

# BRONYA

**SUPERFINE HEAT INSULATION**

Applied as a paint -  
acts as a heat barrier



Examples of application and description  
of the tasks to be solved and the result obtained  
by the use of coatings "Bronya" at the facilities  
of oil refining, industrial and processing complexes

The main advantage of the use of coatings "Bronya" from the well-known traditional insulation and Russian and foreign analogues – is a high economic difference in comparison of the total estimated cost (material + work), which depends on the type of object and the type of task of thermal insulation, the difference can be from 20% (pipelines, equipment, valves) to 150% (tanks), and this without taking into account service life (10 years) and weather resistance, maintainability, vandal resistance.

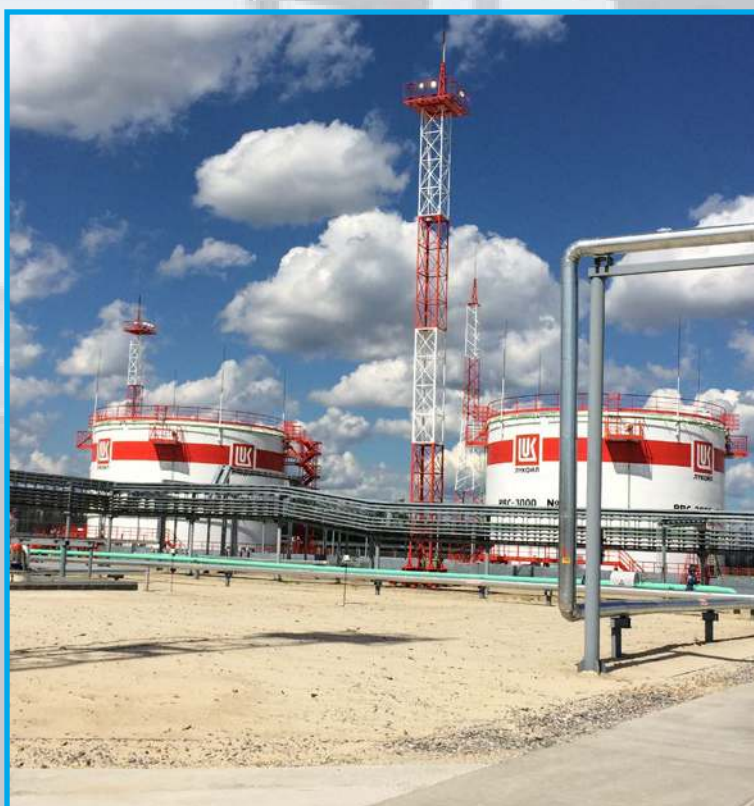
## 1. At thermal insulation of tanks, two problems are solved:

- **in the winter** – the maintenance of the required temperature of the oil, reducing the cooling time, reduce the cost of heating.
- **in the summer** - reducing the evaporation of petroleum products when heated by solar radiation, ultraviolet rays. Unlike traditional heaters, which in their thermal properties pass solar radiation, thermal insulation coating "Bronya" protects the tanks, reflecting solar radiation due to radiant component.

■ a) Open Society LUKOIL, Variegan oil and gas field, Tyumen region. Isolation of oil tanks.

The thickness of the coating "Bronya Winter" 2 mm. Work was done by airless spraying. Consumption 2.8 l per 1 sq. m. the Volume of two tanks of 20 000 m<sup>3</sup> each, technological equipment with an area of 500 m<sup>2</sup>.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.



■ b) EuroChem-North-West JSC, Kingisepp, Leningrad region.

Application was made on two fuel oil tanks of new production which have heating of fuel oil. On matte epoxy anti-corrosion soil is applied in two layers of a total of 1 mm. material Consumption was 1.4 liters per 1 m<sup>2</sup>. The total area of 7500 m<sup>2</sup> of each tank.

**Solved problems:** reduced energy costs for heating fuel oil.



■ c) JSC "Tamanneftegaz", Krasnodar region. Oil tank.

Coating " Bronya Classic" layer thickness of 1.5 mm is applied to the outer walls of 2 tanks with a volume of 40 000 m<sup>3</sup> each, for storage of petroleum products (gasoline). Tanks consist of two walls of the main and protective, the outer wall is not sealed, insulation is applied to the main wall.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.



■ d) CHP-26 JSC "Mosenergo»,  
Moscow.

The technical Council of JSC "Mosenergo" Nopz-17 from 18.04.2014, according to the results of a comparative analysis of five thermal insulation materials, it was decided to use liquid insulation "Bronya" on the project "Application of heat-saving coating on fuel oil tanks No1-4 CHP-26".



Project documentation was prepared by the project organization "Lipetsk GIPROMEZ". A tender was held for the supply of ultra-thin insulation "Bronya" according to the Federal law No223-FZ.

**Coating:** "Bronya Antirust" 1 mm thick, "Bronya Classic" 2 mm. Total volume 75 000 m<sup>3</sup>. Airless application of Graco Mark V.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.



■ e) Yaroslavl refinery, Yaroslavl. Fuel oil storage tanks.

The coating "Bronya Classic" thickness of 2 mm. the Application was made with a brush with interlayer drying 24 hours. Consumption of 2.2 liters per 1 m<sup>2</sup>. A volume of 450 m<sup>3</sup>.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.

■ f) Nikolaevsk storage depot, JSC "Aktiv Grupp", Rostov oblast.

Thermal insulation of tanks with a volume of 500 m<sup>3</sup>. Earlier, this facility has already carried out work on thermal insulation with the use of Liquid thermal insulation "Bronya", then 4 tanks were covered and customers were satisfied with the result, so in 2017 2 more tanks were covered with thermal Insulation "Bronya Universal NF". The work was carried out by the apparatus of airless application Graco Mark M.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.



■ g) Open Society "LUKOIL" in the Volgograd storage unit.

Heat insulation "Bronya Classic" with a thickness of 1.5 mm. the Work was carried out by airless application apparatus Graco Mark V. the Volume of the tank is 35 000 m<sup>3</sup>.

**Solved problems:** in the summer, decreased heating of petroleum products and evaporation, respectively; in winter, lower costs of energy for heating the petroleum products.



## ■ h) Diesel fuel storage Tanks, Kazakhstan.

The coating "Antikor" thickness of 1 mm, "Bronya Classic" thickness of 1.5 mm. the Work was carried out by airless application Graco Mark V. the Volume of tanks of 350 m<sup>2</sup>.

Solved problems: in winter – prevention of cooling of diesel fuel below the permissible temperature.



## ■ i) Refinery, Zhanaozen, Kazakhstan.

A temporary storage facility.

Applied thermal insulation "Bronya ANTIRUST" with a thickness of 1mm, "Bronya Classic" 1.5 mm thick. the Work was carried out by airless application Graco Mark V. the Volume of containers 1 500 m<sup>3</sup>.

Solved problems: in summer – reduced heating of petroleum products and, accordingly, evaporation; in winter – prevention of cooling of diesel fuel below the permissible temperature.

## ■ j) Asphalt Plant "ProMix", China.

Thermal insulation of a two-ton asphalt mixing plant with an electric heater and a 10-meter tank with a diameter of 2.5 m. The coating "Bronya Antirust" with a thickness of 0.5 mm and "Bronya Classic" with a thickness of 3.5 mm was applied. For testing in the tank, water was filled with a temperature of 90°C, after 24 hours, the temperature in the tanks decreased to 65°C. This suited the customer and a decision was made on the mass application of thermal insulation "Bronya" at all facilities of the enterprise.

**Solved problems:** prevention of asphalt cooling below the permissible temperature.



## 2. Thermal insulation of tanks, tanks in order to prevent freezing of liquids, oil products in winter and evaporation liquids in summer time.

■ a) The tank farm of Almerac.  
The task is to prevent freezing of water in fire-fighting tanks.

Thermal calculation was performed by specialists of the engineering Department of Bronya. According it a layer with a total thickness of 1.2 mm of the "Bronya Classic" modification was applied to the tank. The application was carried out by the Graco airless spray apparatus, interlayer drying was 24 hours.



**Solved problems:** water does not freeze in tanks at low temperatures, reduced the cost of maintaining the temperature above 0 degrees.

■ b) Wood processing Plant.  
Fire tanks, Volgodonsk, Rostov region.

Applied coating "Bronya Antirust" 1 mm thick directly on the rusty surface. The application was carried out by the Graco airless spray apparatus, interlayer drying was 24 hours. The volume of containers is 30 000 m<sup>3</sup>.

**Solved problems:** water does not freeze in tanks at low temperatures, reduced the cost of maintaining the temperature above 0 degrees.



## ■ c) Novorossiysk. Fire tanks.

Coating "Bronya Facade" with a total thickness of 3 mm. the Application was carried out by the Graco airless spray apparatus, interlayer drying was 24 hours. Since the container is made of composite material, the application was carried out by thick technological layers of 1 mm. the Volume of containers of 5 000 m3.



**Solved problems:** water does not freeze in tanks at low temperatures, reduced the cost of maintaining the temperature above 0 degrees.

3. Reducing the surface temperature of pipelines, steam lines, valves and process equipment to the standard (according to SNiP), preventing burns to personnel.

## ■ a), Open Society "GAZPROM ENERGY", ABK shop ViK.

Hot water pipes and steam lines. The thickness of the coating "Bronya Classic" 2 mm. Consumption of 2 liters per 1 sq. m. Volume of 2,000 liters.

**Solved problems:** surface temperature reduction: surface temperature before application + 150°C; after application + 45°C.





■ b) Gas processing plant of LLC "Gazprom добыча Astrakhan", Astrakhan.  
Coating "Bronya Classic", thickness of 2.5 mm, on the camera reboiler unit on the installation.  
Brush application with drying in 24 hours. According to the results of the application, a technical report with confirmation of the thermal conductivity coefficient of 0.001 was prepared.

**Solved problems:** surface temperature reduction: surface temperature before application + 150°C; after application + 45°C.

  
ООО «ГАЗПРОМ»

**ОБЩЕСТВО С ОГРАНИЧЕННОЙ  
ОТВЕТСТВЕННОСТЬЮ  
«ГАЗПРОМ ДОБЫЧА АСТРАХАНЬ»**  
(ООО «Газпром добыча Астрахань»)  
АСТРАХАНСКИЙ  
ГАЗОПЕРЕРАБАТЫВАЮЩИЙ ЗАВОД

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*О жидких керамических покрытиях серии БРОНЯ*

**Уважаемый Ринат Равильевич!**

В Октябре 2014 года было произведено тестовое нанесение теплоизоляционного покрытия «Броня Классик» на основе полых микросфер выпускаемое по ТУ 2216-006-09560516-2013 на камеру ребойлера аппарата E03A на установке ЗУ-272 Астраханского газоперерабатывающего завода ООО «Газпром добыча Астрахань».

Покрытие зарекомендовало себя с положительной стороны. Изменений свойств материала, повышенной температуры на поверхности, отслоений покрытия нет. Слой теплоизоляционного покрытия «Броня» толщиной в 2,5 мм снизил на поверхности камеры ребойлера температуру со 150°C до 45°C.

Покрытие «Броня» возможно к применению на технологическом оборудовании и трубопроводах, используемых без пароспутников.

Заместитель директора  
по капитальному ремонту  
и капитальному строительству

  
**И.В. Трегубов**

*А.В. Бородаев  
2-44-15*

Недостатками применения минеральной ваты является увеличение площади теплопотери, что негативно сказывается на теплоизоляционных свойствах, а так же сложность монтажа и не долговечность.

**Выводы.**  
В ходе испытаний было установлено, что коэффициент теплопроводности ЖКТМ Броня «Классик» равен 0,0012 Вт/м<sup>2</sup>С, что соответствует заявленным по ТУ 2216-006-09560516-2013 0,001=0,0002.

**Сопоставление фактических характеристик ЖКТМ Броня «Классик», с заявленными характеристиками заводом изготовителем:**

Согласно заявленным изготовителем характеристикам, покрытие должно быть белым равномерным, без отслоений, выдерживать температуру до 200 °С без разрушения и пожелтения.

В ходе проведения испытаний по нанесению ЖКТМ Броня «Классик» на элементы установки ЗУ-272 Астраханского газоперерабатывающего завода ООО «Газпром добыча Астрахань» было установлено следующее:


В точках замера покрытие равномерное.  
Отслоений нет.

Материал не разрушен при воздействии высоких температур, а также влияния атмосферных осадков.

Средний коэффициент теплопроводности, выявленный в ходе эксперимента составил 0,0012 Вт/м<sup>2</sup>С.

**Рекомендации по применению Жидких керамических покрытий серии БРОНЯ:**

С октября 2014 года покрытие зарекомендовало себя с положительной стороны. Изменений свойств материала, повышенной температуры на поверхности, отслоений покрытия нет. Рекомендуем к применению покрытие на технологическом оборудовании и трубопроводах используемых без пароспутников.

Временно исполняющий обязанности  
заместителя директора по КР и КС АГПЗ :  Горбачев В. В.

**ВРИО ЗАМ ДИРЕКТОРА АГПЗ  
ПО КР И КС ГОРБАЧЕВ В. В.  
ПР-382364 ОТ 28.07.15**



■ c) Oil refinery, China.

Fuel oil heating furnace. "Bronya Classic" layer thickness of 1 mm, the application was made manually in 2 layers. As a result, the temperature of the furnace surface was reduced from 80°C to tactile weakly warm, a significant increase in the efficiency of heating oil products to the required temperature was recorded, as well as a decrease in the air temperature in the shop to a comfortable for maintenance personnel. The capacity of 3000 liters.

**Solved problems:** reduction of surface temperature: the surface temperature prior to the application of + 80°C; after the application of + 32°C, lowering the temperature of the air inside the room up to +28°C.



- d) Close corporation "TAMANNEFTEGAS", Krasnodar Krai. The Park of oil and oil products.

Thermal insulation "Bronya" is applied to steel valves of the steam line.

To reduce the temperature of the surface of steel valves in steam lines on the viaduct draining the oil, reduce heat loss and prevent burns to personnel from accidental contact with the maintenance works applied Insulation "Bronya Classic" a layer thickness of about 1 mm and the surface temperature of the valves before the occurrence of the material ranged from +160 to +200°C. Thermal insulation Bronya was applied in thin layers, in consistency, "milk", i.e. highly diluted with distilled water in layers.

**Solved problems:** reduction of surface temperature: the surface temperature prior to the application of + 200°C; after the application of + 48°C.



■ e) "NUTRICIA – DANONE", Istra, Moscow region.

The application of thermal insulation of the "Bronya" on the pipes hot, cold-water, heating, steam piping, ventilation ducts with the aim of reducing surface temperature, reducing the temperature indoors. Coating with a total thickness of 2 mm. brush Application.

**Solved problems:** reduction of surface temperature: surface temperature before application + 150°C; after application + 39°C, reduction of indoor air temperature to +28°C.



■ f) Novouralsk nuclear power plant, Sverdlovsk region.

Reducing the surface temperature of steel valves. Coating "Bronya Classic" with a thickness of 2 mm.

**Solved problems:** surface temperature reduction: surface temperature before application + 150°C; after application + 45°C



■ g) Oil pipeline in China.

Coating - insulation "Bronya Antirust" with a thickness of 0.5 mm and insulation "Bronya Classic" thick technological layer of 1.5 mm. the layer of insulation has shown excellent result, which was a pleasant surprise to our Chinese customers. There are dozens of such boilers on this oil pipeline, and this particular company has a total of thousands. The volume of the boiler is 7 000 m<sup>3</sup>.

**Solved problems:** surface temperature reduction: surface temperature before application + 115°C; after +50°C (at air temperature +38°C).



■ h) Oktyabrsk. The pipeline.

To reduce energy losses applied Insulation "Bronya Antirust" with a thickness of 1 mm and "Bronya Universal" thickness of 1.5 mm. Work was done by hand-made regular paint brush.

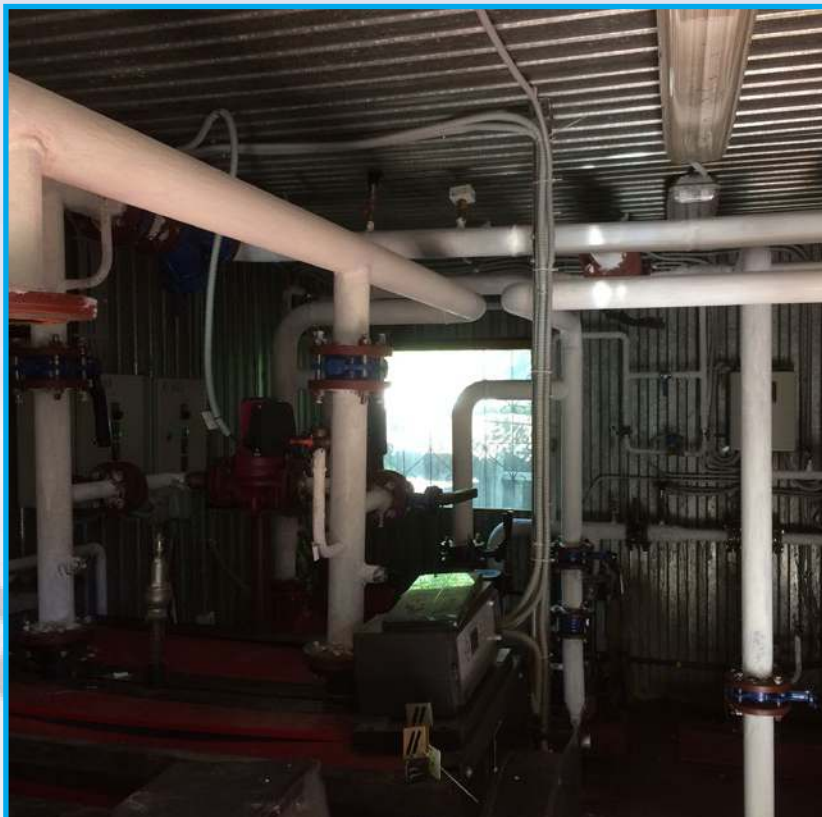
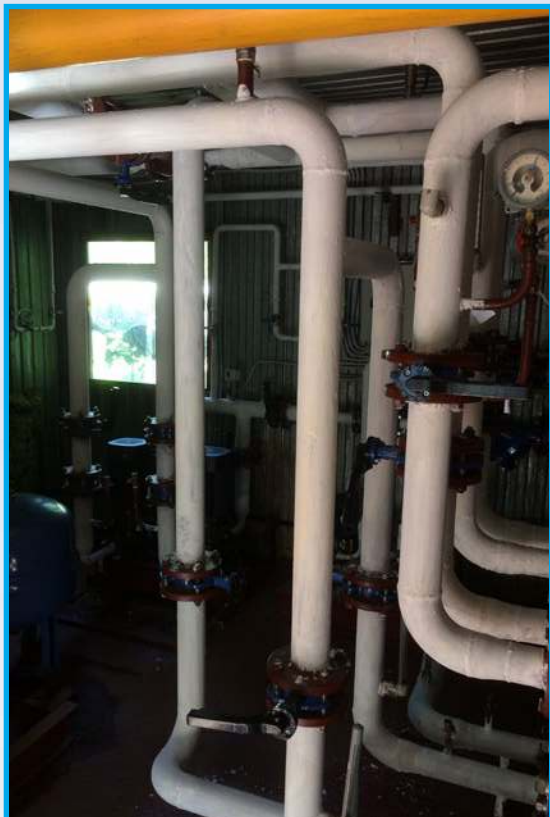
**Solved problems:** reducing heat loss, reducing surface temperature: surface temperature before application + 150°C; after +50°C.



■ i) Oktyabrsk, Samara region.

To ensure the thermal insulation of the pipeline, modifications were applied to the thermal insulation "Bronya Antirust" and "Bronya Universal" layer thickness of 2 mm. the Work on the application was carried out manually with a conventional paint brush with the addition of color according to customer requirements.

**Solved problems:** reducing heat loss, reducing surface temperature: surface temperature before application + 140°C; after +45°C.



■ j) Cherepovets, Thermal insulation of the hot water pipeline in the boiler room.

For implementation of thermal insulation the modification "Bronya Standard NF" layer thickness of 1 - 1,5 mm is applied, works were made manually. Consumption 1,5 l/1 m.

**Solved problems:** surface temperature reduction: surface temperature before application + 100°C; after +35°C.



■ k) Volgograd.

For the thermal insulation of the thermal point and the main pipeline, the "Bronya Standard" modification was applied with a layer thickness of 1.5-2 mm, the inter-layer drying time was 24 hours.

**Solved problems:** surface temperature reduction: surface temperature before application + 100°C; after +35°C.



■ l) JSC "MOSGAZ", Moscow.

For thermal insulation of the pipeline of Autonomous boiler production base modifications "Bronya Antirust" thickness of a layer of 0,5 mm, and Bronya Classic" in 2 layers in thickness of 1 mm with kolerovka of the last are put. The inter-layer drying time was 24 hours after each layer.

**Solved problems:** surface temperature reduction: surface temperature before application + 150°C; after +45°C.



■ m) Company "Forte Prom", Volgograd.

For the insulation of the equipment used modification "Bronya Classic NF" (completely non-combustible modification) layer thickness 1-1.5 mm, the work on the application of the material was carried out with a brush.

**Solved problems:** surface temperature reduction: surface temperature before application +150°C; after +45°C.



#### 4. Reduce the heat loss of piping, equipment, parts, being on the street.

■ a), JSC "Gazpromneft-NNG", Sporishevskoe and Medium-Iturskoe field, in the Tyumen region. Nodes and pipes of the pipeline.

For thermal insulation modification "Bronya Winter" layer thickness of 2.5 mm, the application was carried out at a negative temperature by conventional paint brushes. The volume of 1 300 litres.

**Solved problems:** reduction of heat loss.





■ b) JSC LUKOIL, Variegan oil and gas field, Tyumen region.  
Reduction of heat losses of equipment and oil pipeline. On the pre-prepared and primed surface heat Insulation "Bronya Winter" layer thickness of 1.5-2 mm. Method of application – brush.  
Volume of 10 000 liters.

**Solved problems:** reduction of heat loss.




■ c) PJSC ALROSA, the main pulp mill of the concentrator, the Republic of Sakha (Yakutia).  
The application of "Bronya Winter" at a temperature of  $-50^{\circ}\text{C}$ . type of application – with a brush. Coating thickness 2 mm. Volume 5 000 liters.

**Solved problems:** reduction of heat loss.



■ d) JSC "Gazprom NEFT", Moscow.  
Coating "Bronya Classic" 1 mm. brush application. According to the results of the application, a technical report with confirmation of the thermal conductivity coefficient of 0.001 was prepared.

**Solved problems:** reduction of heat loss.



ОТКРЫТОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО  
«ГАЗПРОМНЕФТЬ-МОСКОВСКИЙ НПЗ»  
(ОАО «ГАЗПРОМНЕФТЬ-МНПЗ»)

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21.11.2013 № 325

Технический отчет  
Определение фактических теплоизоляционных свойств Жидкого керамического теплоизоляционного материала Броня «Классик» по результатам проведения испытаний на ОАО «Газпромнефть-МНПЗ»

В соответствии с п.2 Протокола рабочего совещания по испытанию СТИ производства ООО «ГК «НСТ» от 25 октября 2013 г. (Приложение 3) для пилотного испытания жидкого керамического теплоизоляционного материала Броня «Классик» сформирована Программа испытаний (Приложение 4).

В соответствии с п.1 Протокола и п.3.1 Программы для пилотного нанесения жидкого керамического теплоизоляционного материала Броня «Классик» были выбраны участки блока теплообменников установки «Теплоцентр».

В соответствии с п.1 Программы целями испытаний явились:

1. Определение фактических теплоизоляционных и эксплуатационных характеристик Жидкокерамического теплоизоляционного материала, поставляемого ООО «ГК «НСТ» и сопоставления с заявленными характеристиками.
2. Определение возможности применения ЖКTM, поставляемого ООО «ГК «НСТ», на НПЗ ОАО «Газпром нефть».

В соответствии с п.3.2 представители ОАО «Газпромнефть-МНПЗ»:

- обеспечили представителям ООО «ГК «НСТ» доступ на объект;
- организовали возможность безопасного проведения работ на высоте;
- обеспечили на территории ОАО «Газпромнефть – МНПЗ» место для хранения инвентаря и ЖКТ материалов;
- предоставили исполнителям средства защиты обрабатываемых участков от атмосферных осадков в ходе выполнения работ.

В соответствии с п.4.1 представителями ООО «ГК «НСТ» подготовлена поверхность объектов к нанесению ЖКTM.

Работы по нанесению производились в сроки согласно п.7 Программы.

ОАО «ГАЗПРОМНЕФТЬ-МНПЗ»



11.11.2013 проведены контрольные замеры температур поверхности в соответствии с п.5.1, 5.2 тремя способами:

1. Тепловизор Flir i5;
2. Тепловизор Flir i5 с предварительным покрытием поверхности ЖКTM бумажным малярным скотчем;
3. Измеритель точки росы Elcometer 319.

Использование нескольких вариантов измерений связано с радиопрозрачностью ЖКTM (по информации ООО «ГК «НСТ» (п.5.2 Программы).

Результаты контрольных замеров температур поверхности представлены в Акте приема работ (Приложение 5).

Для подтверждения заявленных характеристик ЖКTM Броня «Классик» по результатам испытаний рассчитан коэффициент теплопроводности и проведено его сравнение с заявленной производителем величиной 0,001 Вт/м·°С.

Результаты расчетов коэффициента теплопроводности ЖКTM по трем вариантам замеров температур представлены в таблице 1.

В ходе проведения испытаний по нанесению ЖКTM Броня «Классик», на элементы теплообменника № 7 установки Теплоцентр ОАО «Газпромнефть-МНПЗ» (Приложение 4), было установлено следующее:

В точках замера покрытие равномерное;  
Отслоений на дату осмотра нет;  
Материал не разрушен при воздействии температур до 165°С.  
Средний коэффициент теплопроводности ЖКTM Броня «Классик», выявленный в ходе эксперимента, составил:

$\lambda = 0,0040 \text{ Вт/м} \cdot \text{°С}$  (Тепловизор Flir i5+скотч);  
 $\lambda = 0,0054 \text{ Вт/м} \cdot \text{°С}$  (Тепловизор Flir i5);

Данные результаты связаны с радиопрозрачностью ЖКTM и не могут быть использованы для анализа. Подробнее о данном эффекте можно ознакомиться в Приложении 1.

$\lambda = 0,0013 \text{ Вт/м} \cdot \text{°С}$  (Elcometer 319).

Выводы

1. Коэффициент теплопроводности ЖКTM Броня «Классик», рассчитанный на основании данных, полученных в результате испытаний при использовании показаний прибора Elcometer 319, в среднем составил 0,0013 Вт/м·°С. Отклонение от заявленной величины в 0,001 Вт/м·°С составляет 30%, что, с учетом погрешности метода испытания и измерений, является допустимым. Таким образом, заявленные теплотехнические характеристики материала подтверждены.

Исполнительный директор – руководитель проекта по преобразованию и операционным улучшениям

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■ e) Astrakhan.

Thermal insulation of the pipeline from chillers to fan coils of the air conditioning system. To isolate the pipeline, two modifications of the ultra-Thin thermal insulation "Bronya" were used: "Bronya Antirust" 0.5 mm thick and "Bronya Classic" with a total thickness of 1 mm. the Work was carried out by the Graco Mark V airless spraying apparatus. The Application of thermal insulation made it possible to save up to 20% of electricity monthly.

**Solved problems:** reducing surface heating in summer and, as a result, reducing the cost of air conditioning systems.



■ f) Edelweiss Plant, Lipetsk region.

The goal is to eliminate the condensate on the pipes with negative temperature energy carrier with the use of "Bronya Anticondensate" in the production of mineral water "Edelweis" in the Lipetsk region. To eliminate condensation and prevent his further education applied thermal Insulation "Bronya Anticondensate" with a thickness of 4-5 mm. To similar objects "Bronya Anticondensate" is the absolute panacea, as it enables to repair-insulating work without stopping the main production process of the enterprise and directly into wet due to the condensation surface.

**Solved problems:** elimination of condensation on pipes with continued operation of the equipment.



**5. Insulation of household, production, industrial hangars, containers to ensure the desired temperature, preventing the formation of condensation, reduce the cost of heating and air conditioning.**

■ a) Gellert Plant, Astrakhan.

For thermal insulation of walls of the hangar and applied insulation "Bronya Universal" layer thickness of 2 mm, the work was carried out by airless spray apparatus Graco Mark V.

**Solved problems:** ensuring the required temperature in the room, reducing heat loss, reducing heating costs, preventing condensation.



■ b) Tetra Pak, Lobnya, Moscow region.

The task is to eliminate condensate. Over the entire interior surface of walls and ceiling condensation on the surface of the roofing sheet at low temperatures, and then turned to ice. When warming, the ice melted, the water flowed to the floor and froze again, which greatly hindered the movement of forklifts and workers on the territory of the warehouse.



From the end of December 2017 to the beginning of February 2018, the "Bronya Nord" was applied with the help of an airless Graco device. After the work on the application of the material "Bronya Nord" with a total thickness of 3 mm, the problem was completely solved.

**Solved problems:** ensuring the required temperature in the room, reducing heat loss, reducing heating costs, preventing condensation.



■ c) Quail poultry farm, village Shepilova, Moscow oblast. Thermal insulation 40-foot containers for compact modules. To increase the thermal resistance of the metal container according to the technology patented by LLC NPO Bronya, insulation with use of thermal Insulation "Bronya Antirust" and "Bronya Classic" with a total thickness of 1.5 mm was made. The work was carried out by the Graco airless spraying apparatus for 3 layers. In addition to high thermal efficiency and no release of harmful substances, Bronya coating has an important advantage implemented on such objects - resistance to ammonia-alkaline environments.

**Solved problems:** ensuring the required temperature in the room, reducing heat loss, reducing heating costs in the winter, reducing the cost of air conditioning in the summer, preventing condensation.



## ■ d) Modular buildings, Rostov region.

Room for staff on the basis of a modular building of 40-foot containers. To increase the thermal resistance of the walls and create a comfortable indoor climate, the thermal Insulation "Bronya Universal NF" with a layer thickness of 1 mm was used, the work was carried out by the Graco Mark V airless spraying apparatus, a water-emulsion paint coated in dark gray on top of the thermal insulation was applied at the customer's request.

**Solved problems:** ensuring the required temperature in the room, reducing heat loss, reducing heating costs, preventing condensation.



## ■ e) PJSC ALROSA (Yakutia).

For thermal insulation of walls of industrial shop of plant the covering "Bronya Facade" was used. Thickness 2 mm. the Work was carried out by airless spray Graco in 3 layer.

It is important to note that the specialists of PJSC "ALROSA" independently produced energy heaters, with data and indicators that fully confirmed both the high energy-saving performance of thermal Insulation "Bronya" and the manufacturer's declared thermal conductivity coefficient of  $0.001 \text{ W/m}^2$ !

**Solved problems:** ensuring the required temperature in the room, reducing heat loss, reducing heating costs, preventing condensation.

