TECH-INN PETROLEUM

Member of Tech-Inn Corporate







Introduction

Iran has 2nd natural gas and 4th Oil resources in the world with an economy based on selling of raw (crude) natural resources and strategic hydrocarbon resources. Hence "Azerbaijan Tech-inn Petroleum Refining industries" is founded for refining of raw hydrocarbon resources to improve manufacturing and export cycle. "Azerbaijan Tech-inn Petroleum Refining industries" is founded in 2013 to play a critical role in middle stream of the oil & refining industries and its first unit is started to refining of heavy oil derivatives in 2015.





Production Unit

Design & construction of production units based on the latest engineering principles with the knowledge and experience of the international experts.

Quality Control Quality Assurance Unit

Quality control unit and laboratory are equipped by the modern, full automatic and digital equipments and all controls and experiments are done according to the 946M/ASTM D-70 & 946 AASTHO M20 standards.

Barrel Filling Unit:

Standard and qualified new drums are filled in this unit for easy shipment to international markets.

Loading Unit:

Weighting and loading of the bulk product is performed by the 6th. generation of digital weighbridges by considering safety and environmental procedures.

Standards

ISO 9001 Iranian National Standard





In order to provide more services and facilitating the foreign and domestic transshipments "Azerbaijan Tech-inn Petroleum Ref. Ind." is covering following delivery terms according to Incoterms 2023.

EXW/ FOB/ CPT/ CFR/ CIF , ...

Sales & Marketing

"Azerbaijan Tech-inn Petroleum Ref. Ind. "is using the latest refining technologies and state of the art systems to control the process and product quality in order to attain the ultimate quality which makes a competitive advantage in the foreign markets.

Domestic Markets

Bitumen is used in road construction companies, asphalt companies, insulation manufacturing companies, etc.



Our main customers and Market targets are: Turkey, Georgia, CIS, China,India, etc.





Products 🔶

Oxidized Bitumen

"Azerbaijan Tech-inn Petroleum Refining industries" has the ability of refining more than 360,000 MT of heavy oil derivatives to produce Fuel Oils, Paraffinic Oils, Bitumen,

Asphaltene and other derivatives according to the international standards and customer demand.

Oxidized bitumen is mainly used for industrial purposes such as roof insulation, flooring, industrial mastics, pipe coating, paints and etc.

Oxidized bitumen is categorized based on softening points and penetration rate. For example: oxidized bitumen 85/40 is a type of bitumen which softening point is 85±5°C and its penetration rate is 40±5 dmm.

Oxidized bitumen is also expected to make up for weight loss under heat. The softening point in oxidized bitumen is much higher than in regular bitumen, causing lower thermal sensitivity. The penetration index (PI) in oxidized bitumen is higher than in road construction bitumen (8>PI>2) because the letter has a gel-like structure due to asphalt accumulation.

Index	Standard	Oxidized Bitumen Grade					
	otandara	75/30	85/25	85/40	95/25	105/35	115/15
Softening Point Temperature (C)	ASTM D36	75±5	85±5	85±5	95±5	105±5	115±5
Penetration at 25°C (dmm)	ASTM D5	30±5	25±5	40±5	25±5	35±5	15±5
Thermal Loss Percentage	ASTM D1754	0.2	0.2	0.2	0.2	0.2	0.5
Solubility in trichloroethylene	ASTM D2042	99.5	99.5	99.5	99.5	99.5	99.5



Penetration Grades

In the past, the penetration index was defined based on the assumption that thermal sensitivity in the bitumen used in road construction was zero. Bitumen is a thermoplastic material, meaning that it becomes pliable or moldable above a specific temperature and returns to a solid state upon cooling. Penetration-grade bitumen is mainly used in road surfacing. Bitumen with lower penetration grade is used in the regions with warm climate while higher penetration grade

is used in colder weather. Penetration rate bitumen is graded based on penetration and softening point tests.

This table describes the physical properties of penetration-grade bitumen based on European standards. Penetration-grade bitumen is mainly used in road construction. During the last two decades of the 20th century, most road construction projects showed inclination for solid bitumen which results in more effective asphalt.

NIOC-Compliant Penetration Grade Bitumen									
Test	Methodology	30-40	40-50	60-70	85-100	100-120			
Density	ASTM D-7	1.01-1.06		1.01-1.06		1.01-1.04			
Penetration Rate at 25°C	ASTM D-5	30-40	40-50	60-70	85-100	100-120			
Softening Point °C	ASTM D-36	55-63		49-56					
Ductility at 25°C (cm) - Min	ASTM D-113	100	100	100	100	100			
Flash Point °C - Min	ASTM D-92	250	250	250	250	250			
Solubility in Disulfide %wt	ASTM D-4	99.5	99.5	99.5	99.5	99.5			
Stain Test	AASHTO -T -102	Negative	Negative	Negative	Negative	Negative			
Weight Loss by Heating %wt-Max	ASTM D-6	0.2	0.2	0.2	0.2	0.2			
Penetration Loss by Heating %-Max	ASTM D-6-D-5	20	20	20	20	20			

6

Viscosity Grade

Bitumen is graded based on absolute viscosity at 60°C or kinematic viscosity at 135°C. The SI physical unit of dynamic viscosity is poise and kinematic viscosity is expressed in Centi Stokes. Pure bitumen has been graded based on AASHTO-M226 and ASTM-D3381 standards. Tables 11- to 16- indicate tests and criteria.

Table 1-1

Technical specifications of pure bitumen based on viscosity at 60°C (AASHTO-M226)

viscosity				Toot			
AR-160	AR-80	AR-40	AR-20	AR-10			
					Viscosity at 60°C		
550	400	275	200	140	Viscosity at 135°C		
20	20	25	40	65	Penetration at 25°C. 100 grams, five seconds		
52	50	45	40		Penetration at 25°C, 100 grams five seconds, minimum		
75	75	75	100*	100**	Ductility at 25°C. 5cm/min		
	Test on Primary Bitumen						
238	232	227	219	205	Flash point, Cleveland open cup		
99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene		

* AASHTO T240 may be used but as a comparing method.

** If the ductility is less than 100 at 25°C, the material will be accepted if its ductility at15.8 °C is more than 100cm at a pull rate of 5cm/min



Table 1-2 🔶 Viscosity Grade

Technical spesifications of pure bitumen on viscosity at 60°C (AASHTO-M226)

Viscosity							
AC-40	AC-30	AC-20	AC-10	AC-5	AC-2.5	lest	
4,000±800	3,000±600	2,000±400	1,000±200	500±100	250±50	Viscosity at 60°C	
400	350	300	250	175	125	Viscosity at 135°C	
40	50	60	80	140	220	Penetration at 25°C, 100 grams five seconds	
232	232	232	219	177	163	Flash point, Celevelant open cup	
99.0	99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene	
Test on the residue of thin bitumen layer							
0.5	0.5	0.5	0.5	1.0	-	Heating loss	
16,000	12,000	8,000	4,000	2,000	1,000	Viscosity at 60°C	
25	40	50	75	100	100	Ductility at 25°C. 5cm/min	
					Stain	Test	
Negative						Naphtha Solvent	
Negative						Naphtha-Xylene Solvent, Xylene Percantage	
Negative						Naphtha-Xylene Solvent, Xylene Percantage	

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Table 1-3 🔶 Viscosity Grade

Technical specifications of pure bitumen based on viscosity at 60°C (AASHTO-M226)

		Viscosity		-	
AR-16,000	AR-8,000	AR-4,000	AR-2,000	AR-1,000	lest
10,000±4,000	8,000±2,000	4,000±1,000	2,000±500	1,000±250	Viscosity at 60°C
550	400	275	200	140	Viscosity at 135°C
20	20	25	40	65	Penetration at 25°C, 100 grams five seconds
52	50	45	40	-	Penetration at 25°C, 100 grams five seconds, minimum
75	75	75	100*	100**	Ductility at 25°C. 5cm/min
238	232	227	219	205	Flash point, Celevelant open cup
99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene

* Thin-film oven test may be used but the rolling thin-film oven test shall be the referee method.

** If ductility is less than 100 at 25°C, material will be accepted if ductility at 15.6°C is 100cm min at a pull rate of 5cm/min.





Table 1-4 🔶 Viscosity Grade

Technical specifications of pure bitumen based on viscosity at 60°C (ASTM-D3381)

		Viscosity				
AC-40	AC-20	AC-10	AC-5	AC-2.5	lest	
4,000±800	2,000±400	10,000±200	500±100	250±50	Viscosity at 60°C	
300	210	150	110	80	Viscosity at 135°C	
20	40	70	120	200	Penetration at 25°C. 100 grams, five seconds	
232	232	219	177	163	Flash point, Cleveland open cup	
99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene	
Test on Residue						
20,000	10,000	5,000	2,500	1,250	viscosity at 60°C	
10	20	50	100	100*	Ductility at 25°C, 5cm/min	

* If ductility is less than 100 at 25°C, material will be accepted if ductility at 15.6°C is 100cm min. at a pull rate of 5cm/min.



Table 1-5 🔶 Viscosity Grade

Technical specifications of sure bitumen based on viscosity at 60°C (ASTM-D3381)

		Viscos	sity					
AC-40	AC-30	AC-20	AC-10	AC-5	AC-2.5	lest		
4,000±800	3,000±600	2,000±400	1,000±200	500±100	250±50	Viscosity at 60°C		
400	350	300	250	175	125	Viscosity at 135°C		
40	50	60	80	140	220	Penetration at 25°C. 100 grams, five seconds		
232	232	232	219	177	163	Flash point, Cleveland open cup		
99.0	99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene		
	Test on the residue of thin bitumen layer							
20,000	15,000	10,000	5,000	2,500	1,250	viscosity at 60°C		
10	20	50	75	100	100*	Ductility at 25°C, 5cm/min		

* If the ductility is less than 100 at 25°C, the material will be accepted if its ductility at 15.8°C is more than 100cm at a pull rate of 5cm/min



Table 1-6 🔶 Viscosity Grade

Technical specifications of pure bitumen based on viscosity at 60°C (ASTM-D3381)

		Viscosity			
AR-16,000	AR-8,000	AR-4,000	AR-2,000	AR-1,000	lest
10,000±4,000	8,000±2,000	4,000±1,000	2,000±500	1,000±250	Viscosity at 60°C
550	400	275	200	140	Viscosity at 135°C
20	20	25	40	65	Penetration at 25°C. 100 grams, five seconds
52	50	45	40	40	Penetration at 25°C. 100 grams, five seconds, minimum
75	75	75	100	100**	Ductility at 25°C. 5cm/min
238	232	227	219	205	Flash point, Cleveland open cup
99.0	99.0	99.0	99.0	99.0	Solubility in trichloroethylene

* Thin-film oven test may be used but the rolling thin-film oven test shall be the referee method.

** If ductility is less than 100 at 25°C, material will be accepted. If ductility at 15.6°C is 100cm/min at a pull rate of 5cm/min.



Performance Grade (PG)

From October 1987 to March 1993, Strategic Highway Research Program (SHRP) was conducted in the United States. The program was focused on the development of new methodes for assessing the performance of bitumen binders. The research resulted in the development of a new method known as Superior Performing Asphalt Pavements (Superpave).

The main specifications of this method included:

Using the efficiency criterion for bitumen binders and asphalt concrete. Considering climatic conditions in application of bitumen.

The problems studied in this method are as <u>follows:</u>

Winter low-temperature bitumen cracking not related to loading.

Bitumen fatigue cracking due to loading Summer high-temperature bitumen deformation due to loading.

The primary objective behind determining the new secifications was to facilitate the purchase of bitumen products of better quality because these specifications will clearly describe the product for potential buyers. The new specifications also guarantee the proper performance of bitumen in coating. Climatic conditions are important factors in the efficiency of coating, but limited research has been conducted on this issue due to limited time and quite similar weather conditions. Moreover, they would not be precise if the loading factor is not taken into consideration. In performance grade the focus is on the mechanical specifications of bitumen while in penetration grade, experimental parameters are involved. In Iran, pen-grade is more common, but in some cases, PG has better be used for a better performance. Today, a PG is defined for polymer modified bitumen and pure bitumen based on environmental conditions and temperature. A wider PG range means higher resistance and more favorable specifications.

Performance Grades Bitumen

High Temperature Performance °C	Low Temperature Performance °C
46 PG	-34,-40,-46
52 PG	-10,-16,-22,-28,-34,-40,-46
58 PG	-10,-16,-22,-28,-34,-40
64 PG	-10,-16,-22,-28,-34,-40
70 PG	-10,-16,-22,-28,-34,-40
76 PG	-10,-16,-22,-28,-34
82 PG	-10,-16,-22,-28,-34



Cutback Bitumen 🚽

Bitumen is "cutback" by adding controlled amounts of petroleum distillates, such as kerosene. Type and quality of Cutback depends on type and amount of solvent in the puere bitumen. The more solvent in Cutback bitumen, leds to the more viscosity in the bitumen. Cutback bitumen is used when there is limited access to heating equipments, bitumen decomposition in high temperature, bitumen cooling throughout working, workers safty, fire and time consuming. This type of bitumen is used in road operations for surfacing and pavement. Medium-Curing (MC) bitumen is achieved from solving pure bitumen into kerosene. Cutback bitumen is classified based in viscosity grade. It is divided into three categories:

Rapid-Curing (RC)

The cutback bitumen is known as rapid-curing (RC) if the bitumen is solved in gasoline. The reason is that evaporation occurs quickly and the bitumen is deposited. RC cutbacks are divided into RC250, RC70, RC800 and RC3000 categories. The numbers indecate the viscosity of bitumen. Naptha could be mixed with bitumen 80/100 for more dilution

Medium-Curing (MC)

MC cutbacks are prepared by solving bitumen in kerosene which evaporates more slowly than gasoline. MC cutbacks are divided into five groups with their viscosity varying from 3,000 to 6,000 at 60 degrees Centigrade. This kind of bitumen may be achieved by solving bitumen 85/100 in Kerosene.

Slow-Curing (SC)

Slow-curing cutback may be achieved from solving bitumen in gasoil or fuel oil or directly from distillation of crude oil. SC cutbacks do not evaporate under normal weather conditions, but they gradually experience changes in their molecular form. This kind of bitumen is achieved from solving bitumen 85/100 in heavy solvent such as Gasoil or Fuel oil which will not only evaporate but also make it hard. Types of this kind of bitumen includes SC 70, SC 250, SC800 and SC 3000

In Britain and most European countries, new standards about bitumen cutbacks have not been renewed while this country is a leading producer and consumer of cutbacks. The reason for non-renewal of standards for cutbacks in England is environmental concerns and growing oil prices which have raised the price of kerosene and gasoline. Meantime, a new generation of environment-friendly emulsions is emerging In Iran, bitumen emulsions have net yet become common, but MC250 is widely produced.



Cutback Bitumen

MC250 Physical Specifications						
Test	Method	MC-250				
Kinematic Viscosity at 60°C	ASTM D-2170	250-500				
Penetration at 25°C, mm/10	ASTM D-5	120-250				
Ductility at 25°C, cm	ASTM D-113	100 min				
Flash Point (TOC). "C	ASTM D-3143	250 min				
Solubility in triclorethylene, %wt	ASTM D-2042	99 min				
Water Content, %wt	ASTM D-95	0/2 max				
Distillation at 225°C, vol%	_	20 max				
Distillation at 260°C, vol%	_	5-55				
Distillation at 316°C, vol%	_	60-90				
Residue from distillation at 360°C, vol%	_	67 min				

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Bitumen Emulsions

Whatever the end use, application conditions usually require bitumen to behave as a mobile liquid. In principle, there are three ways to make highly-viscous bitumen into a low-viscosity liquid: Heat it, Dissolve it in solvents, Emulsify it.

Bitumen emulsions are two-phased systems consisting of bitumen, water, and one or more additives to assist in formation and stabilization and to modify the properties of the emulsion. The bitumen is dispersed throughout the water phase in the form of discrete globules, typically 0.1 to 50 microns in diameter, which are held in suspension by electrostatic charges stabilized by an emulsifier.

Bitumen emulsions can be divided into four classes. The first two are, by far, the most widely used: Cationic emulsions, Anionic emulsions, Non-ionic emulsions, Clay-stabilized emulsions

The terms anionic and cationic stem from the electrical charges on the bitumen globules. This identification system originates from one of the fundamental laws of electricity-like charges repel, unlike charges attract. If an electrical potential is applied between two electrodes immersed in an emulsion containing negatively charged particles of bitumen, they will migrate to the anode. In that case, the emulsion is described as "anionic. Conversely, in a system containing positively charged particles bitumen, they will move to the cathode and the emulsion is described as "cationic". The bitumen particles in a non-ionic emulsion are neutral and, therefore, will not migrate to either pole. These types of emulsion are rarely

Bitumen emulsions are divided into three categories in terms of setting:

Rapid-setting (RS) Medium-setting (MS) Slow-setting (SS)

Cationic RS emulsion is currently the widely used category in Iran. Emulsion setting is irreversible phenomenon which may occur due to the evaporation of the water phase or the attraction of water by stone materials. Throughout this phenomenon, the water phase disappears and bitumen particles will have less space. Then, the bitumen gradually moves towards the surface or coats the aggregate.



Anionic Emulsions

These emulsions, which carry negative chare, are divided into the following categories

Anionic Emulsions							
RS	MS	SS					
RS-1	MS-1	ss-1					
RS-2	MS-2	ss-1h					
HFRS-2	MS-2h						
	HFMS-1						
	HFMS-2						
	HFMS-2h						
	HFMS-2s						

Cationic Emulsions

these emulsions are known as cationic because their bitumen aggregates carry positive charges by using Ammonium salts or Amines compounds. They are divided into the following categories:

Cationic Emulsions							
CSS	CMS	CRS					
CSS-1	CMS-1	CRS-1					
CSS-1h	CMS-2h	CRS-2					

Tips

a. C stands for cationic b. Letters and numbers are the same as explained for anionic emulsions

Tips

a. HF, which stands for high-float, indicates the bitumen coating of aggreates

b. Numbers 1 and 2 show respectively low and the high

percentage of

c. H indicates the use of pure bitumen in emulsiond. S indicates the usability of bitumen for mixingwith sand materials.



Polymer Modified Bitumen Emulsion (PMBE)

Polymer Modified Bitumen Emulsion (PMBE) is used to improve performance at high temperatures. Production of PMBE is difficult and needs more energy than the production of other categories of bitumen. Depending on the desired viscosity, varying amounts of bitumen are needed for producing PMBE. Normally, 67 to 70 percent of emulsions is bitumen and the performance has been satisfactory. But in PMBE, bitumen comprises 80 percent of the emulsion. PMBE and regular bitumen emulsions are used similarly and they are sensitive to weather and workshop conditions. Their advantage is that their performance is high even under heavy traffic load. Few International standards have been defined for PMBE which is mainly used in road operations with heavy traffic load. This kind of bitumen is being used for paving highways because of its better resistance, otherwise with regular emulsion the asphalt may break soon.

Preserving and Carring Conditions

Bitumen emulsion is produced more quickly than it is consumed. Therefore, it is necessary to provide storage equipment. Bitumen emulsions need to be stored for months without losing their quality and physical specifications. Storage facilities for bitumen emulsions should not be tall and its horizontal cross-section must be the minimum possible. Emulsions of different ionic emulsifiers should never be mixed together and the storage facilities need to be fully cleaned before a different type of emulsion is stored. These storage tanks should have mixers to avoid agglomeration. Emulsions are very sensitive to freezing and they should not become frozen. A frozen emulsion is by no means reusable and therefore the emulsion storage tanks need to be equipped with heating system. The same principles apply to emulsion tankers and the only difference is that storage lasts longer.

Modified Bitumen

Roads represent a major economic and social activity as they are directly related to communications. Paved roads can resist bad weather conditions and heavy traffic load. Construction of these roads requires an appropriate structural design, formulation and procurement of materials Nearly a century has passed since the start of modern road construction in the world, but these developments have yet to become common in Iran. Rapid expansion of roads, heavy traffic load and growing demand for services of better quality require engineers to make efforts for boosting the quality of roads.

Uses

Bitumen emulsions are often used in road surfacing. But due to their unique specifications, they are also used in the following cases: Patchwork, Sealing, Microsurfacing, Coating, Surface dressing, Penetration coating, Sealing, Surface coating, Protection asphalt, Mulching, Concrete sealing



Packing

Products of "Azerbaijan Tech-inn Petroleum Ref. Ind." are packed:

Bulk

Products are loaded in the fluxed containers at 170°C

Jumbo Bag

Bitumen with jumbo bag packaging (play bag, bitobag), a two-layer bag, with an outer layer of sacking and an inner layer of nylon and with a temperature tolerance of up to 120 degrees. Packaging is used to export, 85/100, 60/70 60/90 and 50/70 bitumens.

Large sack bags with good flexibility, the inner layer of which is made of nano nylon and have a high heat tolerance, which is 109°C as standard and melts at 160°C. Often used to move bitumen and bulk or powdered materials. Trapezoidal or conical bitumen jumbo bag model has special dimensions of 110cm length, 110cm width and 100cm meter height that can withstand a load of 1 ton. The shape of the bitumen trapeze jumbo bag is designed in such a way that in hot

summer weather and due to sunlight, after it bitumen

comes out of its initial state and relaxes, the bitumen jumbo bag does not lose its shape. This product, whose outer layer is made of sack and polypropylene, is classified according to the standards related to polybags and is flexible. The inner layer of the play bag is made of nano-nylon, which is resistant to high temperatures. The standard temperature of these nylons is usually 109°C, and these polybags remain unchanged if filled at this temperature. Playbags melt at 160°C. Appearance and how play bags stand cube or envelope model commonly used in the 250 kg sample. 1 ton cube model, which is usually designed at a more reasonable price and in the so-called market. The third model is the belt model (which has an iron frame around each bitumen polybag)



Products are packed in new drums with following specification

Specification	158 kg	192 kg	231 kg
Net weight	150±2 kg	182±2 kg	220±2 kg
Diameter	50Cm	50Cm	50Cm
Cap Location	Center	Center	Center
Cap Diameter	10Cm	10Cm	10Cm
Height	83Cm	98Cm	98Cm







