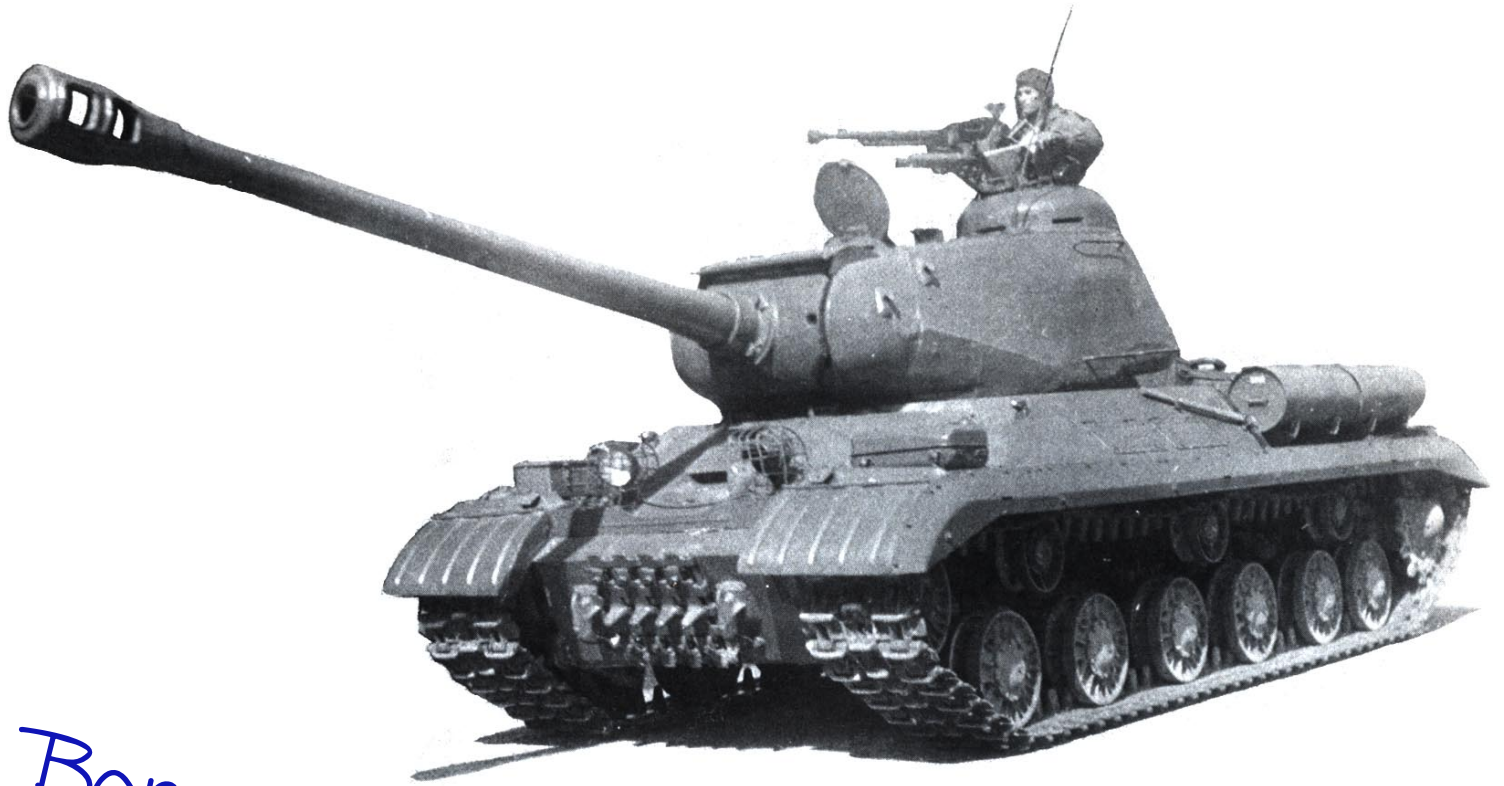


IS-2M



*Bonus: Russian tank
helmet details!*

ИС-2М

Photography, writing, design, layout, etc.

Jakko Westerbeke <jakko@xs4all.nl>
<http://www.xs4all.nl/~gurth/afv>

Other images

Front cover photograph from unknown source, via **Tank Data 2** (E.J. Hoffschmidt & W.H. Tantom IV, editors, WE Inc., 1969).

IS-2M drawings on page 5 from unknown Russian publication, via **Tank Data 3** (Harold E. Johnson, WE Inc., 1972).

Degtyarev 1938/46 and DTM photographs on page 4 from **Military Small Arms of the 20th Century** (Ian V. Hogg & John Weeks, Arms & Armour Press, 1977).

“Page” icon taken from one of KDE 3.0’s icon sets.

Technical stuff

The photographs in this net.book were taken using a Fujifilm 6900Zoom digital camera, while the computer graphics were created with POV-Ray 3.5 and the KPovModeler 0.20 front-end for it. The document was laid out in Palatino Linotype and **Futura XB1k BT** using QuarkXPress 4.1 for Windows. The PDF was created with Adobe Acrobat Distiller 3.01 and edited with Adobe Acrobat Exchange 3.0.

Printing tips (read this first)

This document is designed to be printed double-sided, with the even pages going on the backs of the odd ones. It is for this reason that the photographs on the odd pages, while their captions are on the even pages: printing out a large graphic on both sides of a sheet of ordinary printing paper is likely to cause the paper to ripple, which is avoided this way.

To print double-sided, you most likely will need to print out the odd pages first, then put them back into your printer to print the even pages. You can select which pages to print in the Print dialog that appears when you choose to print out the document.

Printing double-sided will require a bit of experimentation to make sure you get it right, but because of the many different types of printer in use, no definite, all-encompassing instructions can be given here.

When figuring out how to put the paper back into

Copyright & distribution

This document is copyright © 2003 by Jakko Westerbeke, all rights reserved. Unless otherwise indicated, all photographs and other illustrations in this document are copyright © 2002-2003 by Jakko Westerbeke.

This document may be freely distributed, on the following conditions: that no changes or modifications are made to the document in any way; and that no profit is made off the distribution.

Thanks to

Marc Tempels for measuring the DML, Tamiya and Trumpeter IS-2 and IS-3 kit roadwheels.

the printer, the following points are what you need to pay attention to:

- The side of the paper the printer prints on;
- The paper’s orientation in the printer (to which side the top of the page points);
- Whether the pages should go in with the first page on the top or on the bottom of the stack.

Should you have access to a printer that can print double-sided as standard, just switch on that option and print the whole document in one go.

If you print to A4 paper (that is, if you live outside of North America), you should *not* have your PDF viewer resize the page to fit the paper, unless you notice a problem with parts of the photos or text disappearing in the margins.

For those using Letter-size paper, you *should* set your PDF viewer fit the page to the paper size, else you will probably miss the bottoms of most pages.

Joseph Stalin IS-2M

The IS-series of tanks was developed in the Soviet Union during 1943, as a further development of the earlier KV-series of heavy tanks. It went into production in January 1944 and first saw action against German forces in the spring of that year.

Later in 1944, the design was modified in a number of ways to simplify manufacture and rectify some minor defects, producing the IS-2 model 1944. After World War II, these soldiered on for some years beside the newly-designed IS-3, until in 1954 a program was begun to upgrade the IS-2 tanks to more modern standards.

The rebuilt tank was known as the IS-2M, and featured a large number of improvements and modifications. Although replaced in front-line service by more modern types, these vehicles remained in use for a number of years afterward.

Layout

The IS-2 had a conventional layout for a late- or post-World War II tank. The lower hull was constructed principally from welded steel plates, with a cast nose and glacis section welded on. The upper hull, above the track guards to about halfway down the length of the vehicle, was also a cast section. The rear hull plate was sloped, and bolted into place so that it could be removed for access to the engine. The turret was almost entirely of cast construction, with a separate, cast front and a steel plate roof both welded on. Armour thickness varied from 20 mm on the floor to 110 mm on the gun mantlet, though the glacis was protected with 105 mm of armour at 60° to give an effective armour thickness of over 200 mm.

6-7 The driver was seated at the front of the hull, in the center without a bow machine gunner beside him. There was no driver's hatch, though the driver did have a vision slot as well as one fixed and two rotating periscopes for observation.

30-31 The turret crew consisted of the commander and gunner on the left of the turret, and the loader on the right. The commander had a cupola on the left of the turret roof, with a simple, forward-opening loader's hatch beside it. The cupola had six vision slots and a rotating periscope, the latter fitted into one of the two semi-circular hatches that opened fore and aft.

The turret had no basket, so the loader had to stand on the floor and walk along with the turret when it rotated. The commander and gunner had seats that rotated with the turret, however.

Although the IS-2's internal fuel tanks held 520 liters of diesel, which gave it a maximum range of some 250 km. Even in World War II, most IS-2s carried two extra, external drums on each side of the engine compartment with a total of 300 liters additional fuel. The IS-2M could also carry two more, 200-liter drums on the rear of the hull, in the location otherwise used to mount smoke generators, which were also cylindrical but much smaller than the fuel drums.

None of these external tanks were hooked up to the vehicle's fuel system, however, so that their contents had to be pumped into the main tanks by hand when those were empty.

Drive train

All versions of the IS-2 were powered by a 12-cylinder diesel engine located in the rear of the tank, of type V-54K-IS in the IS-2M that produced about 380 kW. The engine drove the track through a rear-mounted sprocket.

22-25 The suspension consisted of six, double roadwheels on each side of the hull, carried on torsion bars. The wheels were similar to those on the earlier KV-series of tanks, being made entirely from steel without rubber tyres, but in the IS-2M upgrade had the number of bolts increased to ten per wheel hub (other models of IS-2 had only five). The front-mounted idler wheel was identical to the roadwheels, but was unsprung—though it did have a device to adjust track tension with. Each side of the tank also had three return rollers, smaller than the roadwheels but also made completely from steel.

26-27 The 65-cm-wide tracks were entirely cast from steel, and were of the so-called "dead" type—meaning they sag down over the return rollers in the top run. Unlike in the KV, which used tracks with two different types of link (with and without central guide tooth), the IS-2M was normally fitted with tracks that had only one type of link. 87 to 90 links made up each track.

Basic data

Length	9.83 m (incl. gun)
Width	3.07 m
Height	2.74 m
Weight	46,300 kg
Speed	37 km/h
Range	150 km
Crew	Commander, driver, gunner, loader

Armament

The IS-2's main armament was powerful for its time, in part to combat German heavy armour, but principally because of the IS-2's wartime role of an infantry-support tank.

The main gun was a D-25T weapon of 122 mm caliber with a rifled bore, which was derived from the A-19 field gun by fitting a different type of breech that permitted quicker reloading. The gun had a double-baffle muzzle brake to reduce recoil, and fired ammunition with separate projectiles and propellant charges, making for a relatively slow rate of fire compared to other tank guns of its time. 35 rounds of ammunition (and propellant charges) were carried, seven more than the IS-2. Most of these were stowed in the rear of the turret and on the floor of the hull, underneath the turret.

Secondary armament consisted of a 7.62×54 mm DTM machine gun coaxially to the main gun, on the right. The IS-2 had a second DT in a ball mount in the turret rear wall, but on the IS-2M this was replaced by a ventilator. The IS-2 also carried a DT machine gun fixed in the right side of the hull, operated by the driver and firing forward, but it is not clear if this weapon was retained in the upgrade to IS-2M standards.

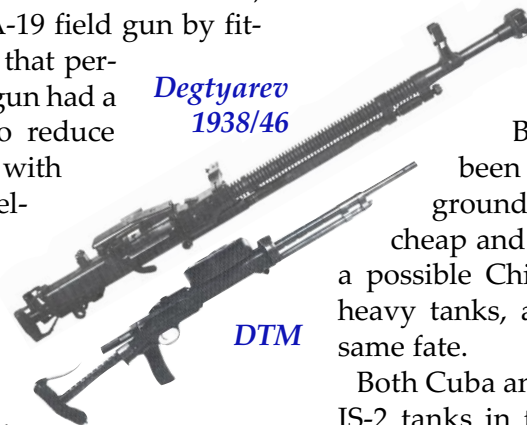
A 12.7×108 mm Degtyarev 1938/46 machine gun¹ could be mounted on the commander's cupola, with 360° traverse.

The amount of machine gun ammunition carried appears to be unsure. Some sources indicate 350 rounds of 12.7 mm and 3,024 round of 7.62 mm, while others say 250 and 2,330 rounds, respectively—although both figures for 7.62 mm ammunition seem odd because the DTM was fed from a 60-round drum magazine, and neither 2,330 nor 3,024 is divisible by 60 (or by 47, which is the number of rounds in the magazine of the DP infantry machine gun, from which the DTM was derived) ...

¹ Often mistakenly called a DShK, which is only correct for the World War II version of this weapon.

Weapon data

	DTM	Degtyarev 38/46	D-25T
Caliber	7.62×54 mm R	12.7×108 mm	122 mm
Overall length	118 cm	159 cm	unknown
Barrel length	59.7 cm	107 cm	525 cm
Empty weight	12.9 kg	35.7 kg	2,588 kg
Rate of fire	600 rpm	575 rpm	2½ rpm
Magazine	60-round pan	Belt	—
Operation	Gas	Gas	—
Effective range	800 m	2,000 m	14,200 m



Degtyarev
1938/46

DTM

Service

By the late 1950s and early '60s, in Soviet service the IS-2 was deployed only with second-line units, as the vehicle had been replaced in front-line service first by the IS-3 and then the T-10 heavy tanks. As

such, it probably never saw combat, and likely spent more time in tank depots than in active service.

By the 1970s, many IS-2 tanks had been given a new role: dug into the ground near the Russian-Chinese border, as cheap and powerfully-armed bunkers to repel a possible Chinese invasion. Many other elderly heavy tanks, again IS-3s and T-10s, suffered the same fate.

Both Cuba and North Korea were provided with IS-2 tanks in the 1960s; it is not known if these were IS-2M variants, but given the date, this seems a likely proposition. The IS-2M does not otherwise appear to have been exported from the Soviet Union.

Colours & markings

Soviet vehicles are not known for their colourful markings or intricate paint schemes, and the IS-2M was no different. These tanks were usually painted overall Russian green with perhaps some markings such as turret numbers, but that is about it.

The inside of the muzzle brake was an orange-red colour. The reason for this is unknown, but it could also be seen on vehicles other than IS-2Ms during combat operations, such as the invasion of Czechoslovakia in 1968.



The photos

The picture series starting on page 6 shows the IS-2M in the collection of the Imperial War Museum Duxford, in the UK. It is an intact vehicle that was delivered direct from Russia in exchange for a Conqueror heavy tank in 1988, and is displayed in a World War II setting (obviously incorrect for a 1950s tank) in the Land Warfare hall at Duxford airfield.

Modelling the IS-2M

Although several kits of IS-2 tanks have appeared in the 1990s, all of these represent World War II tanks. In 1:35th scale, Dragon Models Ltd. released an IS-2 model 1944 in 1995 as kit 6804, which was later re-issued by Shanghai



DML kit 6804
artwork



Zvezda kit 3524
artwork

Dragon under the same number. Zvezda also has a kit of the IS-2 model 1944, kit number 3524, but as the author does not have one, little can be said about it here.

To build an IS-2M mainly requires the addition of hullside stowage boxes and side skirts, as well as building new front and

rear mudguards and several other details.

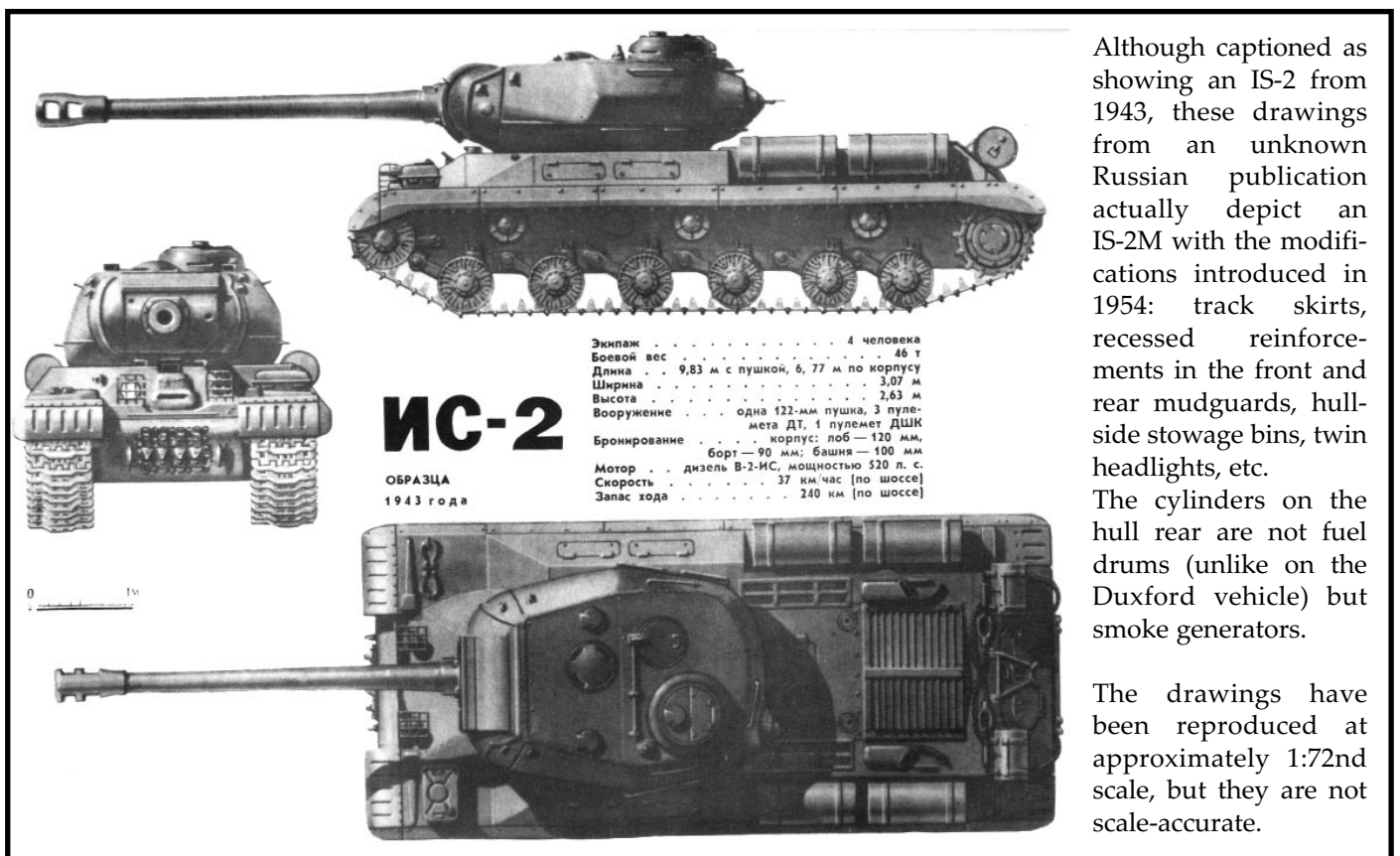
To be accurate, the roadwheels and idlers will need to be replaced, because they should have ten bolts around the hubs instead of the five present on kits of World War II vehicles. Currently, the only source for these wheels is the Trumpeter kit of the IS-3M, from which other parts could also be taken and adapted to the IS-2 model—such as the mudguards and other post-war fittings.

Also note that the Dragon kit is inaccurate in some of its dimensions, most notably the road-wheel diameter and the lower hull height. The latter can be fixed by adding about 1 mm to its top edge before fitting the upper hull, while replacing the roadwheels by those from Trumpeter changes the wheels from being too small, to being too large (but not by as much—the Dragon wheels are 14.9 mm and the Trumpeter ones are 16.0 mm, while they should be 15.7 mm; those in Tamiya's IS-3 are correct in diameter but need five bolts added to be correct for the IS-2M).

The Dragon kit represents a tank produced at the UZTM factory, with a sharper glacis plate than the Duxford vehicle has, but photos show that UZTM-produced IS-2s were also upgraded to IS-2M, so the hull front does not need to be changed.

The rear-hull fuel drums are *probably* the same as on other Russian tanks, so a spare set from a T-55, T-62 or T-72 kit will come in handy. They need to be fitted to completely different cradles than on those tanks, however. Other bits that could be taken from these kits are fittings such as night driving lights and similar small details.

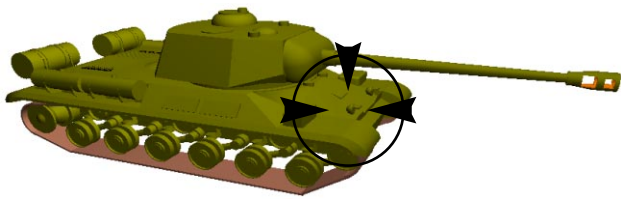
In all, building an IS-2M model is mainly a matter of changing details on the base kit, not of major conversion work. As such, it is not difficult but does benefit from a well-stocked spares box.



Although captioned as showing an IS-2 from 1943, these drawings from an unknown Russian publication actually depict an IS-2M with the modifications introduced in 1954: track skirts, recessed reinforcements in the front and rear mudguards, hullside stowage bins, twin headlights, etc.

The cylinders on the hull rear are not fuel drums (unlike on the Duxford vehicle) but smoke generators.

The drawings have been reproduced at approximately 1:72nd scale, but they are not scale-accurate.



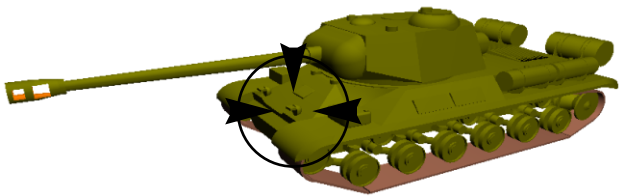
① **Hull front right**

The hull front seen from the right, showing many of the fittings installed on it. For vision, the driver has a visor with a periscope above it (the little flap), and two more rotating periscopes in the hull roof. The oval opening in the glacis to the left of the photo is the firing port for a forward-firing machine gun operated by the driver—though it is not certain this was actually fitted to the IS-2M.

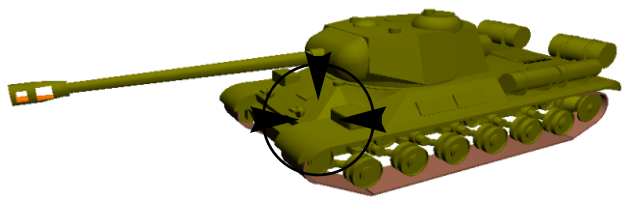
② **Headlight left**

This is the left-hand headlight with its protective cage or brush guard, and underneath it is the vehicle's horn. The headlight has a black-out hood attached, which lets only a narrow bundle of light fall on the ground ahead of the vehicle, so as to make it hard to detect especially for aircraft. The right-hand headlight is similar but without the horn.

Note that this is a post-war style of headlight. During World War II, the IS-2 and IS-2m had just one headlight, located higher up on the glacis plate. It was of a large model than this one, and did not have a brush guard. The sheet steel plate at the bottom of the photo is the splash plate, which prevents water from running too far up the glacis when fording.







③ **Track guard left**

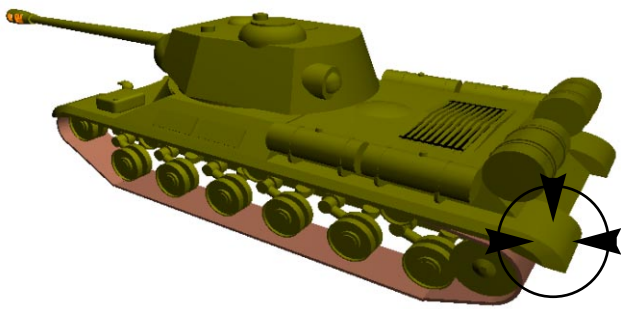
An overall view of the hull front from the left, with the track guard featuring prominently. The IS-2 had plain track guards, without the reinforcing ribs or the sections hanging to the side of the tracks, but the IS-2M refit introduced these features.



④ **Track guard left**

This tank is carried on the left front track guard; it is most likely an oil tank of some kind. It is only fitted to the IS-2M; the wartime IS-2 had no stowage at all on the left track guard. Similarly the skirts extending down from the track guard were only installed on the IS-2M.





⑤ **Track guard rear left**

The track guards are of a style peculiar to the IS-2M variant (though they are very similar to those of the IS-3M), with four pressed ribs and a wide support holding them up. This is the left rear track guard, with a rubber mudflap bolted to it.



⑥ **Stowage bins left**

In the post-war refit, the IS-2 received additional stowage bins along its hull sides in a similar style to those of the IS-3 tank. However, whereas the IS-3 has three bins per side, the IS-2M only has two, due to the external fuel drums (see pages 18-19). The whole assembly is made from thin steel plate, and attached to the real side armour which is further inward—the join between the bins and the armour can just be seen to the left of the station-keeping light.

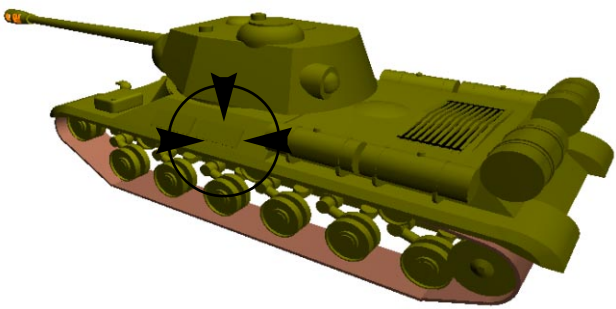
The bins on the right are pretty much identical, but there is an unditching log stored above the tops of the lids.

Rear track guard & stowage bins (1)



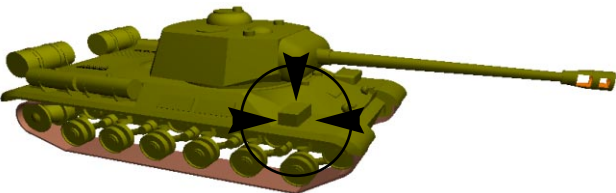
⑦ Stowage bin & tool brackets

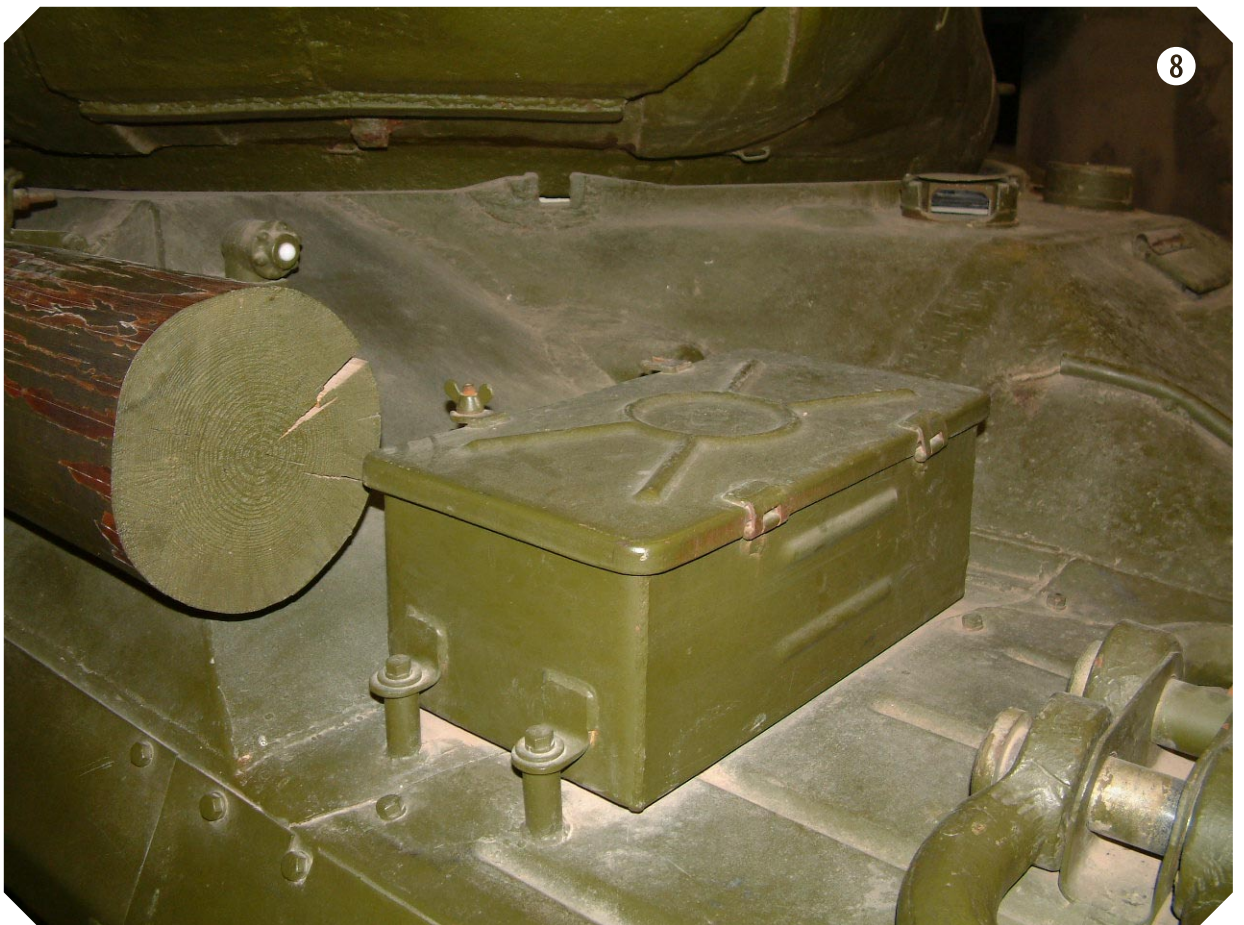
A view of the lid of the second stowage bin on the left side. They are hinged upward, and apparently locked and unlocked by means of a square key. The clasp at the top is for the pickaxe handle; this tool is stored with the head attached to the shaft (unlike on many American vehicles), the head sitting vertically in front of the first external fuel tank.



⑧ Stowage bin right front

Another stowage bin is carried on the right front track guard. Like the oil tank (page 9), it is a post-war fitting only present on IS-2M tanks. Note the unditching log and the towing shackles. The latter were also carried on this same track guard by earlier IS-2-series tanks, but lengthwise.







⑨ **Engine deck right**

The engine deck seen from the right front, looking toward the left rear of the vehicle. The grilles are obvious features (the one in the foreground is an air intake, and there is a corresponding one on the left-hand side), as are the raised section further back and the bulged hatch in the centre of the front section.

The hatch is for access to the engine, while the raised grilles are for exhaust air passing through the radiators underneath the grille.



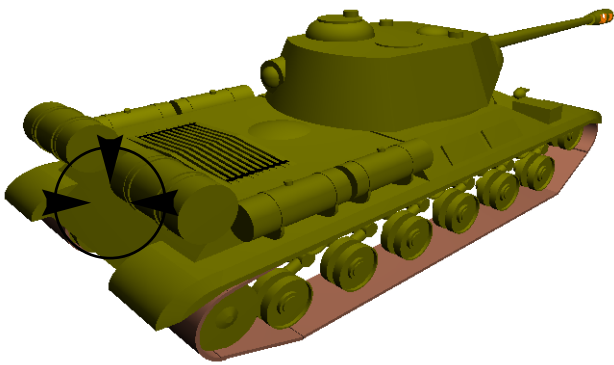
⑩ **Engine deck left**

The engine deck from the other side. It is pretty much symmetrical along the vehicle's centreline, and the most obvious feature is the large section of mesh over the sloped radiator grilles (the hot air exhaust) at the back.



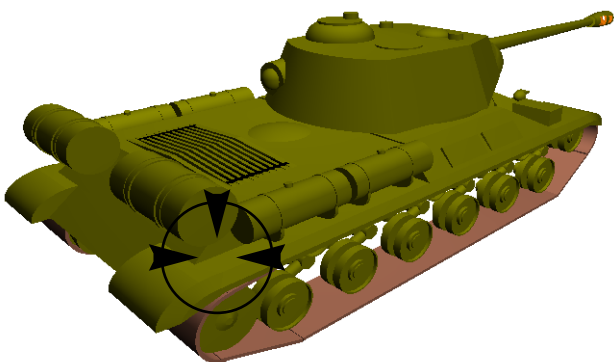
⑪ **Hull rear**

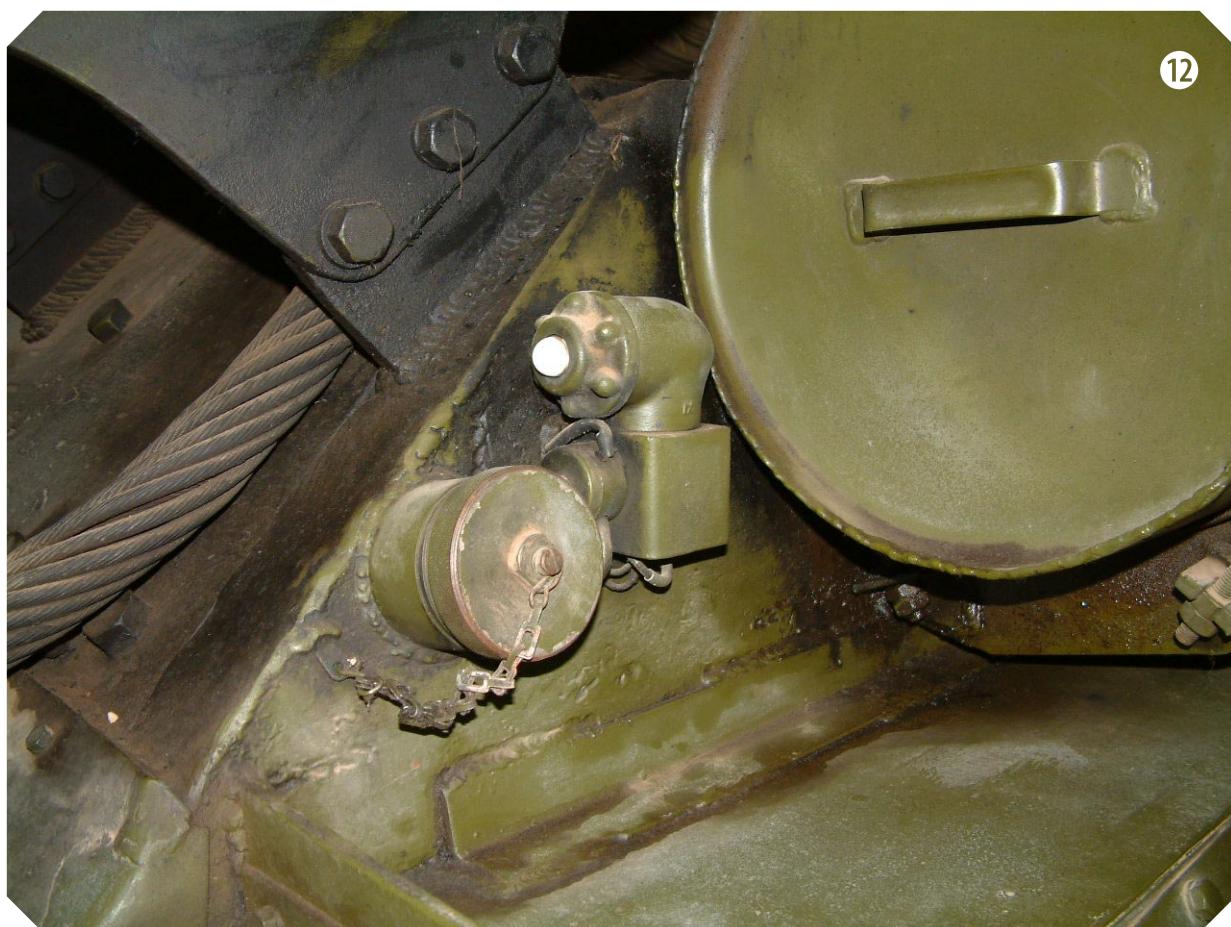
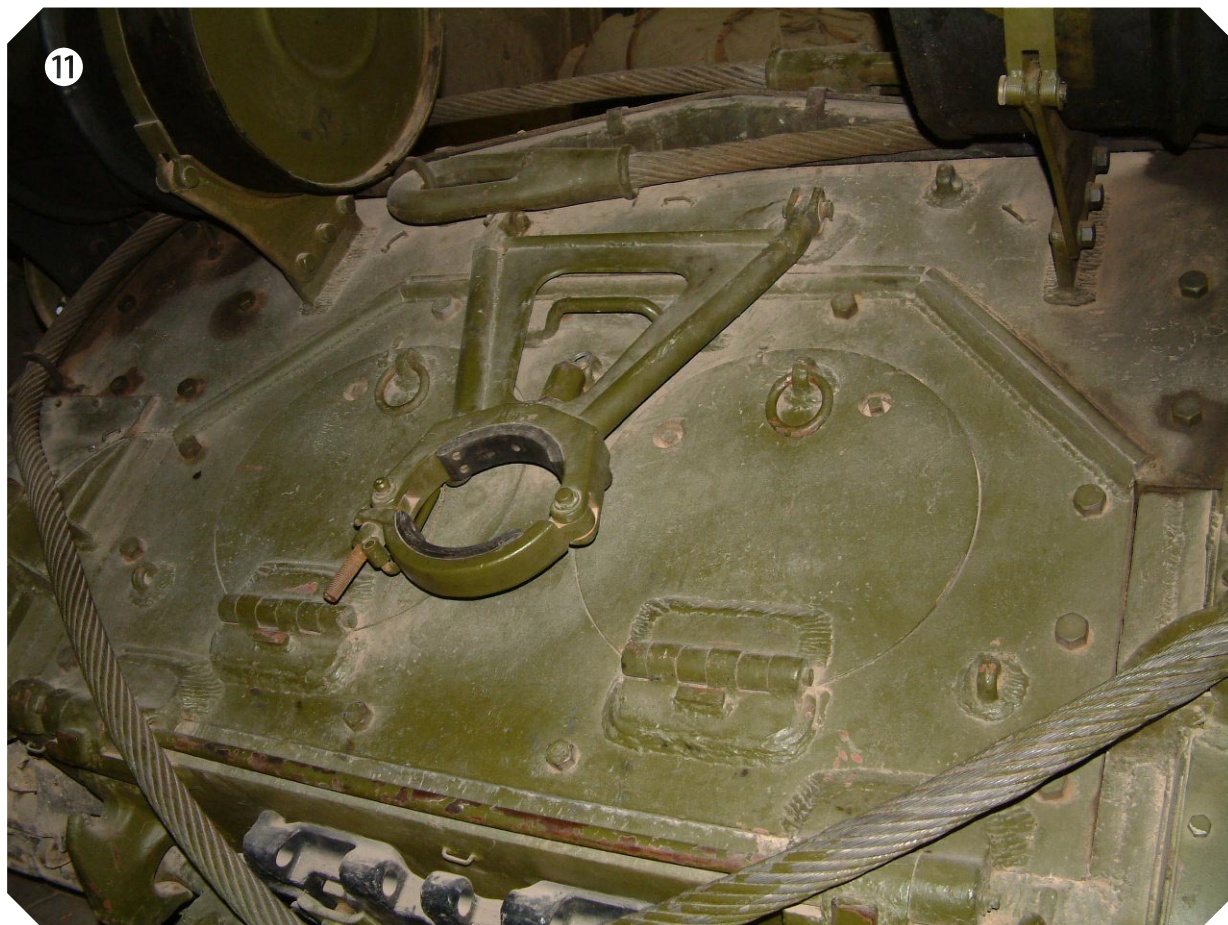
The rear hull plate has a large, bolted-down access panel with two circular hatches in it. Various other items are fitted to it, such as the fuel drum cradles, the gun travel lock (note its rubber padding) and hooks for the tow cables.



⑫ **Night-driving light**

This shot of the rear right corner of the tank shows the two types of fuel tank and their brackets, as well as details of the station-keeping light (for night driving).







⑬ **Hullside fuel drums**

The IS-2M carries a lot of fuel in external drums along the rear of the hull. This is the front-most drum on the left side of the hull, which was also carried on World War II vehicles. It is just a simple, steel cylinder with a handle at either end, holding 75 liters of fuel.

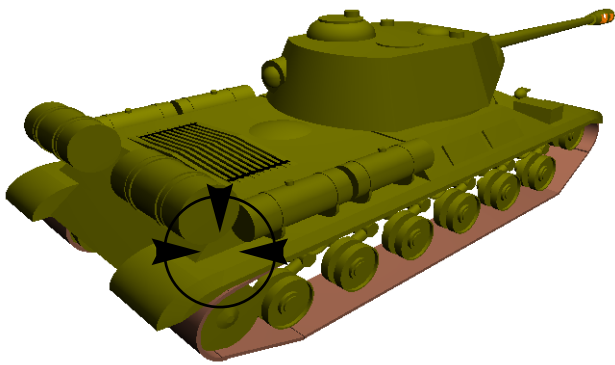
The clasp just in front of the drum is to hold the head of a pickaxe, with its shaft pointing forward and up along the hull side.

⑭ **Fuel drum cradle**

The hullside fuel drums are carried in cradles, two per drum. A steel strap passes over the drum, and its outboard end is secured to the cradle by the arrangement shown in this close-up: a threaded section is secured in a U-shaped bracket with a washer and a nut.







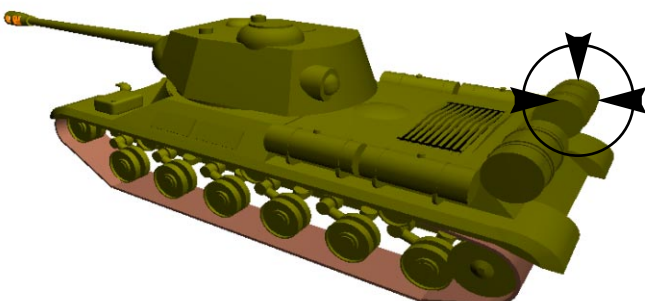
⑮ **Rear fuel drums**

Two more fuel drums are carried on the rear of the hull, but these are a post-war fitting and were not present on World War II vehicles.

The large drums hold 200 liters each.

⑯ **Rear fuel drum fasteners**

The rear fuel drums are held on slightly differently than the side drums. They still rest in a cradle, but instead of a single steel band fastened to the cradle at its free end, each cradle has two steel bands attached which are fixed together with a bolt through the brackets welded to the free ends of the bands, located at the top of the drum.







⑰ **Drive sprocket**

The IS-2's drive sprocket is located at the rear of the hull, and is quite large. Its most obvious feature is the conical hub, the center of which is a separate piece held on by the six bolts visible in the photograph. The skirt plate at the top of the photo is a post- World War II fitting peculiar to the IS-2M variant.

⑱ **Drive sprocket inside**

Looking at the inner face of the drive sprocket from the front shows its profile. Note the small webs on the hub, reinforcing the ring onto which the actual sprocket ring is bolted.

The prominent arm visible is a mud scraper, to prevent mud building up between the sprocket and the track, which could cause the track to run off the wheels. It is a feature of many Russian vehicles, both from World War II and the modern period.





①9 Wheels

This photo shows all the wheel types, except for the drive sprocket (which is pictured on page 23). The idler wheel is identical to the roadwheels, it is just raised above the ground. The horizontal fitting behind the idler is its adjusting gear, by which the wheel can be moved forward or back to adjust the track tension. Note that the track on this vehicle is almost uncharacteristically tight—most photos of IS-2s in service show the top run of the tracks sagging drastically, especially in front of the drive sprocket.

The return rollers are very large, relative to the roadwheels—but at 55 cm in diameter those are small compared to the wheels of other tanks of the IS-2's size.

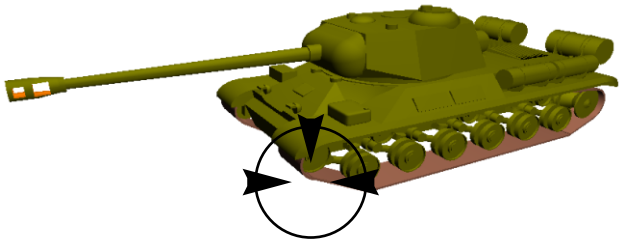


②0 Suspension arm & bump stop

Each of the six roadwheels per side is carried on a suspension arm like this one, with a stop fitted above it to limit its upward travel. There are no external shock absorbers on any of the suspension arms, though. The lack of rubber tyres on the roadwheels is also obvious in this photo.







②① **Track outside**

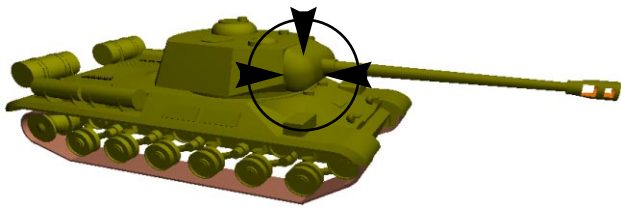
The outside of the track shows the deep profile, though it is partially obscured by the dust and mud applied to this vehicle to put it into a scenic setting (as is the case on many of Duxford's exhibits).

②② **Track inside**

The inside face of the track used on the IS-2M. It is a single-pin track made entirely from steel, without rubber pads on either the inside or the outside. This track has a guide horn on every link, but some vehicles used alternating links with and without guide horns.

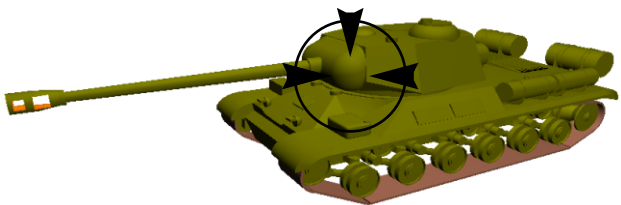






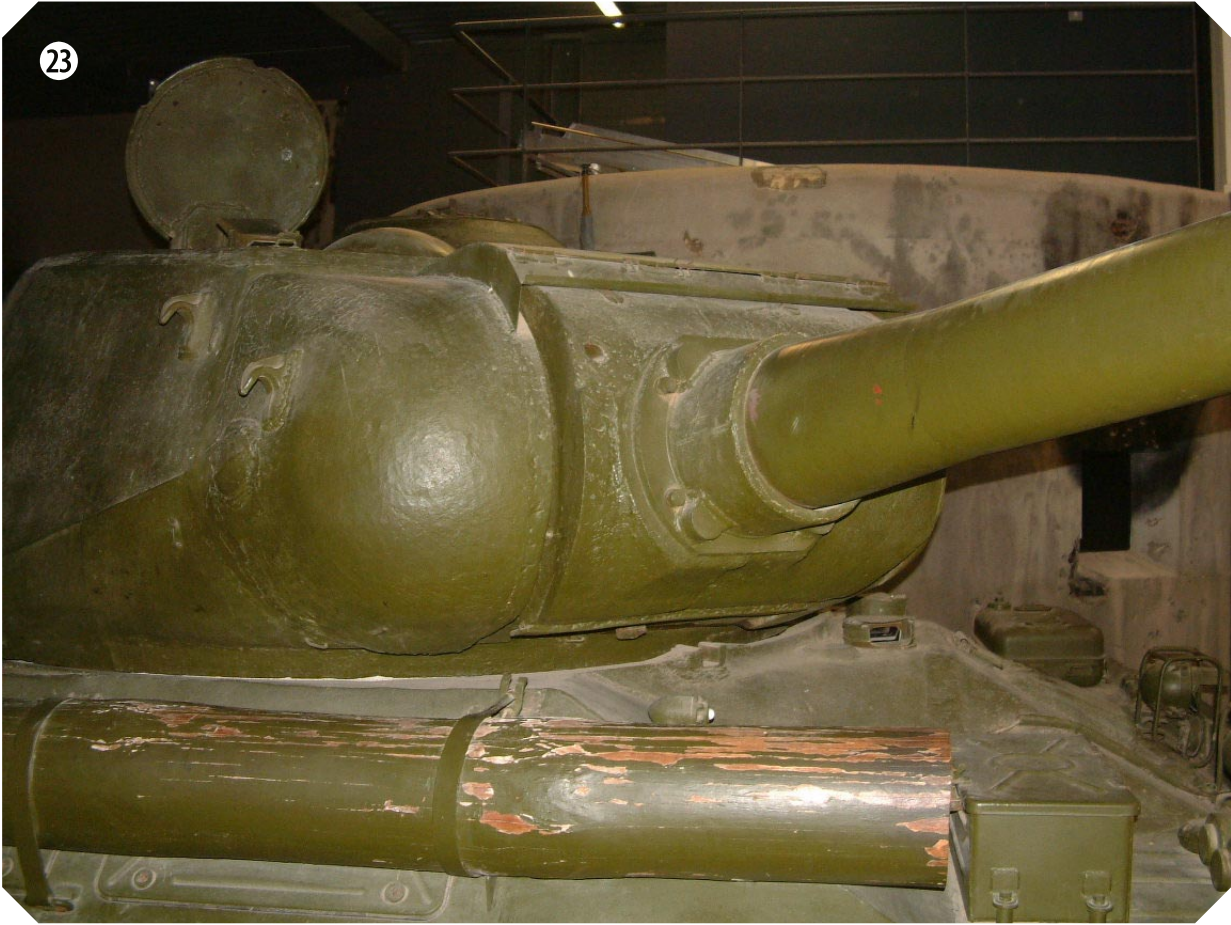
②③ **Turret cheek right**

The IS-2 has a fairly narrow mantlet for the main gun, and it is attached to a rounded, cast armour section welded to the rest of the turret. The hole on the right of the gun is for the coaxial DTM machine gun.



②④ **Turret cheek left**

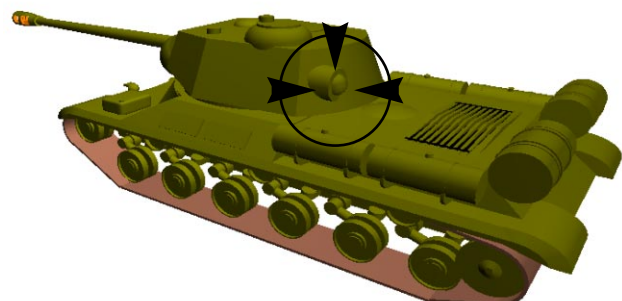
The left-hand side of the gun mantlet, and the forward section of the turret. The mantlet on the IS-2 model 1944 and IS-2M is larger than on the basic IS-2, for increased strength, and is wider on the left than on the right. Note also that it has its lower left corner cut off, which is not a detail of this particular tank, but was this way on all IS-2Ms. The hole on this side of the mantlet is for the gunner's telescopic sight.





②⑤ **Front turret left**

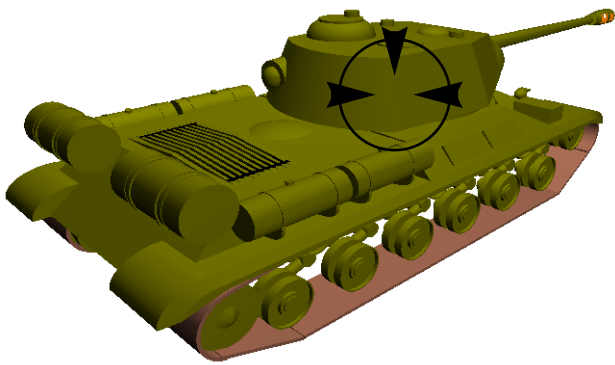
The forward section of the turret's left side. The rails on the turret side are for infantry to cling onto when the tank was used to carry troops into battle. The bulge in the turret side is a very characteristic feature of the IS-2.



②⑥ **Rear turret left**

At the left rear of the turret was originally (in the IS-2) a ball mount for a DT machine gun, firing toward the rear of the turret. This weapon was dropped in the IS-2M, and its position used for the installation of a ventilator instead. The dome-shaped bulge can be seen to have an opening along its bottom edge for this purpose.





②⑦ **Turret rear right**

The very plain right rear side of the turret. The bag hanging from the grab rail is a Red Army rucksack, of very simple design: it is basically a sack open at the top, closed by a strap tied around it just below the opening. These remained in use until the 1960s at least (the author owns one with a 1963 date stamp in it).



②⑧ **Turret front right**

The right forward section of the turret shows the cast finish of the turret and the crude welds that are typical of Soviet-made tanks. The open hatch is the loader's, and the wooden log at the bottom of the picture was used to free the tank when it got stuck in difficult ground: by shackling it to the tracks, it often provided the extra traction necessary to get the tank out.





② **Muzzle brake**

The main gun is equipped with a double-baffle muzzle brake, of quite crudely-cast construction. Its inside is painted in an orange-red color (primer?), which is also apparent on other Russian vehicles with muzzle brakes.

Also note the rough finish, which seems to have been cleaned up very little after the muzzle brake came from the mould.

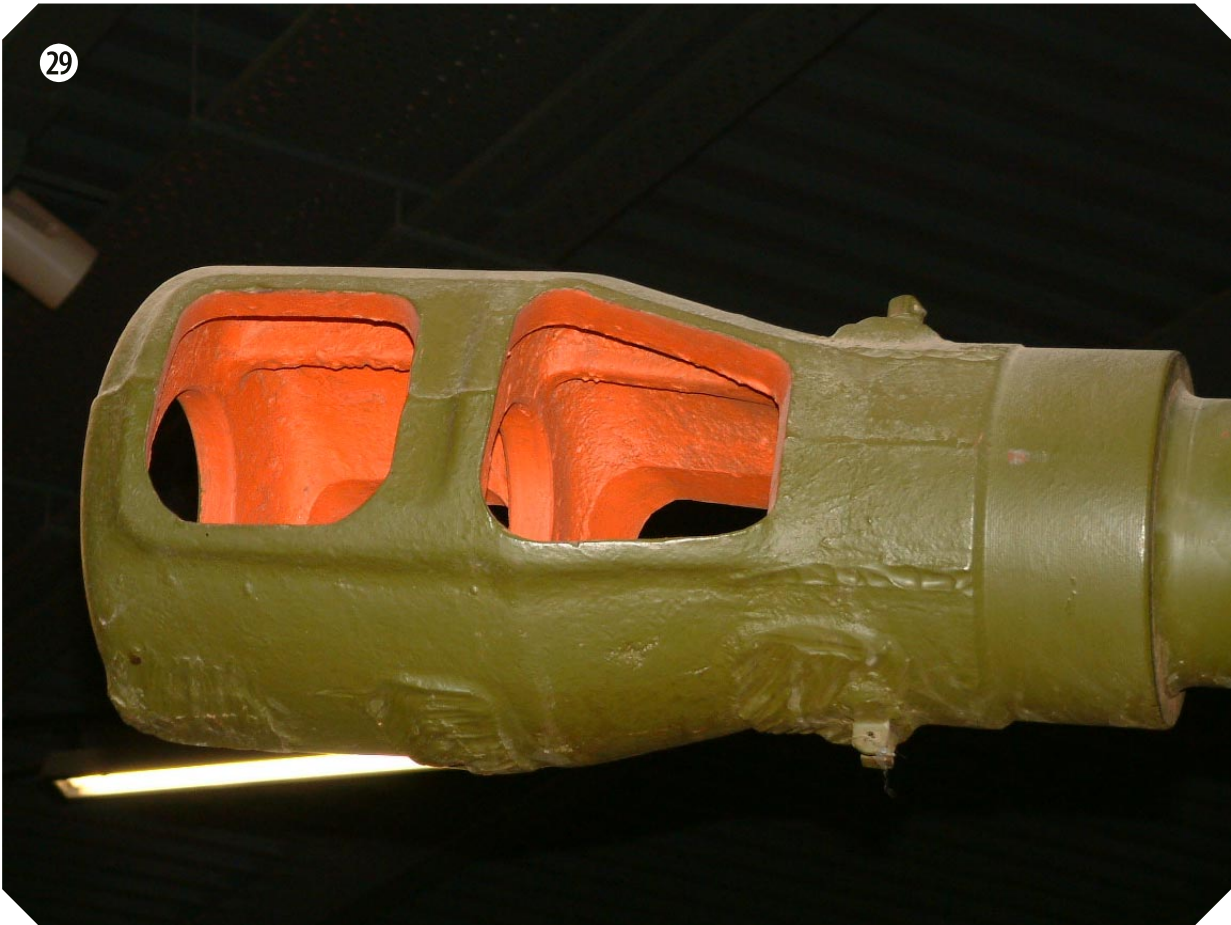
Russian Combat Vehicle Crew Helmet

The Russian combat vehicle crew (CVC) helmets are very reminiscent of early aircraft flying helmets, with only the addition of padding over the skull to really distinguish it from these. The basic design has changed little since before World War II, although there are clear differences between the WWII and modern models. The helmet shown on the following pages is a modern example, manufactured in November 1979.

The helmet consists essentially of a fairly thick cotton outer shell, with a finer cotton inner layer sewn into it. Flaps on the sides can be fastened under the chin with a leather strap-and-buckle,

and a loudspeaker is located in a rubber pad sewn into either flap, forming a headset (one of the recognition points of the post-WWII helmet is that the speakers are bigger than in the earlier model). Running back to front from the brow to the nape of the neck are four padded strips to absorb impacts against the vehicle's roof (this is another recognition point of the post-WWII model helmet, as examples from that war have only three bands of padding). There are also two smaller strips transversely above the headset and a larger pad horizontally on the forehead. A cotton neck curtain at the back of the helmet can be worn either down or buttoned up. Two more leather straps are used to

29



adjust the helmet's size to the wearer's head: one at the top of the head, underneath the padded bands, and one at the back underneath the neck curtain.

The loudspeakers are connected together by electric wires at the back of the helmet, while the link-up to the vehicle's intercom is a thick cable, about 50 cm long, at the left rear of the helmet. Also coupled to this is a set of two throat microphones, each with a leather strap threaded through a sliding buckle. By pulling the buckle up to the throat, the microphones are held pressed against the sides of the throat. By undoing a few buttons on the helmet

and pulling the speakers out of their rubber pads, the whole set of speakers, microphones and connection cable can be removed from the helmet as a single set—probably for replacement when it is damaged, and/or to allow washing of the helmet without damage to the electronic components.

The helmet is nominally black in color, but this fades to a dark grey with wear. On the photographed example, even the most sheltered part of the helmet (high up under the neck curtain) is noticeably greyer than a fairly new, black T-shirt.

Russian tank helmet

① **Left front**

This photo shows how the helmet is typically worn by vehicle crews, with the side flaps unbuckled. The throat microphones are pulled tight here; a close-up picture of them is on page 41.

② **Left front**

Similar to the last photo, but now the flaps are closed by means of the leather strap and buckle. The throat microphones can get a bit in the way when closing the flaps this way, but as the photo shows, they can sit below the closed flaps.

③ **Left rear**

The left rear side of the helmet, though the right side is pretty much identical, with the neck curtain worn down. The location of the cable for the headset is clearly visible, coming out of the helmet between the curtain and the left side flap.



Russian tank helmet

④ **Left rear**

Another photo of the helmet's left rear side, but now with the neck curtain buttoned up. For this purpose, it has two small buttons on its "inside", which are on the outside when the curtain is folded up as in the photo. The button is fastened into the lower button hole of the headphone covering (see photo 3 on page 37): with the flap down, another button near the top of the flap, on the outside, goes into this same button hole.

⑤ **Overhead**

An overhead view of the helmet, clearly showing how the padded bands run across the skull, as well as the leather adjusting strap that sits beneath and under the padding. (The front of the helmet is to the left in the photo.)

⑥ **Inside**

The inside, which is pretty much just plain black cloth, with only the earshells of the headphones in a different color. This is the summer helmet; there is also a winter helmet, which is identical in most respects except it has a sheepskin lining for warmth.

Also visible in the photo is how the throat microphones fit into the helmet, coming through two holes at the sides of the neck. Barely visible between the throat microphones is the neck adjusting strap at the back of the helmet.



⑦ **Throat microphones**

A detail shot of how the microphones fit onto the throat. They are fitted to brown leather straps which are equipped with a sliding buckle to pull them tight (the loose ends of the straps being joined by a pin to prevent the slider being loosened too far and falling off).

From the back, how far forward the microphones sit can be adjusted by means of a button provided with three button holes on each side.

⑧ **Headphone right**

The headphones are installed on each side of the helmet, a rubber piece sewn into the cotton shell to hold the removable speaker that can be pulled out with little effort. The whole is covered by a cloth flap fastened with the two buttons visible in this photograph.

The two wires coming from the actual speaker join it to the throat microphone and the opposite speaker; by taking the speakers out of the rubber fittings and unbuttoning the microphones, the whole headset can be easily removed from the helmet.

⑨ **Vehicle connector**

This is the plug at the end of the headset cable, with four pins to connect it to the vehicle's communications system. Though there is only one screw on this side, there are two on the other, side-by-side. The plug $3.4 \times 1.9 \times 3.4$ centimeters in size, not including the pins.

The printed "IX-89" on the plug indicates the headset was manufactured in September 1989, whereas a stamp on the rest of the helmet says that was made in November 1979.

