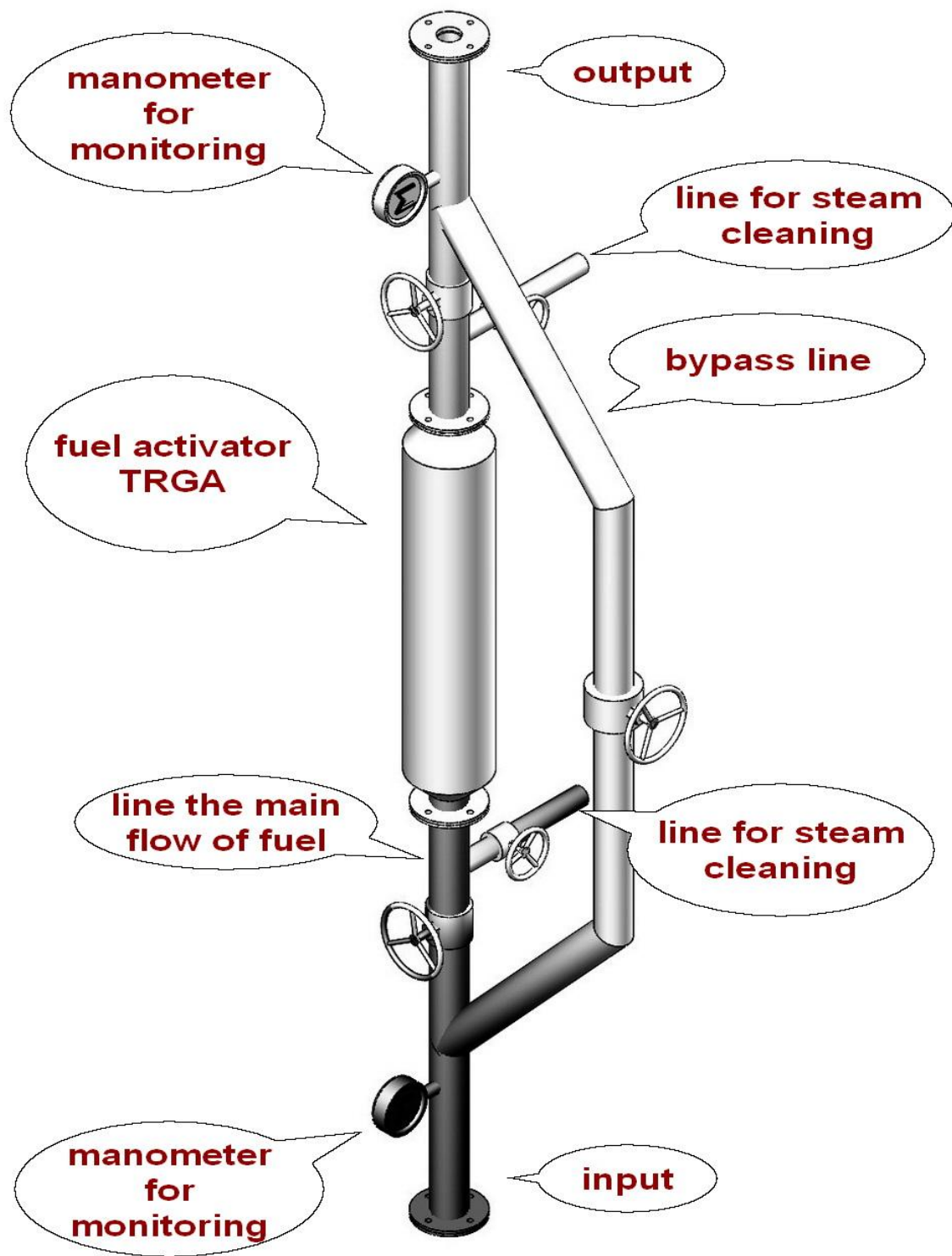
4.4. **Be sure to clean the assembly plant for TRGA-3G from welding and other possible residues before installing the proper homogenizer, otherwise the homogenizer may be completely incapacitated or partially damaged during start.** At **TRGA-3G** installation the cutoff valves should be provided for the eventual dismantling of the device and its further flushing or steam blowing. The standart system operation (when TRGA-3G shutdown for maintenance) shall be provided by opening the bypass gate, with the closed cutoff valve.

In the case of **contamination in the fuel oil supply line**, (pictured below) is recommended to make a node installation TRGA-3G in advance, together with an **insert, which temporarily replaces TRGA-3G**.

You must **install this insert**, rinse the entire **the fuel oil supply line** (fuel oil or other liquid) for several hours for sludge particles do not fall into TRGA-3G in the first minutes of launch.



If a blockage is, you should immediately remove the TRGA-3G, rinse it in accordance with p.6.2 of this manual, and started again.



To provide **TRGA-3G** flushing or blowing without any dismantling it is recommended to install directly before and after **TRGA-3G** extra inlet and outlet pipes with plugging taps on the ends. **For TRGA-3G flushing without dismantling** open the bypass gate, close the cutoff valves on **TRGA-3G** installation line, after that open the plugging taps and clean **TRGA-3G** with steam or hot operating fuel. The steam reverse supply is possible (though not recommended), but flushing or blowing shall be executed in the forward direction only.

4.5 Compressed air, solvent, hot gasoil or direct steam shall be used for cleaning. When the treatment is terminated close the plugging taps, open the cutoff valves, the outlet gate is to be opened first at that.

4.6 Flanges TRGA-3G manufactured from steel type 20 to the Russian Standard (A29/A29M, type 1020 - according to ASTM), please pay attention to this when you select welding electrodes. The normal tightening sequence shall be observed for **for smooth and tight connection**.

4.7 **TRGA-3G**'s flanges are non-symmetrical. The inlet flange is installed with its narrow end towards the flow direction. The outlet flange is installed with the cone's wider end towards the flow direction.

4.8. No fuel leakage is admissible after **TRGA-3G** installation at the joints of the device with flanges. Sleeves (sealing) installed between the coupling flanges shall be made of leather or paronite. Other standard couplings at the customer's facilities are also permissible. The customer bears all liability for the due choice of sealing sleeves (sealing).

4.9. Where any solid abrasives are available in the treated medium, the filter is required before the device.

4.10. Direction of the treated flow is as on the label on the device's housing.

4.11. Do not hesitate to contact the manufacturer in the event of any questions arisen during the installation.

## **5. OPERATION AND ADJUSTING**

5.1 **TRGA-3G** adjusting is performed by means of the pressure pump selection and by means of the bypass gate connecting the pump inlet and outlet. The best pressure for the fuel oil treatment and/or water-fuel oil emulsions is 8-16 atm. (0.8-1.6MPa). The reduced operating pressure enables the stable water-fuel oil emulsions (WFE) with 20% of max. water content as a result of double or multiple circulation. The operating pressure increase up to 12 atm. (1.2MPa) does not result in the considerable improvement of WFE dispersion, though it improves the grinding rate of solid inclusions in the fuel, being it useful in the event of by-product-coking fuel use or old fuel oil use.

5.2 It is recommended to keep the register of the test pressure gauges readings and the treated medium temperature. The increased pressure on the test pressure gauge (pressure difference of the gauges on inlet and outlet) is the evidence of the device clogging, which shall be removed as described above.

In the event of contaminated medium (sand, abrasives ...) one or even more filters are to be installed before the device that shall be regularly washed and cleaned. There may be two ore more filters equipped with cutoff valves, in order to disconnect and service them from time to time.



**5.3 Where abrasives get inside TRGA-3G, its service life can be reduced even to 100-200 operation hours. The operation mode in abrasive medium is admissible. During 100 hours of operation with the fuel including 5% of sand, through the device TRGA-3G-20 for example transmits up to 2000 ton of treated fuel and up to 100 ton of sand. That allows multiple pay back worn device, but such operation shall be agreed with the manufacturer in the contract (agreement).**

**Anticipatory supply of new TRGA devices at special prices with the further return of worn-out equipment to the manufacturer for the purposes of their wear level evaluation is admissible under the previous approval.**

**5.4 The wear evidence is the pressure drop in the device under 50% of the usual value of the pressure drop in the operation mode. The medium flow through the device shall be monitored thoroughly in order to detect eventual faults or decreased output of the pump.**

## **6. MAINTENANCE**

**6.1 The device maintenance includes the visual observation of the joints condition and the pressure gauges readings.**

**6.2 In case of increase the pressure difference on the gauges before and after the homogenizer more then 3.5 MPa should:**

- dismantle the device and flush it using the treated product solvent; blow it in the reverse direction with compressed air or direct steam; then blow it in the forward and reverse direction
- re-install the device.

**6.3 All operations in the item 6.2. can be performed without any dismantling as well. For that open the bypass flap, then close the cutoff valves, discharge fuel from the device through the open cocks of drain fittings, supply steam or flush fluid to the inlet flush fitting, enabling the outlet fitting drainage.**

**6.4 If you are unable to clear the TRGA-3G**

- contact the manufacturer for advice;
- if this does not solve the problem, send it to the manufacturer.

## **7. SAFETY MEASURES**

**7.1 The staff should study the equipment certificate and this manual before TRGA-3G maintenance.**

**7.2 Where the fuel fails to transit the device, dismantle it and immerse into hot fuel oil for 4-8 hours or other operation medium solvent, flush it with diesel fuel or other solvent under pressure, blow it through and re-install.**

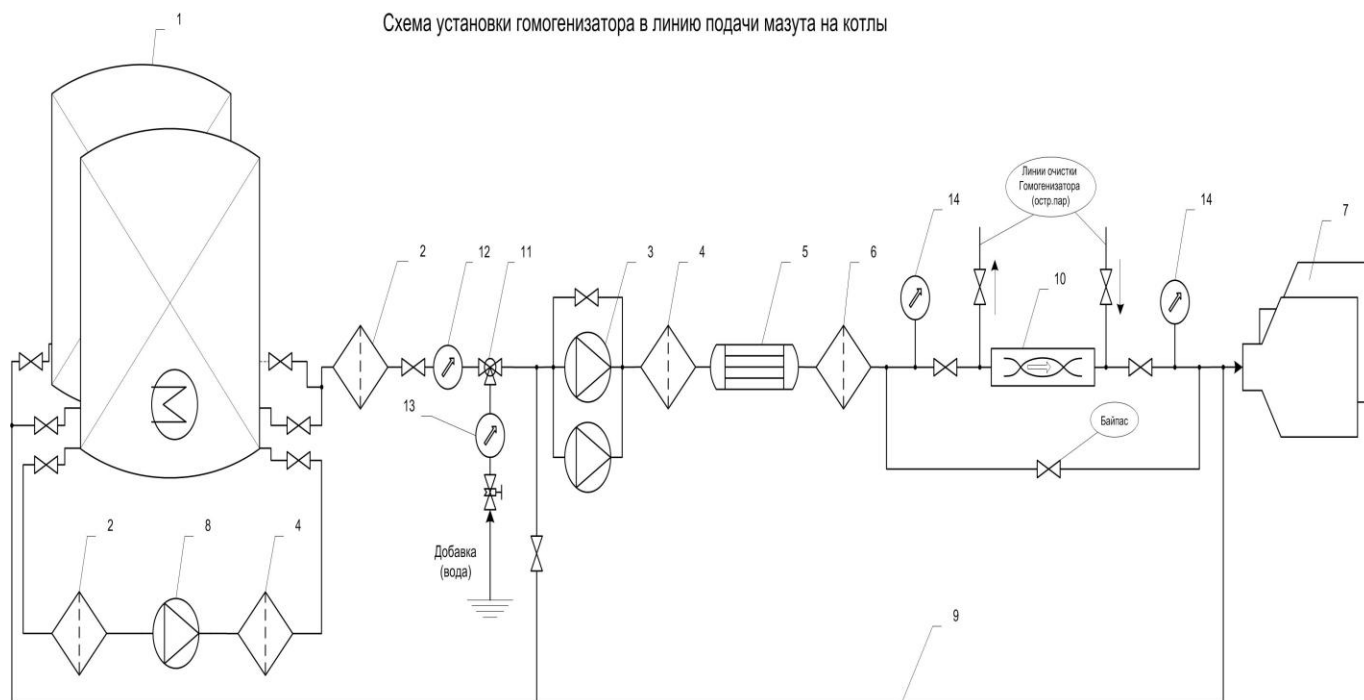
**7.3 The filter installed before the device shall have the rated filtering capacity equal to 1 mm of maximal coarseness (64 cells per 1 cm<sup>2</sup>) and mounted at the maintenance accessible place.**

**7.4 The flow rate inside TRGA-3G is 15 m per second and more. Solid parts in the treated medium may cause erosion and even the device housing destruction with the lapse of time. In the event if any leakage or housing damage promptly disconnect the device from the line, dismantle it, flush and send it to the Manufacturer's address. The user shall not repair the device. Any repair of the device, except flushing and blowing is prohibited.**

7.5 The oil fuel temperature range is +50°C...+250°C. The temperature range of other treated fluids should provide their fluidity.

7.6 For the purpose of TRGA-3 correct installation monitoring the user shall e-mail a photo of the installed TRGA-3 to the manufacturer on [5183898@list.ru](mailto:5183898@list.ru)

7.7 Schematic diagram installation of the device TRGA-3G in-line fuel supply to the burners of boilers. The specific setup of agreement with the customer in each case.



Спецификация оборудования			
Обозн.	Описание	Обозн.	Описание
1	Мазутные резервуары	8	Насос рециркуляции
2	Фильтр грубой очистки	9	Трубопровод обратной подачи мазута
3	Насос подачи мазута на котел	10	Гомогенизатор топлива TRGA
4	Фильтр тонкой очистки	11	Смеситель
5	Пароподогреватель мазута	12	Расходомер мазута
6	Щелевой фильтр (при наличии)	13	Расходомер подачи подтоварной воды
7	Котлы	14	Манометры

## 8. OIL TREATMENT

The most profitable ways of **TRGA-3G** use are as:

- a) Homogenizer in the fuel preparation system in the electric power installations. The result of the treatment is the atomized fuel, which have no harmful impact on such installations operation and considerably improves the burning efficiency;
- б) Blended fuels emulsor, e.g. for fuel and remaining water in it; the result is highly dispersed water-fuel emulsion;
- в) Various fuels blending or mixing with additives.

**TRGA-3G** installation options:

- a) For fuel preparation. – on the elevation from the storage tank
- b) After the normal circulating pump.
- c) After the normal pressure pump, before atomizers.

**TRGA-3G** installation enables to:

- 1) Reduce the fuel viscosity.
- 2) Decrease the flash temperature.
- 3) Decrease the fuel heating temperature.
- 4) Reduce the amount of mechanical impurities and resins, improving thus the fuel dispersion and fuel burning in the chamber.
- 5) Reduce the amount of harmful emissions during the liquid fuel burning.
- 6) Improve the atomizers service life and slow their clogging.

**TRGA-3G can be used for highly dispersed suspensions (subject to the manufacturer's approval).**

### **Pre-treatment with its own fuel pressure pump.**

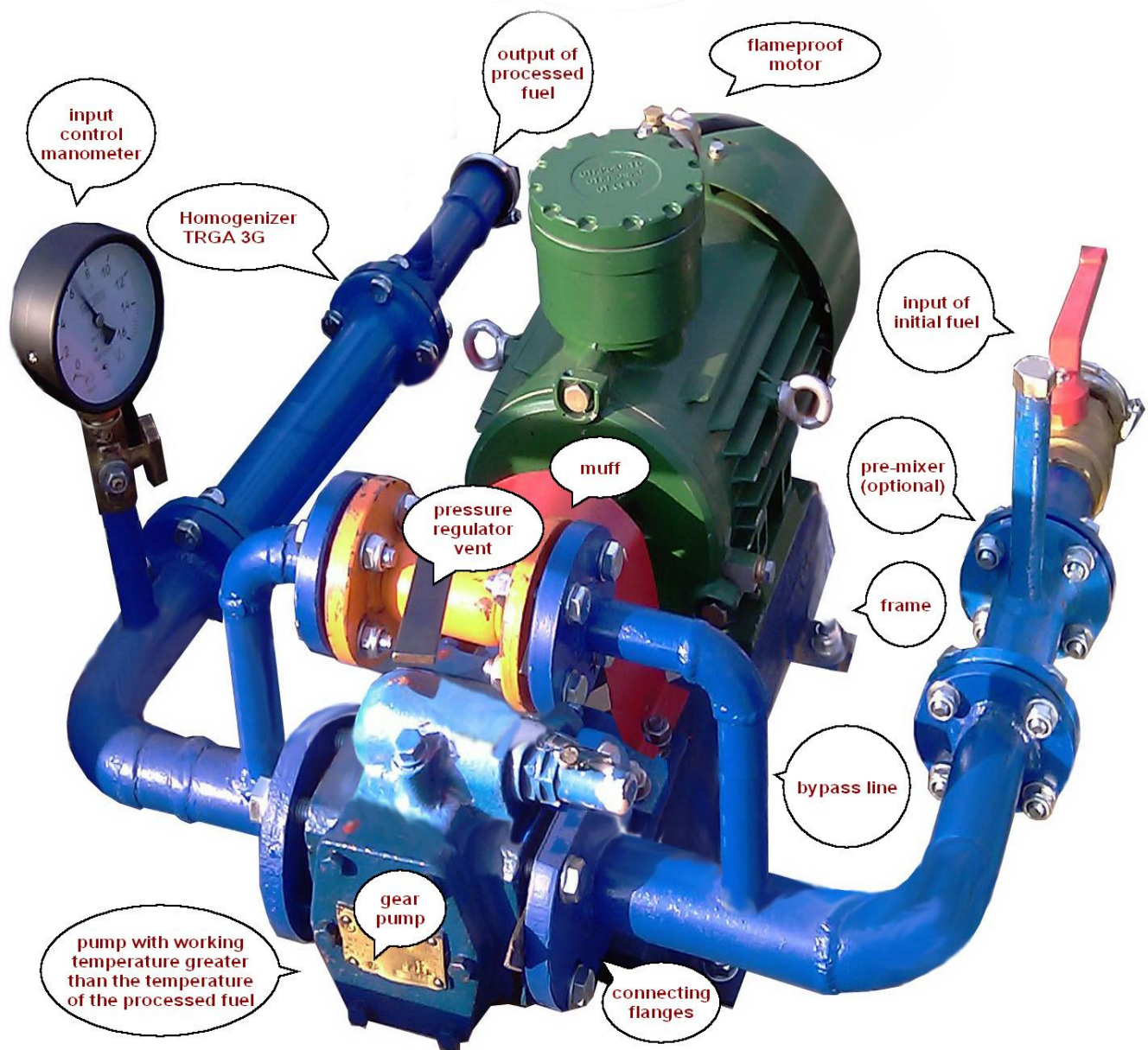
This diagram provides the maximal quality of the medium treatment.

- in such a case the device is actuated after the gear pump, considering the treated fluid flow direction;
- the device can be used both for the fuel transmission out of one (initial) tank into another (final) tank, and for recirculation (at transmission within the same tank).

At recirculation (out of the storage tank) the intake pipe shall be placed close to the tank bottom, and the outlet pipe shall be placed a little bit lower than the fuel level in the tank; it is desirable that the outlet jet is in parallel to the bottom.

The treated product shall have the less density; that is why the treated product shall accumulate in the upper layers in order to avoid any repeated treatment.

For oil fuel treatment (as well as other viscous medium) the double treatment of the product is the most efficient.

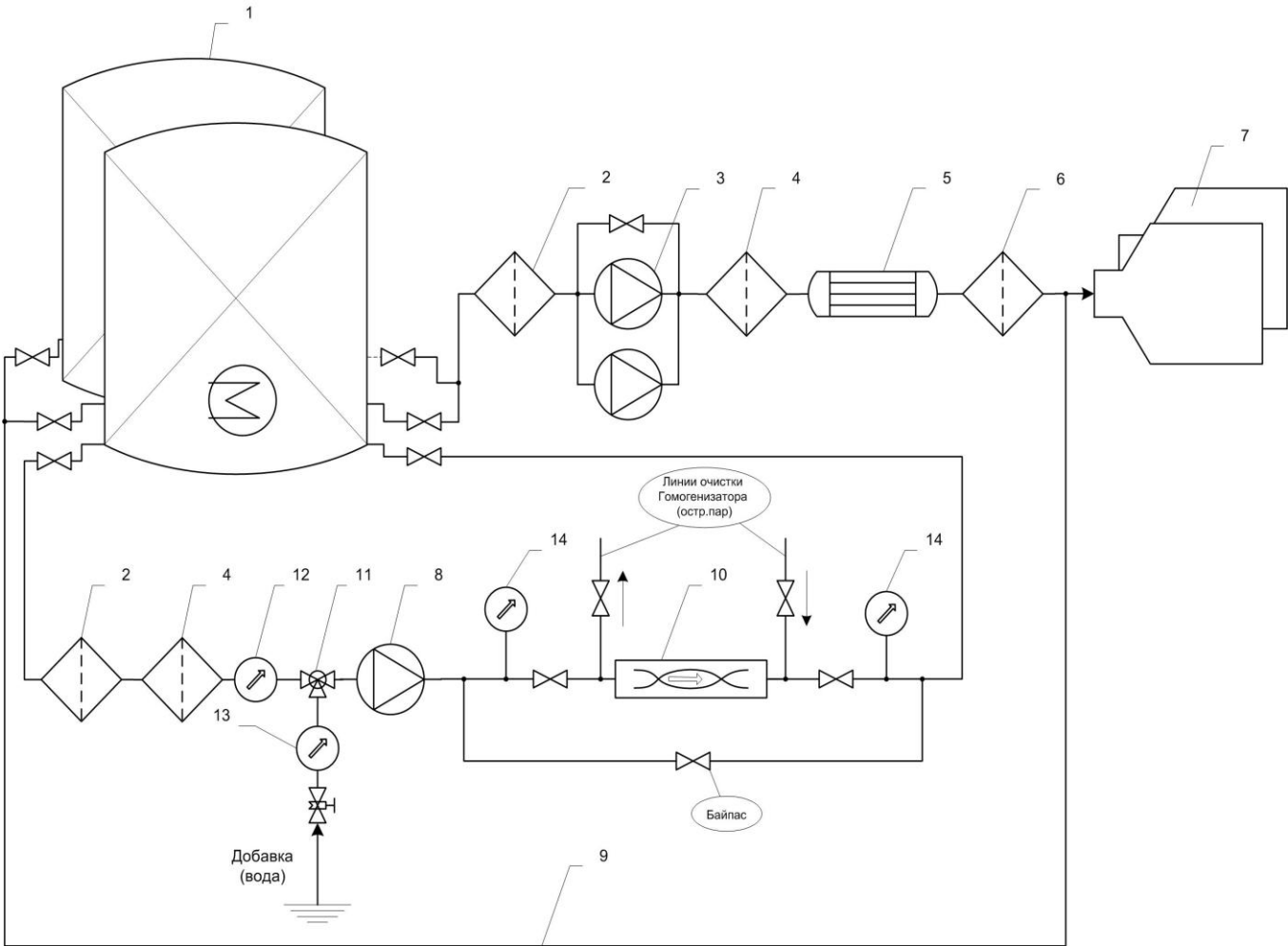


**The demixing period depends from :**

- the pressure supplied by the gear pump (the higher pressure – the higher quality of treatment, no more demixing occurs);
- the environment temperature (the higher temperature – the faster the product returns into the initial state);
- initial product kind and composition (water contents in the fuel oil, density...).

# Schematic diagram of the processing of fuel storage tanks

Схема установки гомогенизатора в линию рециркуляции мазута



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3	Насос подачи мазута на котел	10	Гомогенизатор топлива TRGA
4	Фильтр тонкой очистки	11	Смеситель
5	Пароподогреватель мазута	12	Расходомер мазута
6	Щелевой фильтр (при наличии)	13	Расходомер подачи подтоварной воды
7	Котлы	14	Манометры

All schemes illustrative and to be corrected in each case.



