**What are the similarities between the homogenizer TRGA
and the bullet (caliber 9 mm.) from a Makarov gun?**

Here is the installation at the boiler **www.afuelsystems.com/ru/trga/s155.html**
www.afuelsystems.com/ru/trga/s163.html

TRGA **inlet T=102** deg. Celsius, TRGA **outlet T=109** deg. Celsius, Q = **6 m. cub**. of heavy black oil

T outlet	T inside-2	T inside-1 (max)	T inlet
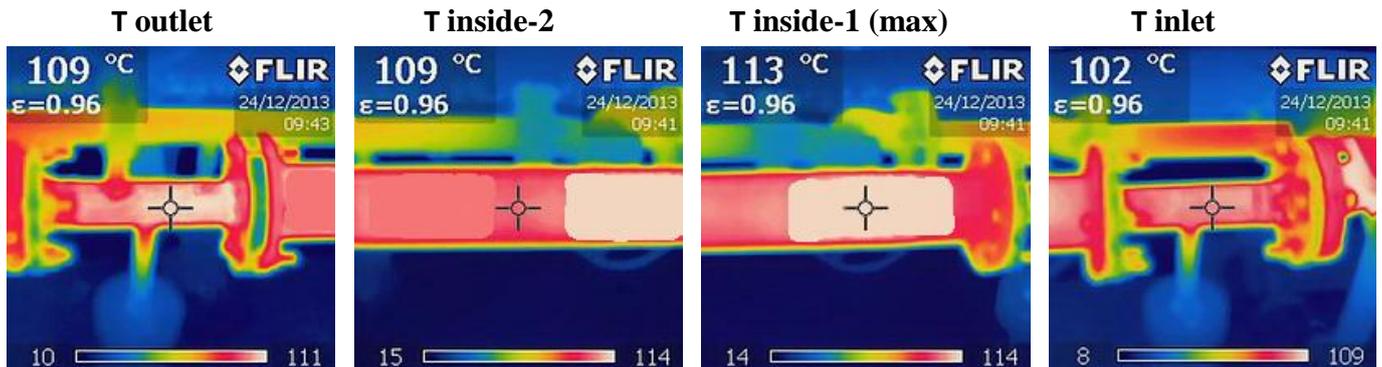
Question 1 - **how much energy is it necessary**, **for heating black oil that flows** through the homogenizer
TRGA in quantity of **6 cubic meters per hour**? (Pressure pump - 6.3 cubic meters, max pressure 25 bar,
working pressure at this moment = 12 bar, **pressure drop 2.3 bar**).
(In this version of the document use retouching some zone of our device. Everything else - no change)

1. Consider **specific heat (Ct)** of fuel oil for T = 102 deg. Celsius

    Ct= 1738 + 2,5*T , Joule/kg*/C = 1738+2.5*102= 1993 Joule/kg*/C

2. **M (6 m. cub. Black oil) = 5 400 kg.**

3. **Formula for calculating energy**

    W*t*3600*1000 = M*Ct*dT

W - power, kW (kilowatt = 1000 watts = 1000 J / s)
t- time in hours (h = 3600 s)
M - mass in kg = 5400 kg
Ct - heat   = 1993 J / kg / deg
dT - heating medium degrees.

Calculate the necessary energy for heating **6 cubic meters** black oil by
1 degree **from** an initial temperature of **102** degrees (dT=1) , in the flow per 1 hour.

W= (M * Ct * dT)   / (t * 3600 * 1000)   or
W= (**5400** * **1993** * 1) / (1 * **3600** * 1000) = **2.989 kW**.

a) **If   Dt (inlet – outlet)** = 109-102 = **7** C degrees, **(total heating)**
so for heating in the flow 6 cubic meters of black oil up to 7 degrees, **required energy is 20.926 kW**

 b) **If   Dt (inlet – inside max)** = 113-102 = **11** C degrees, **(maximum local heating inside)**
so for heating in the flow 6 cubic meters of black oil up to11 degrees, **required energy is 32.879 kW**

c) **If   Dt (inside max – inside min)** = 113-109 = **4** C degrees, **(power dissipation inside the body)**
so with energy dissipation releases **11.956 kW of energy.**

Note 1 - **TRGA - passive device** that works on the energy flow, which provides a pressure pump.
In classical physics - there is no other energy ...

Pressure pump can not consume more energy which is determined by its passport. Increase in energy consumption from the network can cause overheating and emergency stop pump by its thermal protection system. If the pump is in tandem with TRGA running more than a few hours, this means that its power consumption is not more valid passport.

Pressure pump - 6.3 cubic meters, max pressure 25 bar, working pressure at this moment = 12 bar, **pressure drop 2.3 bar,** power of electric motor is 7.5 kW. (type NMSH 8-25-6.3/25-5)

Question 2 - where is the source of energy that we can see in a TRGA homogenizer and that heats fuel black oil the flow?

Please - if you see an error in the formulas, calculations or logic reasoning please inform me or report it to the author. I will be extremely grateful for all your thoughts concerning this document. Andrew Ruban.

- Flow area in body where the energy dissipates a maximally is 45 mm, ie spase is **1589** sq. mm.

If power dissipation inside the body = 11.956 kW, or 7.52 W on 1 sq. mm.
If the **bullet diameter of the [Makarov pistol] is 9 mm**., so bullet spase is 63.58 mm m.
Thus power dissipation inside homogenizer TRGA on the square of equal area [Makarov pistol] bullet caliber 9 millimeters = **478 Joules**.

Reference - **Energy shot** from the **Makarov** first releases patron - is **300 joules**.
Energy shots from the **Makarov** enhanced patron (which was developed by order of the KGB USSR and was punched bulletproof vest) – is **485-505 joules.**

Photo from thermal imager were provided by our customers [PAO "Esksimnefteprodukt",] Odessa, Ukarina, where in December 2013 was installed homogenizer TRGA-3G-05 in the fuel supply line to the boiler.

Conclusion.
1. Series devices TRGA work long and [reliable]. (installed on September 10, 2009,
photo received on 23 November 2010, on January 1, 2014 - both devices continue to work).
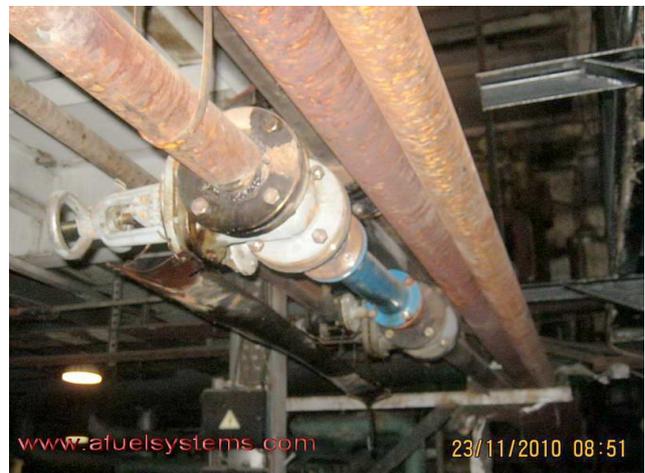
2. We can not explain the source of energy used by TRGA homogenizer for crushing asphaltene and particles in heavy fuels. If you find an error in our calculations - please inform.

3. **But this huge energy spent on the destruction of solid particles in the fuel**, and as a result - an increase in fluidity, reduced freezing point and complete combustion of all the particles in the fuel.

The sample **- original fuel - laboratory filter is completely clogged fuel residues.**
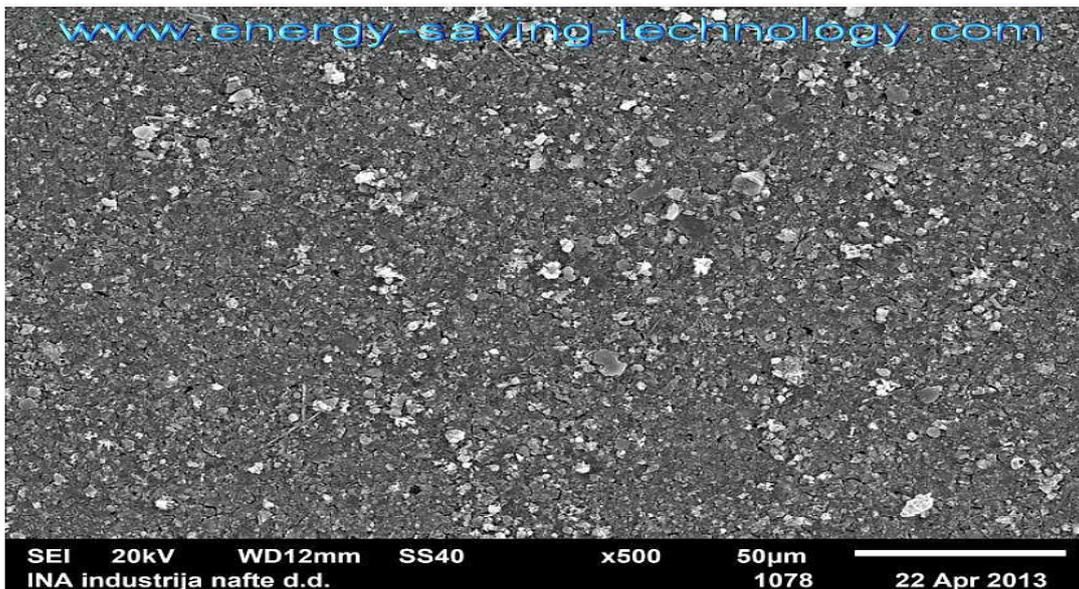
Slika 3.   SEM mikrofotografija uzorka "0" , povećanje 500x

Sample - **processing fuel Laboratory filter is clean - visible filter structure and only a few bits ...**
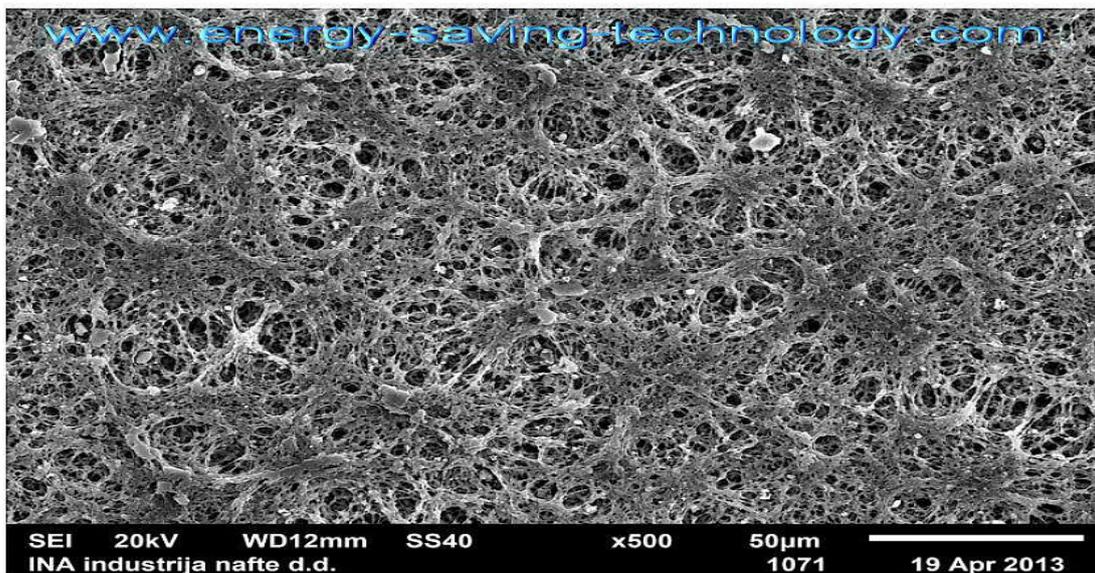
Slika 5.   SEM mikrofotografija uzorka "5" , povećanje 500x

The **oficial report** laboratory INA, Zagreb, Croatia changes in the ship's fuel before and after treatment.
PSSF technology presentation.