

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.
VALID UNTIL 01 AUGUST, 2008**

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

Accepted abbreviations

ACC	Aviation Certification Center
AC	Aircraft
CA	Civil Aviation
NSRI	National Science Research Institute
AIF	Anti-icing fluid
AIT	Anti-icing treatment
SIS	Snow-ice scurf
T_f	Freezing temperature of AIF and its water solutions
T_{aa}	Temperature of atmospheric air
T_{al}	Temperature limit of using AIF and its water solutions (the lowest T at which this fluid can be used for protection of aircraft from on-ground freezing)
T_{aal}	Temperature limit of aerodynamic applicability – the lowest T at which this AIF (or its water solution) will be removed from surface of the aircraft by the coming air before the take-off point during the run-out.
CC	AviaMF Certification Center of Aviation Motor Fuels
IM	Information Manual
AEA	Association of European Airlines
AMS	Aerospace Material Specification
ASTM	American Society for Testing and Materials
ISO	International Standards Organization
SAE	Society of Automotive Engineers
Δt	Temperature supply – normative difference between freezing temperature of AIF (or its water solution) and temperature of air in the environment.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

ABSTRACT

Efficient use of AIF is the most important factor of assuring the **safety aircraft take-off and the regularity of flights in the on-ground icing conditions.**

The use of anti-icing fluid is aimed at reaching this result for the aircraft surfaces which also complies with the НПП ГА-85 and the clean aircraft concept.

The use of anti-icing fluid for anti icing treatment of aircrafts is subject to:

- Instruction Manual (in accordance to HTЭPAT-93);
- AIF instruction manual;
- AIT instruction of the company which does the on-ground service of the aircraft.

Efficient use of AIF depends on the human factor. Selection of appropriate AIF (type and concentration) for the needs of each anti-icing treatment (weather conditions and state of the aircraft surface) and quality control of shape of the treated surface depend only on the working staff. In accordance to the NSRI and current requirements for Civil Aviation in Russian Federation all the flying and ground staff has to pass the training program "Protection of aircraft from on-ground icing". The personnel that have access to the immediate AIT of the aircraft have to thoroughly know the User manual of this AIF. The flying staff also has to have exact knowledge about anti-icing procedures performed on aircrafts while they are on the ground as well as the protecting characteristics of AIF which is used on the aircraft before the take-off.

Use of hazardous and specific substances in the make-up of AIF has to be accounted by the user of AIF while providing:

- a) work safety of the AIT personnel;
- b) ecological safety;
- c) technological processes of AIT (particularly AIF creates slippery conditions on the surface of aircrafts and airports).

User manual of anti-icing fluid "Nizh Yug Air Super-Safe" (Type I) TY 2422-003-26759308-2005, manufactured by "Arcton" Ltd., was developed based on typical manual of NSRI "User manual of anti-icing fluid".

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

1. GENERAL

1.1 *AIM*

1.1.1 AIF "Nizh Yug Air Super-Safe" (Type I) is intended for removal of SIS from the surface of the aircrafts and as a short-time protection from SIS formation in conditions of on-ground icing (see table 3.1). It is manufactured in concentrated form with minimum %65 of diethylene glycol and addition of surface-active and anti-corrosive substances.

1.2 *Usage conditions*

1.2.1 AIF "Nizh Yug Air Super-Safe" can be used in concentrated form, in form of water solutions with concentration not less than 75% (by volume). AIF solutions with concentration of less than 75% (by volume) by protection time do not fully comply with to the requirements to type 1 fluids, however they can be used in order to remove SIS from the surface of aircrafts on the first stage of the two stage treatment (without account of Δt). These fluids i.e. concentrated AIF and its water solutions can be both not heated and heated until the temperature of not more than 80°C (on the exit of the sprinkler). Supply of AIF by the producer is performed in concentrated form, AIF solutions are realized differently.

1.2.2 Temperature limits of application (T_{al}) AIF "Nizh Yug Air Super-Safe" and its water solutions with AIF concentration of not less than 75% (by volume) confirm with the requirements applied for the fluids of type I. T_{al} confirms the lowest T_{aa} for more than which use of this AIF (solution) is accepted with consideration of temperature supply of Δt (in accordance to T_f of AIF or solution) and with consideration of temperature limit of aerodynamic applicability T_{aa} (see table 2.1).

Temperature supply (Δt) - normative difference between the freezing temperature of AIF (or its solution) and temperature of the atmospheric air; for AIF type I $\Delta t = 10^\circ\text{C}$ (for type II and IV $\Delta t = 7^\circ\text{C}$); therefore $T_{al} \geq T_f + (\Delta t) \geq T_{aal}$

For concentrated AIF "Nizh Yug Air Super-Safe" $T_{aal} \geq -35^\circ\text{C}$ (see table 2.2).
For water solution 75:25 (by volume) $T_{aal} \geq -18^\circ\text{C}$ (see table 2.2).

1.2.3 Temperature limits for using AIF water solutions only for removing SIS (without supplying the proposed time of use).

T_f of the solutions used in heated form for SIS removal on the first stage treatment of aircraft can be higher than T_{aa} but not by more than three degrees Celsius.

T_f of the solutions used in heated form for SIS removal on the single stage treatment of aircraft must lower than T_{aa} by 10 degrees (by the amount of temperature supply of Δt).

Thus AIF solution with volume concentration AIF: water 50:50 in heated form can be used at T_{aa} at not lower than -16°C on the first stage of the two stage treatment and not lower than -3°C for SIS removal in one stage treatment of aircraft in the absence of on-ground icing conditions.

1.2.4 Compatibility with other AIF.

AIF "Nizh Yug Air Super-Safe" and its water solutions for two-stage AIT of aircrafts confirm with other AIF types II and IV on the basis of ethylene glycol and propylene glycols. Mixing of AIF "Nizh Yug Air Super-Safe" and its water solutions with other AIF is not allowed. All the equipment and the fluid system in which the AIF of other made was contained have to be washed.

1.2.5 In windy weather applying and spraying of AIF on the surface on aircraft gets harder. In case of impossibility of quality application of AIF the treatment is not made.

1.2.6 AIF "Nizh Yug Air Super-Safe" keeps its factors and characteristics as long as the requirements, rules and regulations stated in the Manual are followed.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

2. MAIN QUALITY SPECIFICATIONS AND APPLICATIONS

MAIN QUALITY SPECIFICATIONS			
	Standard SAE AMS 1424E	Standard TY 2422-003- 26759-308- 2005	Testing Method
Appearance	Homogenous transparent or semi- transparent colorless or colored fluid	Homogenous from transparent to yellowish color fluid	Visually
Density at 20 °C, g/cm³	±0.015 (from manufacturer*)	±1.094-1.102	GOST 18995.1, ASTM D 891
Deflection Factor at 20 °C	±0.015 (from manufacturer*)	1.4090-1.4160	GOST 18955.2, ASTM D 1747
Surface Tension, mH/m, max.	±%5 (from manufacturer*)	40	§ 5.4. of TU 2422- 003-26759308- 2005, ASTM D 1331
Flash Point in Open Cup, °C, min.	100		GOST 4333, ASTM D 93
pH Factor at 20 °C	±0.5 (from manufacturer*)	9.5±0.5	GOST 22567.5, ASTM E 70
Kinematics Viscosity at 20 °C, mm²/sec., min.	±%5 (from manufacturer*)	9.0	GOST 33, ASTM D 445
Temperature Limits of Aerodynamic Applicability of AIF (solution), °C at AIF concentration:	Is defined based on the results of the research in acc. to SAE AMS 1424E	- 35 °C - 24 °C	SAE AMS 1424 & as 5900
<ul style="list-style-type: none"> • 100:0 • 75:25 			

NOTE:

1. Values are complying with the Certificate of Analysis for particular Lot (Party).
2. Each two years, the controlling tests are carried-out within the specially certified laboratory of Scientific Center of NSRI.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

2.2 APPLICATION FACTORS

MAIN QUALITY SPECIFICATIONS			
Solution (Water vs. AIF Ratio)	Freezing temperature T_f, °C, min.	Temperature limit of applicability T at °C, min. *	Deflection factor ***
100 : 00	-55	-35	1.4125
95 : 05	-48	-33	1.4084
90 : 10	-42	-31	1.4042
85 : 15	-37	-27	1.4001
80 : 20	-32	-22	1.3960
75 : 25	-28	-18	1.3918
70 : 30	-24	**	1.3877
65 : 35	-21	**	1.3836
60 : 40	-18	**	1.3794
55 : 45	-15	**	1.3753
50 : 50	-13	**	1.3712
45 : 55	-11	**	1.3670
40 : 60	-9	**	1.3629
35 : 65	-8	**	1.3588
30 : 70	-6	**	1.3546

NOTE:

- * - temperature limit of application T_{al} is stated with consideration of temperature supply and temperature limit (Δt) of aerodynamic applicability T_{aal} which is defined in accordance to the tests (see table 2.1 i.8)
- ** - T_{al} values of are not shown for solutions with concentration of AIF "Nizh Yug Air Super-Safe" less than 75% (by volume) since for these kinds of solutions the compliance of its characteristics to the requirements, applied to fluid type I.
- *** - maximum permissible deviation from given values of deflection factor are ± 0,0020.

For practical use of water solutions of AIF in case of deviation of the indicators from the values shown in the table 2.2., use of graphs of dependence of deflection factor is recommended (fig 2.1.) and graph of freezing temperature (fig 2.2.) on concentration (ratio) of AIF in water solution.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

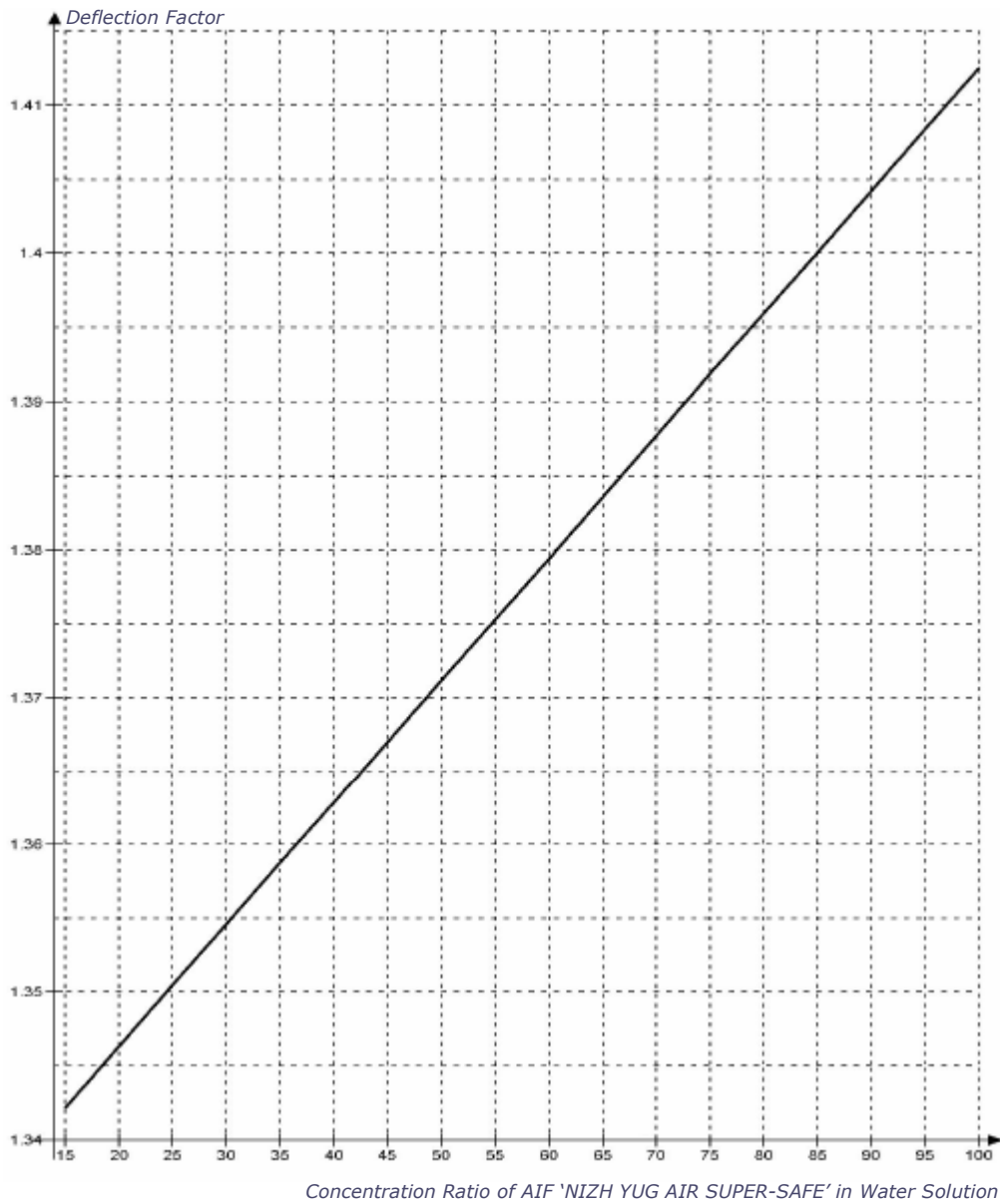


Fig. 2.1. Dependence of deflection factor on concentration (ratio) of AIF "Nizh Yug Air Super-Safe" in water solution.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

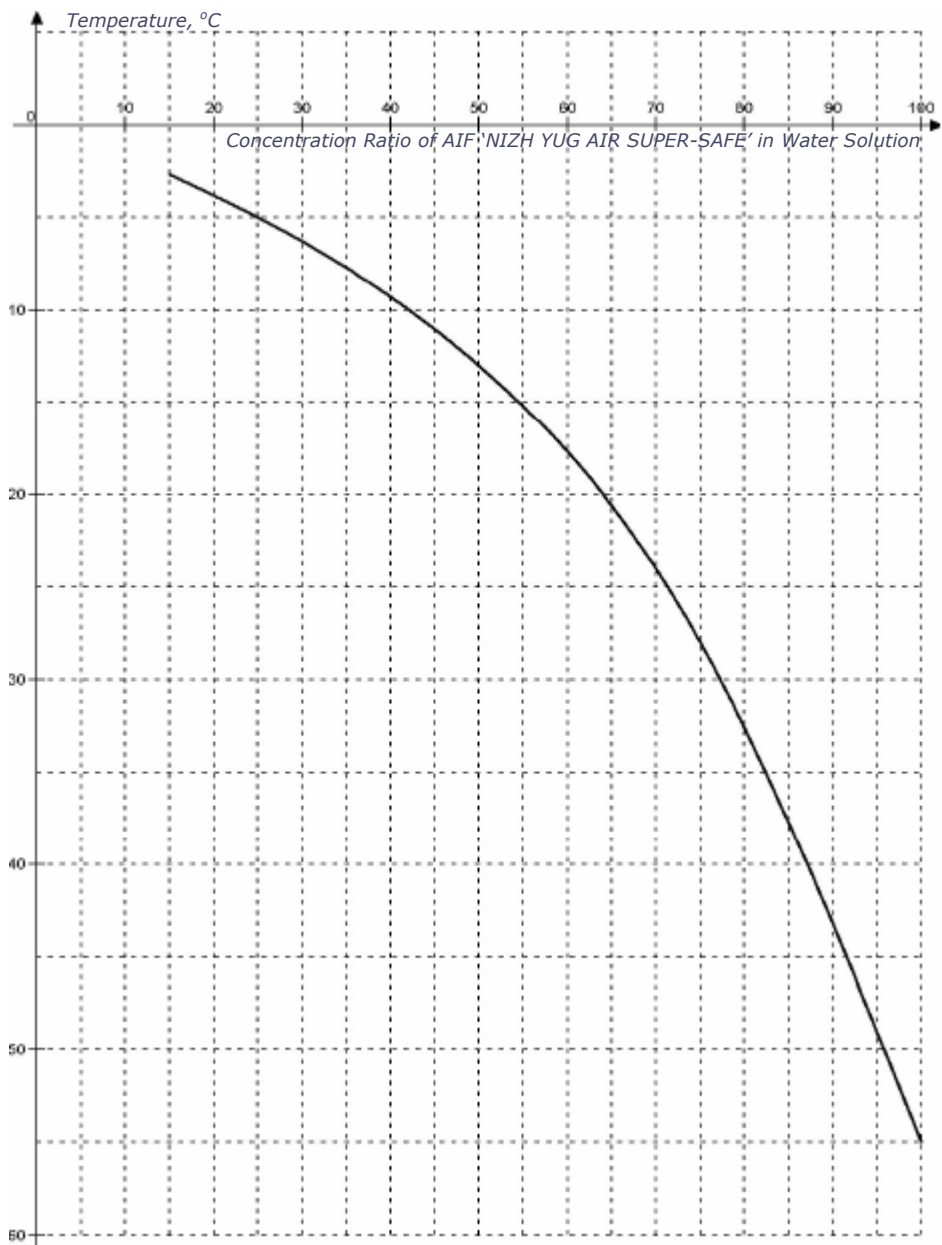


Fig 2.2. Dependence of freezing temperature on concentration (ratio) of AIF "Nizh Yug Air Super-Safe" in water solution.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

3. APPLICATION

3.1 Preparation for AIT

3.1.1 Control of the surface condition of aircraft for presence of SIS

Every AIT starts with control of the surface condition of the aircraft. All SIS found have to be removed from the surface of the aircraft. Depending on the weather conditions on the surface of aircraft different kinds of SIS form on the surface of aircrafts:

- high humidity leads to formation of SIS on the surface of aircrafts directly from air (by means of sublimation) like frost or ice cap;
- freezing fog (drop, crystal or of mixed type) leads to formation of hoar frost (granular or crystal);
- downfall types like snow, freezing spit, freezing rain form snow or ice scurf and also mix of snow and water (mire) and snow and ice (snow-ice gruel).

Presence of fuel in the wing tanks of the aircraft whose temperature is much less than T_{aa} might lead to formation of local SIS on the surface of the wing (in critical zones) in form of smooth transparent granular snow cap. This type of SIS might appear at T_{aa} up to $+15^{\circ}\text{C}$ and high humidity or rain of spit.

3.1.2 Selection of AIF "Nizh Yug Air Super-Safe" concentration and time of protective activity

If the planned flight is performed without on-ground icing conditions then SIS is removed by the most optimal method without control of the protection activity time of AIF. At temperature values of the surrounding air minus (T_{aa}) 18°C and less – then by condition $T_{aa} \geq T_{al}$, and at $T_{aa} \geq -18^{\circ}\text{C}$ then by condition $T_{aa} \geq T_f + \Delta t = T_f + 10^{\circ}\text{C}$.

If the planned flight of aircraft is performed in the condition of on-ground icing, airport service has to approve with the pilot team **selection of the AIF concentration** (concentrated AIF, water solution with AIF not less than 75% (by volume)), defined by the weather conditions at **each concrete AIT and also by the staff work experience**.

Selection of the AIF "Nizh Yug Air Super-Safe" concentration depends on the following factors:

- weather conditions (T_{aa} , type of downfall, wing speed);
- temperature of the wing surface.

AIF protection activity time – period of time, during which the AIF layer applied on the aircraft surface prevents formation of SIS under these weather conditions.

The time count for protection activity time starts at the moment of contract of AIF with the surface of aircraft during the one stage AIT or from the beginning of AIF contact with surface during two-stage AIT. The corresponding coded information must be given by the on-ground service to the pilot team after the end of AIT.

Recommendations for the average protective effect time (Holdover time) AIF "Nizh Yug Air Super-Safe" and its water solutions with AIF ratio not less than 75% (by volume) depending on the type of downfall and T_{aa} are given in table 3.1.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

**3.1.3. AVERAGE PROTECTIVE EFFECT TIME
(IN MINUTES, FOR DIFFERENT WEATHER CONDITIONS)**

MAIN QUALITY SPECIFICATIONS									
T, °C	Frost, Snow, cap *)	Freezing Fog	Snow **)			Freezing spit ***)	Small freezing rain	Rain of cold wing <fuel freze> 2-5 *****)	Other types of downfall
			Very weak	Weak	Mild				
Higher than -3	45	11-17	18-22	11-18	6-11	9-13	2-5		
from -3 to -6	45	8-13	14-17	8-14	5-8	5-9	2-5		
from -6 to -10	45	6-10	11-13	6-11	4-6	4-7	2-5	No recommendations on holdover time	
-10 and lower	45	5-9	7-8	4-7	2-4	No data			

NOTE:

- *) – for the intensive frost formation conditions.
- **)- very weak snow – visibility not less than 3200 m; weak snow – visibility not less than 2000 m; mild snow – visibility about 1000m. These values of visibility are for daylight conditions; in night time while using the electric light sources the given values have to be increased by 1000-1500 m. recommended values of protective effect are true for fluids with temperature not lower than 60°C on the exit of the sprinkler and fluid waste of not less than 1lt for 1m² of the AC surface.
- ***) – in case of doubt in defining the conditions "freezing spit" use the data that applies to the "mild rain" conditions in terms of protective effect time.
- ****) – other types of downfall include hard snow, blizzard, snow rain, mild freezing rain and hard freezing rain.
- *****) – the given values for the protective effect time are recommended at T_{aa} ≥ 0°C.

EXPLANATIONS:

1. In case of hardship in defining the type of the icing conditions and/or their intensiveness one should apply the harsher conditions and use concentrated AIF.
2. Factors leading to lessening of the protective effect time:
 - high intensity of the downfall;
 - intensive wind;
 - airflow from a near passing aircraft
 - presence of fuel in the fuel with temperature lower that atmospheric air.

WARNING!

1. **During performing AIT with consideration of the protective effect of the fluid (concentrated AIF "Nizh Yug Air Super-Safe" or its water solution with concentration of AIF not less than 75% by volume) one should pay attention to that after the AIT of the aircraft surface be covered with a compact film of fluid. Possibility of breaks in this film shows that the fluid in these conditions of AIT (wind, mix of other internal factors) does not have protective effect.**
2. **The company and the staff who performs AIT in process of using AIF "Nizh Yug Air Super-Safe" and its water solutions has to gain and publish the experience (look (10), part 5) both on finding and estimating the recommended protective effect time and in application to the local airport (local weather conditions) which actually show the most popular reasons for on-ground icing, AIT methods and the methods of applying AIF used.**

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

- 3.1.4.1 Preparation of aircraft and for AIT has to meet all the requirements of standard-technical documentation: PO, PЭ, ПЛЭ etc. for each type of the aircrafts. Before the AIT fix the moving surfaces of the aircraft into a position, explained by the aircraft designers for this certain type of aircraft.
- 3.1.4.2 Methods and means for AIT must be approved by the pilot team of the aircraft. During the preparation for AIT all the doors, windows and hatches have to be closed and sealed, motor has to be quieted down (from motor Manual) and the indicators and equipment covered.

WARNING!

During AIT recommendations that are stated in Manual should be followed, based on type of the aircraft, these are: maximum possible temperature and pressure AIF (solution) on the exit of the sprinkler, aircraft configuration, direction of the flow of the fluid, and other points and restrictions on the design elements of the aircraft. One should not point the flow of AIF (water or solution) on the working mechanisms in order to avoid danger on the paint from fluid. If the fluid (AIF or solution) gets on the electro-heating glasses of the pilot cabin it should be carefully removed.

One should apply the fluid symmetrically on both wings and stabilizers and do it in "up and down" direction of the surface of aircraft. One should avoid the fluid from getting on the transducers of full and static pressure, indicators of direction and speed and the corner of attack.

NOTE

At the end of AIT the pilot team is given a special encoded data: type of the AIF and concentration, time of the beginning of protection process, date, for example: TypeI/75/1200/13November2006.

Fact of transfer of this data proves that AIT is finished and aircraft is clean.

3.1.4.3 Discharge rate of AIF "Nizh Yug Air Super-Safe" and its water solutions for AIT

Amount of fluid (AIF or its water solutions) used during the SIS removing procedure should be enough for total cleaning of the aircraft surface affected by SIS.

The discharge rate depends on:

- total mass of the SIS on the surface which is frozen to the aircraft;
- on the means used for applying the fluid on the surface;
- on the qualification of the staff, performing the AIT.

WARNING!

Aircraft surface after AIT must be humid, smooth, and bright, without blur, crystals or clots. Not abundant amount of fluid leads to:

- decrease in quality of treatment (cleaning) of surface of aircraft from AIT,
- decrease in time of protective activity.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

3.2. METHODS OF AIT OF AIRCRAFTS USING AIF "Nizh Yug Air Super-Safe"

In accordance to weather conditions the following methods of anti-icing treatment using AIF "Nizh Yug Air Super-Safe" can be recommended:

3.2.1. Making the AIT in single stage

A. The on-ground icing conditions have stopped and are not predicted

Removing of SIS from surface of the aircraft is done by AIF or its water solution heated to a temperature no more than 80°C. Concentration of AIF in the solution is defined based on the values of T_{aa} , T_f and temperature supply Δt or (at $T_{aa} \leq 18^\circ\text{C}$) by the condition $T_{aa} \geq T_{al}$ (table 2.2).

B. On-ground icing conditions exist or are predicted.

AIF concentration in solution (not less than 75%) or concentrated AIF are selected in accordance to concrete conditions so that $T_{aa} \geq T_{al}$ (table 2.2) and that after removal of SIS the remaining fluid on the aircraft surface does not allow formation of new SIS for the time needed (table 3.1)

WARNING!

- 1. Amount of fluid must be enough for full removal of SIS.**
- 2. While removing of SIS the concentration and protective time of AIF reduces.**
- 3. AIF concentration in solution is selected higher with cold fuel in the wing fuel tanks and temperature of the wing coating lower than T .**
- 4. If the protection time of the available AIF is critical, AIT is always done in two stages. On the second stage AIF which provides the needed protection time is used.**

3.2.2 Making AIT in two stages

The most trusted method of protection from formation of SIS is AIT in two stages (see table 3.2)

First stage of AIT (removal of SIS) may be performed:

- by heated to 80°C AIF "Nizh Yug Air Super-Safe" or its water solutions (while their T_f can be by 3°C higher than T_{aa});
- for SIS removal on the first stage hot air and hot water and might be used, as well as mechanical means of cleaning the surface of aircrafts (following all the restrictions on their use according to the Manual).

Second stage of AIT (applying protective layer of AIF or its water solution):

On the second stage pure AIF "Nizh Yug Air Super-Safe" or its water solution with concentration of AIF of not less than 75% (by volume) selected by the condition $T_{aa} \geq T_{al}$ from table 2.2 is being applied in such a way that it can **totally remove from the aircraft surface the leftovers of the fluid after the 1st stage and create a protective layer of AIF.**

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

**APPLICATIONS PROPOSALS FOR AIF "NIZH YUG AIR SUPER-SAFE" AND ITS'
WATER SOLUTIONS ON T_{AA}.**

MAIN QUALITY SPECIFICATIONS			
T_{aa}, °C	Single Stage AIT	Double Stage	
		A. SIS Removal	B. SIS Protection
-3 and higher	AIF "Nizh Yug Air Super-Safe" or its water solution heated to 80°C with temperature supply of 10°C	Water of AIF (water solution) heated to 80°C. If temperature of wing is less than 3°C water is not used.	Is done not later than 3 minutes the first stage of AIT. Concentration of solution is selected based on T _{aa} and T _{al}
Lower than -3	considering (T _{aa} ≤ -18°C) conditioned by T _{aa} ≥ T _{al}	T _f of AIF (water solution) can be by 3°C higher than T _{aa} .	and in accordance with required protection time.

WARNING!

- 1. AIT of the first stage is done not later than 3 minutes after 1st stage for avoiding the possibility of freezing of the fluid used in the first stage.**
- 2. Amount of fluid must be abundant for creation on a homogenous protective layer of AIF on the surface of the aircraft.**
- 3. AIF concentration in solution is selected higher while cold fuel is there n the wing fuel tanks and the temperature of the coating is less than T_{aa}.**

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

3.3. PROCEDURE OF AIT OF THE AIRCRAFT WITH USE OF AIF "Nizh Yug Air Super-Safe"

3.3.1. Removal of SIS

General facts

For reaching the maximum effect while removing the SIS from the surface of the aircraft AIF (water solution) should be used with temperature on the exit of the sprinkler not less than +60°C and not more than +80°C. For each type of aircraft temperature and pressure of the fluid on the exit of the sprinkler might be bounded by the aircraft designer (look the Manual). For minimal loss of heat AIF has to be applied on the aircraft surface from a minimal distance. Concentration of the solution is selected T_{aa} with consideration of Δt based on the values T_{ai} and T_f for the corresponding solutions (see table 2.2) and with consideration of availability of cold fuel in wing fuel tanks. T_f of the solution used in heated form for SIS removal on the 1st stage of double stage AIT might be higher than T_{aa} by no more than 3°C; value of Δt is not considered here.

Removal of frost, ice caps, hoar frost

Little amount of SIS in frost form, ice caps and hoar frost not connected to the coating very strongly is removed from the aircraft surface by means of a mouthpiece which allows to get the needed flow of AIF. SIS in form of granule frost may reach high masses for their removal recommendations in the "Frozen SIS removal" part should be used.

Snow removal

Temperature and pressure of the AIF solution is recommended to regulate depending on the amount of structural SIS. SIS may be in snow, wet snow or snow with water (mire) form.

NOTES

Before the AIT using AIF "Nizh Yug Air Super-Safe" using of other means of heavy SIS removal look logical (mechanical means, hot water, warm air). However in this case all the requirements and restrictions connected to the use should be met.

WARNING!

Underneath snow layer there may be a thin layer of ice which must be controlled both before and after the AIT.

Removal of frozen SIS

During a long stay on the ground of the aircraft which is accompanied by positive or negative effect on the on-ground icing conditions, on the top of aircraft a big mass of SIS is collected. For removal of SIS frozen to the coating of the aircraft heated fluid (AIF of its water solution) is recommended for use in the following matter. Fluid flow must be directed to one point for thawing out of SIS all the way to the coating. The heat on the coating which has very high thermal conduction with transfer to the close areas and connection of SIS with coating will be broken. The same procedure should be repeated in various points on the treated surface with removal of the layered SIS by means of flow of the fluid at needed force.

Removal of local SIS

In order to remove ice, formed as a result of overcooling of the wing in places where fuel tanks are placed with temperature much lower than T_{aa} (critical zones) heated AIF is used (water solution). For application of the fluid portable equipment can be used (hand sprinkler and container), which confirm with requirements applied to the AIT equipment. The equipment used for standard AIT may be used on minimal mode of serving – by thin flow.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

3.3.2. Anti-icing protection

Protective AIT is done in on-ground icing conditions or in case of prediction of those. For maximum effect on the protection of aircraft from SIS formation before the protective procedure the surface of the aircraft must be fully cleaned from SIS that collected on it before.

The most effective application of AIF first on the up-most areas of the aircraft surface so that when it flows down it will affect the surfaces lying down and AIF continues to work

AIT protection is done directly before the start and in maximum short time (**without loss of the quality of treatment**). So the surface of aircraft must be covered by a solid homogenous layer of liquid which is needed to be visually controlled in the process of AIT. Before the take-off the aircraft surface with applied fluid has to stay smooth, bright, without clots, crystals or blurriness. AIF or its water solutions have to keep viscosity and drop off the wing of stabilization.

The shape of the surface of aircraft after AIT must be controlled up until right the take-off.

WARNING!

Aircraft must be returned back for repeated treatment if:

- **on the surface of the aircraft SIS has formed;**
- **the protective time has run out.**

The repeated AIT in the on-ground icing is always double-stage.

Local protection AIT of the critical parts of the wing (protection of the wing surface from formation of ice in the fuel tank region). In working practice of each company usually the critical zones of the wings of the treated aircrafts are found. The fluid is applied on the critical zones of the wing console symmetrically right after the landing of aircraft.

To apply the protective layer of AIF portable equipment needs to be used (hand sprinkler and a container). Control of the condition of treated and untreated surfaces of the wing must be done before taking away the aircraft from the park. One needs to be sure that there is no ice on both halves of the wing both visually and by feel. The fluid layer on the surface of the aircraft must be viscous, smooth, without blur, clots and crystals.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

4. AIF "NIZH YUG AIR SUPER-SAFE" SOLUTIONS PREPARATION AND QUALITY CONTROL

Preparation of AIF "Nizh Yug Air Super-Safe" solutions by the user shall be as follows:

- Used equipment must be washed for avoidance of other additions from getting mixed into AIF. Quality of water requirements for mixing with AIF are given in table 4.1.
- Concentrated fluid is added into water (cold or hot) or the water (cold or hot) is added into concentrated fluid.
- Preparation of water solutions is done on standard equipment.

WATER QUALITY REQUIREMENT FOR AIF "NIZH YUG AIR SUPER-SAFE" SOLUTION

MAIN QUALITY SPECIFICATIONS		
	Normative Values	Testing Method
Appearance	Homogenous transparent colorless fluid without mechanical additives	Visually by looking at sample of water in cylinder from colorless glass with diameter 20mm in passing light
Total hardness, mg-ekv/lit, max.	Not more than 7	GOST 4151
pH factor	6.0 – 9.0	GOST 22567.5

The basis for use of this AIF solution is documenting of its factors shown in table 2.2 (AIF concentration in solution, T_{al} , T_f).

In case of non conformity of water quality with requirements of the table 4.1 its use must be approved by the manufacturer of AIF "Nizh Yug Air Super-Safe".

WARNING!

The values of the factor of deflection of the final solution may be different from the values shown in the table. In this case concentration of solution and T_f are defined by graphs fig 2.1 and 2.2 respectively.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

5. AIF "NIZH YUG AIR SUPER-SAFE" WORKING EQUIPMENT QUALITY CONTROL

For supplying reliable anti-icing protection on aircrafts an important feature is the quality of work of the fluid system of the used equipment. One should rightly select the needed equipment and different components of the fluid system (pumps, heating systems, pipes etc.) and regularly check the quality of their work. In order to avoid changes in physicochemical characteristics of AIF "Nizh Yug Air Super-Safe" and its water solutions heat transformers and heating elements in the heating systems must be used which provide the temperature where needed on the aircraft surface of not more than 90°C. It is essential to provide a constant unbreakable circulation of fluid in the system. In case if the temperature of the heating surface is higher than 90 C a continuous heating circulation of the fluid has to be provided inside the heating system.

The equipment for AIT must confirm with the requirements of international standard ISO 11077.

5.1 Control of accurateness of work of the mixing system.

If the equipment used for AIT has a system of mixing of AIF with water that in the management of the operator the degree of accurateness of its work should be shown. This information is needed for achieving reliable anti-icing protection and for checking the quality of work of mixing system.

The control of work of the mixing system is done in the following manner:

- tanks are filled with sufficient amount of fluid (water and AIF "Nizh Yug Air Super-Safe");
- the mixing system is run and the wanted ratio AIF : water is selected;
- remove air-locks from the system until AIF solution without air-locks appears on the exit of the injector;
- point the flow from injector into container, connected with plastic bag of corresponding sizes and quality and fill it with abundant amount of fuel;
- compare the **deflection factors** of the selected sample and reference sample mixed by hand. One should control the accuracy of AIF : water ratio in the solution.

6. AIRPORT EQUIPMENT REQUIREMENTS FOR AIT

Aircraft AIT is done on a specially equipped parking place in accordance with recommendations of the Management of anti-icing protection on aircrafts (Doc 9640-AN/940 ICAO, 2000).

For providing of quality of treatment and possibility of control of the state of the surface of aircraft in dark time of the day the parking places must have good lighting equipment.

During AIT of aircrafts the safety measures foreseen during the use of hazardous materials of 4th class (collection and utilization of used AIF "Nizh Yug Air Super-Safe" based on diethylene glycol, no leaks etc.) have to be guaranteed.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

7. SUPPLY AND STORAGE

AIF "Nizh Yug Air Super-Safe" is supplied by the manufacturing factory with accompanying documents that include:

- document of quality for AIF party, from which the shipment is made;
- copy of Sanitary-epidemiologic conclusion (hygienic certificate);
- copy of Certificate of compliance;
- User's Manual, approved by NSRI and AIF manufacturer.

NOTE

1. In document of quality the physicochemical factors of AIF are shown.
2. Information about Certificate of compliance and Sanitary-epidemiologic conclusion can be shown in the Document of quality.

AIF "Nizh Yug Air Super-Safe" is shipped in containers, in compliance with requirements TY 2422-003-26759308-2005 in dry steel barrels according to GOST 6247 type I or 2 with volume of 200 or 275 dm³, according to GOST 13950 type I with volume of 100 or 200 dm³, according to GOST 17366 with volume of 275 dm³, in anti-corrosive barrels according to GOST 26155, in glass bottles according to TY 6-09-5472 with volume of 20 dm³, in automobile or railroad steel containers according to GOST 10674. Also shipment of AIF in user's containers is possible if there is an act of cleaning for the container designed in the required manner.

AIF "Nizh Yug Air Super-Safe" is kept in a 100% sealed container with temperature not less than minus 50°C and not more than plus 50°C. Access of downfall or of ultraviolet light is not acceptable under any conditions. Heated up to 80°C AIF "Nizh Yug Air Super-Safe" and its solutions with water can be kept up to 2 weeks in tightly sealed containers.

WARNING!

Overheating of AIF may lead to thermal destruction and worsening of functional qualities of AIF.

Entering, registering and storing quality control during receiving and storing AIF "Nizh Yug Air Super-Safe" in companies is realized in a certified laboratory Certification Centers or in Scientific Centers.

During the receiving quality control in Civil Aviation companies the products are controlled in following certain areas: "Deflection factor", "General appearance", "Kinematics viscosity".

Under bad results of quality control and also in case expiry date passes samples of AIF are selected and sent to Scientific Centers on NSRI or to the manufacturer of the fluid for making the expertise research and making decision about future use of AIF.

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

8. AIF "Nizh Yug Air Super-Safe" WORKING SAFETY REQUIREMENTS

While working with AIF "Nizh Yug Air Super-Safe" and its solutions means and methods of providing working safety must meet the requirements of the System of standardization of worker safety. Anti-icing fluid belongs to the 4th class of danger in terms of the degree of effect on the human organism according to GOST12.01.007 "Hazardous substances, Classification and General safety requirements".

People, who involve in treatment of aircrafts with AIF must pass a previous training before they are accepted for the job and periodical medical tests, trainings according to ГН 2.1.6-1338-03 "Maximum Permissible Concentrations (MPC) of the hazardous substances in atmospheric air".

While working with AIF one should use individual means of protection from getting AIF on skin, eyes, breath organs and digestive system in accordance to requirements:

- ГOCT 12.4.004 "Means of safety of workers general requirements and classifications";
- ГOCT 12.4.034 "Means of individual safety of breathing organs. Classification and Marking";
- ГOCT 12.4.103 "Special protective clothes. Means of individual protection of feet and hands. Classification"

WARNING!

- 1. While working with AIF one should avoid it getting on skin and eyes. In such a case the fluid has to be removed using a big amount of water.**
- 2. While performing AIT the operator should use respirator and stay on the windy side of the sprinkled AIF.**
- 3. While performing AIF on wing of an aircraft the operator should be especially careful in terms of slippery surfaces from AIF.**

**USER MANUAL OF ANTI-ICING FLUID "NIZH YUG AIR SUPER-SAFE" (TYPE I)
(TY 2422-003-26759308-2005)
MANUFACTURED BY "ARCTON" LTD.**

BIBLIOGRAPHY

1. Technical requirements appointed to AIF approved by MCA, 1992
 2. НПП ГА-85 Recommendations on Civil Aircraft Building
 3. НТЭРАТ-93 Recommendations on use and repair of aviation technology.
 4. Methodical recommendations for anti-icing protection of CA approved by Ministry of Transportation of Russian Federation 23.01.2003.
 5. Testing methods for anti-icing fluids for effectiveness approved by Russian Ministry of Transportation 14.03.2003
 6. Testing manual for AIF in terms of their evaluation on elements of design of the aircraft approved by Ministry of Transportation of Russian Federation 7.11.2002
 7. Anti-icing fluid "Nizh Yug Air Super-Safe" (Type I) TECHNICAL CONDITIONS TY-2422-003-26759308-2005
 8. Tests of anti-icing fluid (AIF) "Nizh Yug Air Super-Safe" (Type I) on evaluation of protection time in climatic room of Certification Center of NSRI. Conclusion approved by deputy general director of and director of National Scientific Research Institute on 10/02/2006
 9. Conclusion on the results of the tests of sample of anti-icing fluid "Nizh Yug Air Super-Safe" (Type I) produced by "Arcton" Ltd. (Nijnekamsk) for effectiveness and aerodynamic applicability. Approved by deputy general director of Scientific Center NSRI of CA on 14.11.2005
 10. Manual for anti-icing protection of aircrafts on earth. Doc.9640-AN/940, 2nd edition, 2000
 11. Federal aviation rules "Certification requirements to the organizations of aviation service for air transportation" approved by decision No.89 on 18.04.2000 Russian Ministry of Transportation (registration of Ministry of Justice of Russia No.2411 5.10.2000)
 12. Federal aviation rules "Certification requirements to the organizations of quality control service of aviation fuels, oil and special fluids for aircrafts" approved by Regulation No.126 of 17.10.2002 Ministry of Transportation of Russian Federation (Registration of Ministry of Justice of Russian Federation No.3867 18.10.2002).
 13. Conclusion No.133-5/05 on Testing the anti-icing fluid Nizh Yug Air Supersafe" type I produced by "Arcton" Ltd. Approved by director Certification Center of NSRI. Moscow 2005.
 14. Decision No. 183H-05 from 16.12.2005 of awarding the Certificate of Conformity to the GOSTP to "Arcton" Ltd. for anti-icing fluid "Nizh Yug Air Super-Safe" .
- International standards:*
15. SAE AMS 1424D, De-icing/anti-icing Fluid, Aircraft, SAE type I, Society of Automotive Engineers – Fluids anti-icing type I.
 16. SAE ARP 4737 Aerospace Recommended Practice – Practical Recommendations