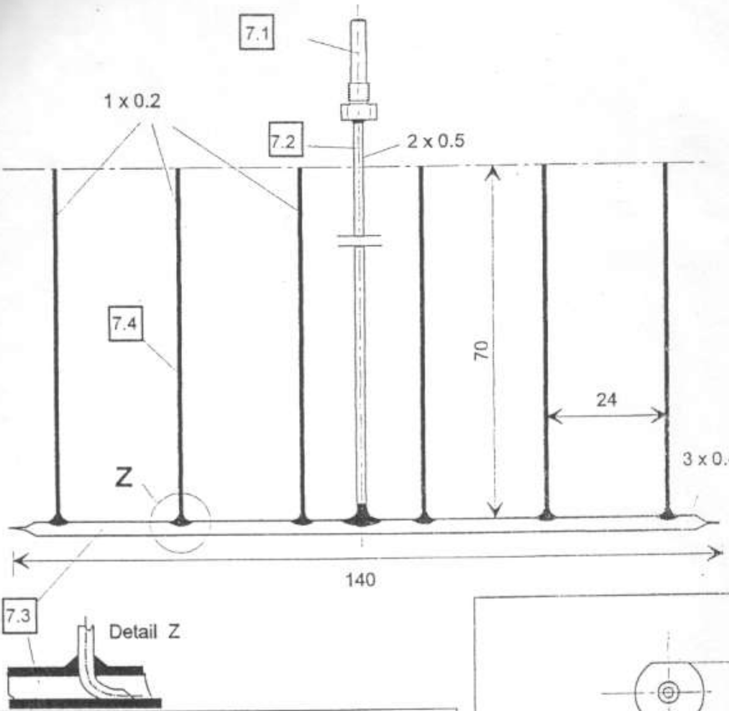

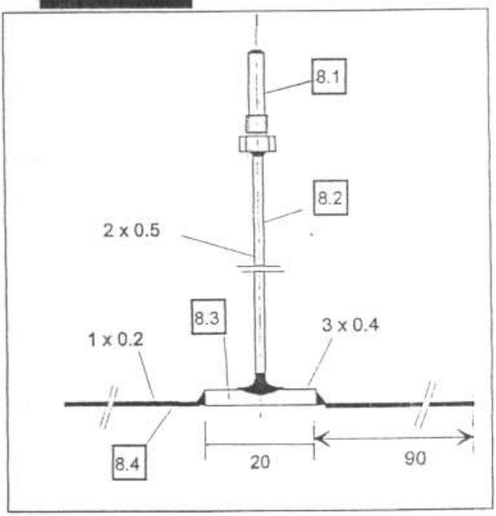

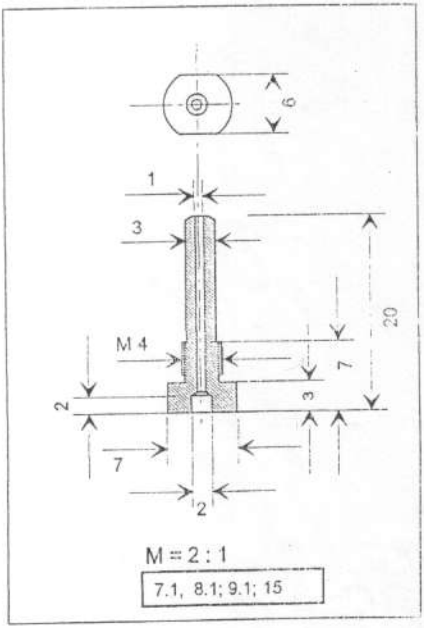

Hartlötverbindungen
hard soldered , all tubes brass, Messing

1 x 0.2 means 1mm outer diameter, 0.2 mm thickness of wall. all tubes brass

KJ - 66
Blatt NR.: J
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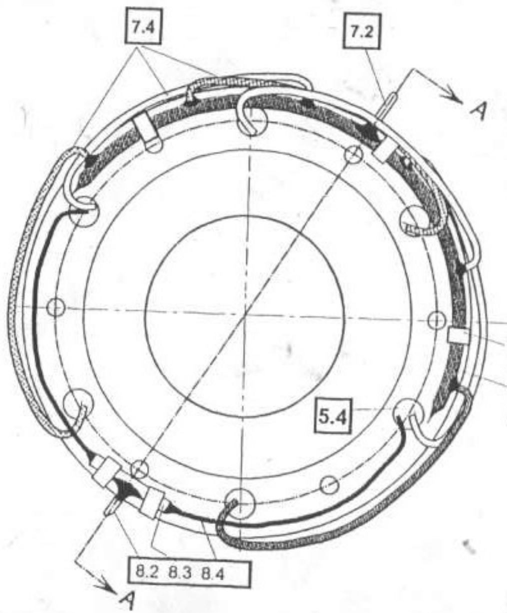
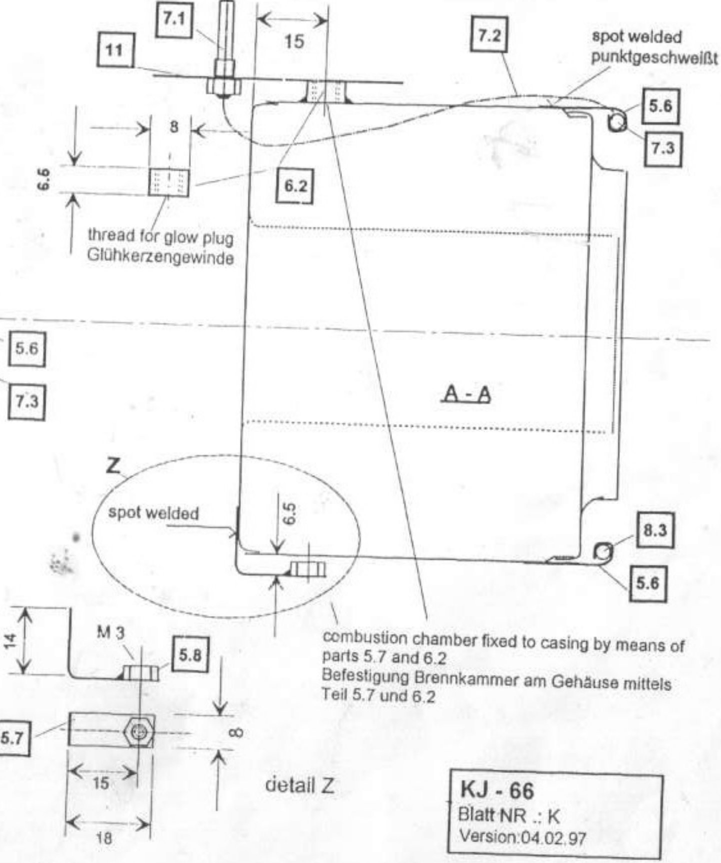


assembling comb.- chamber with fuel- gas supply
Anordnung Brennkammer mit Kraftstoff und Gasversorgung



combustion chamber fixed to casing by means of parts 5.7 and 6.2
Befestigung Brennkammer am Gehäuse mittels Teil 5.7 und 6.2

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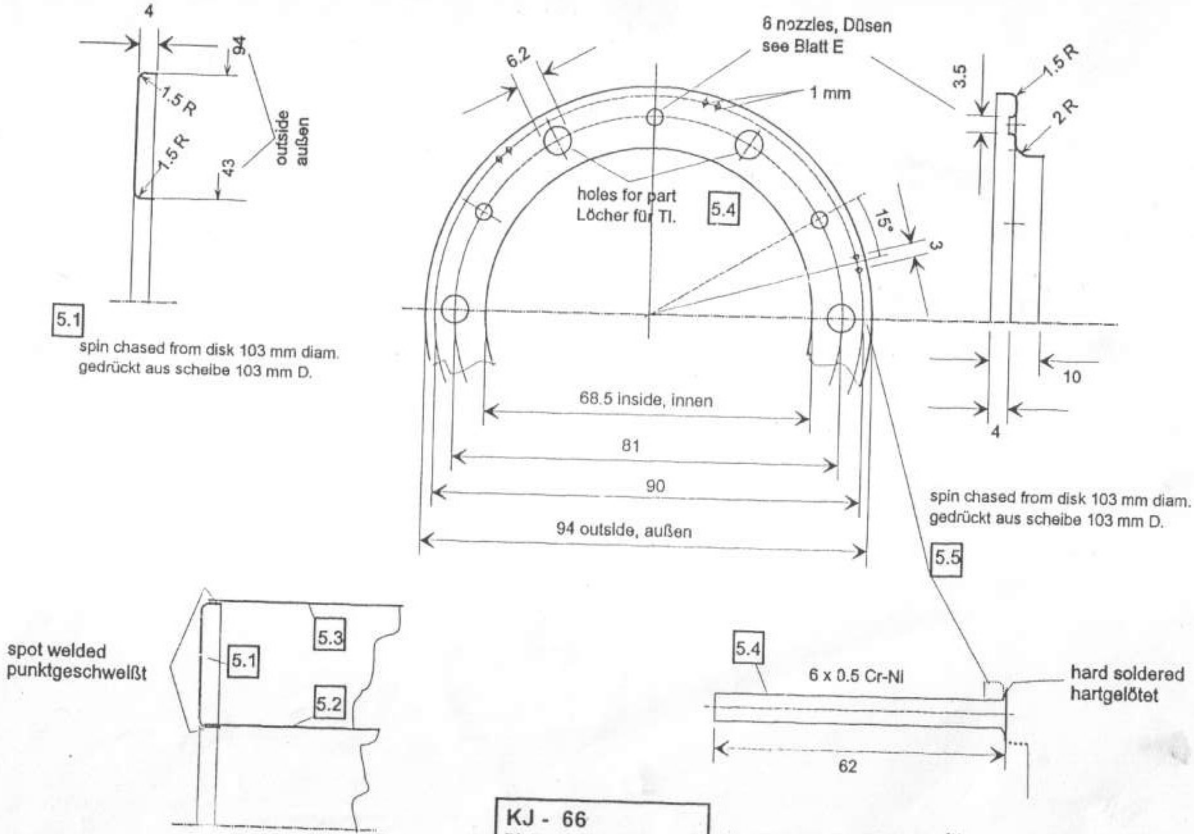
Version:04.02.97



KJ - 66
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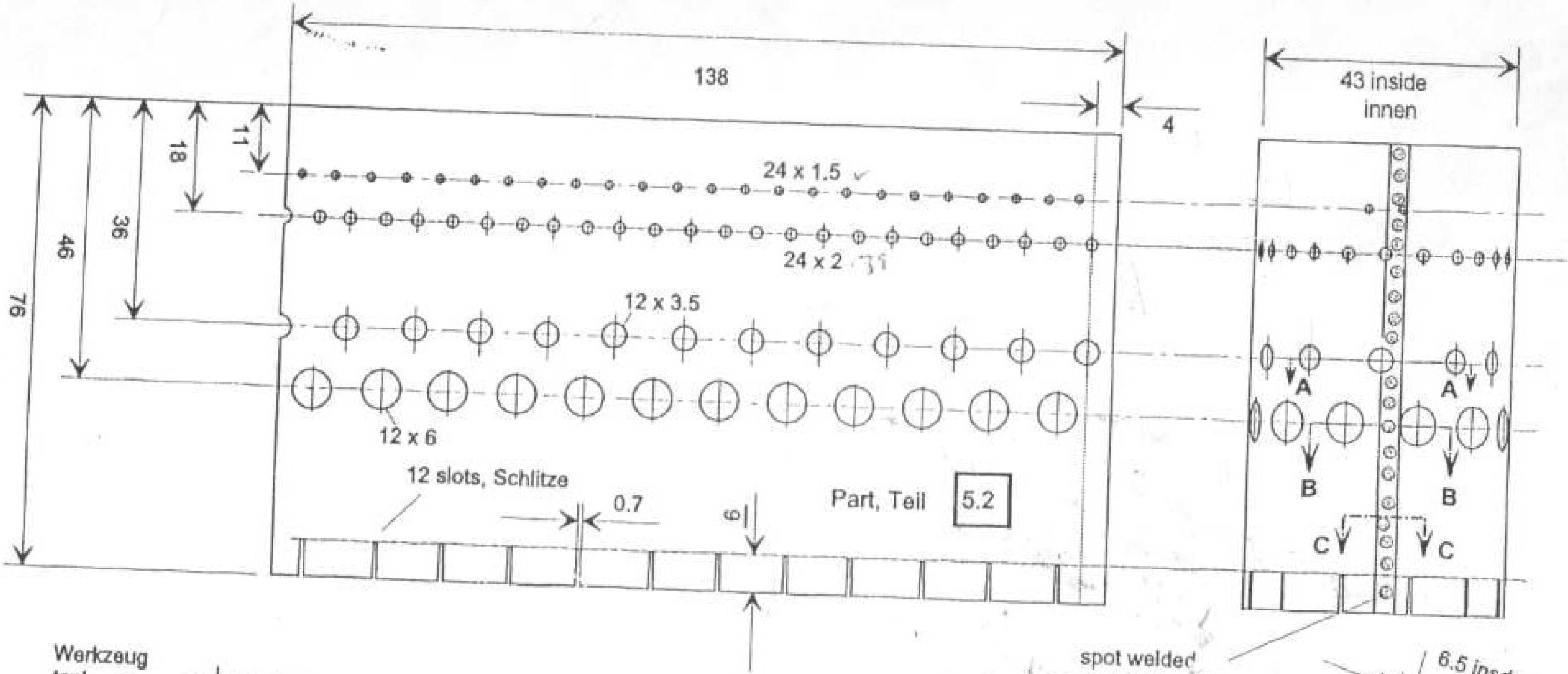
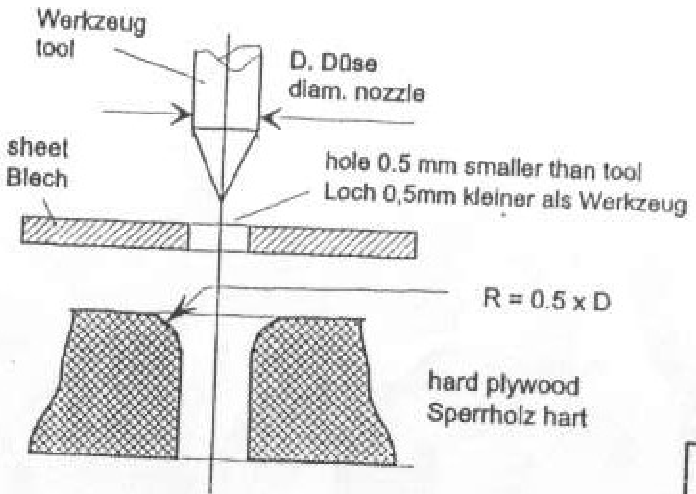
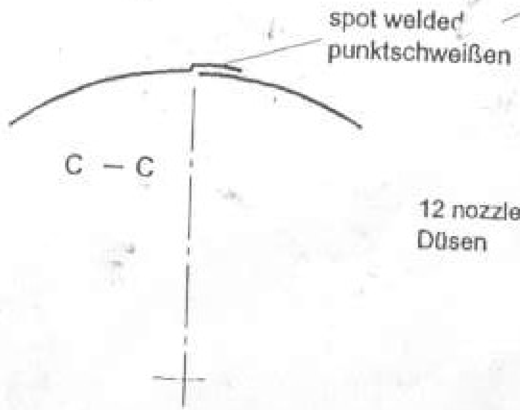
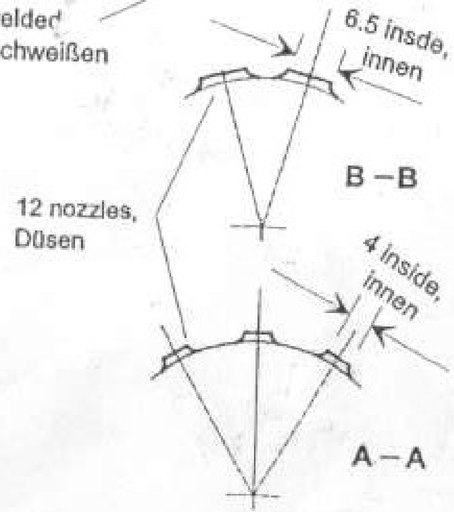
Version: 5.2.97









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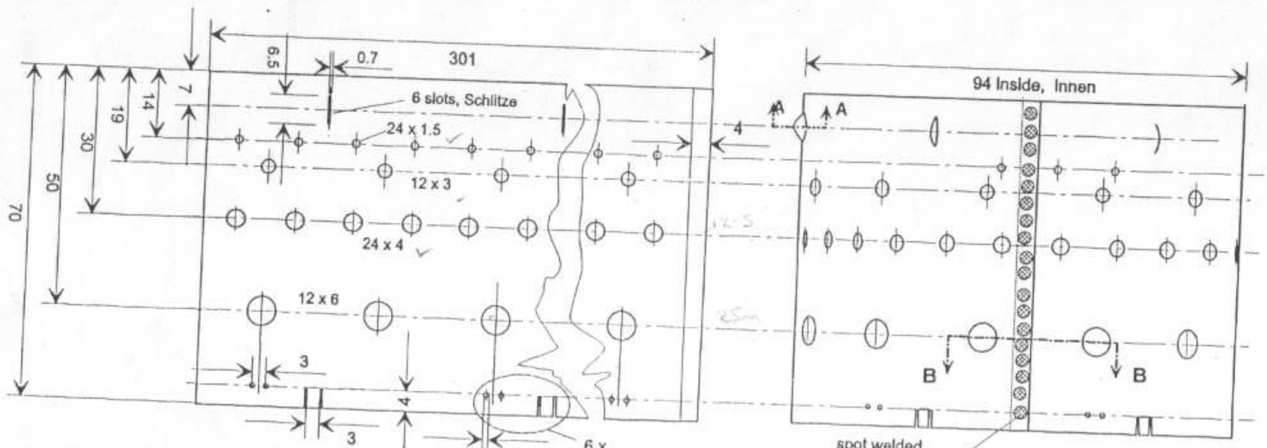
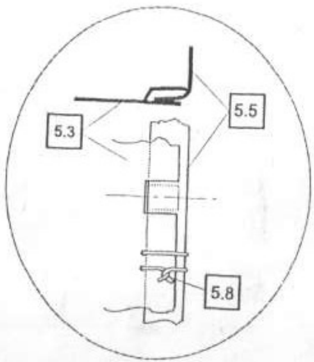
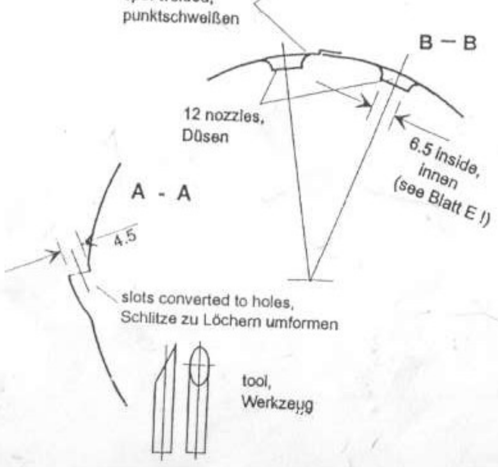
Version: 5.2.97







part, Teil 5.3

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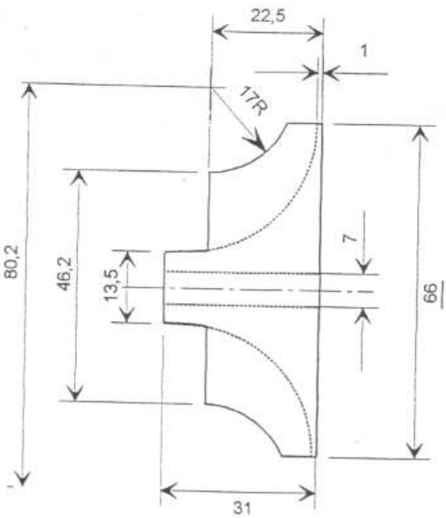
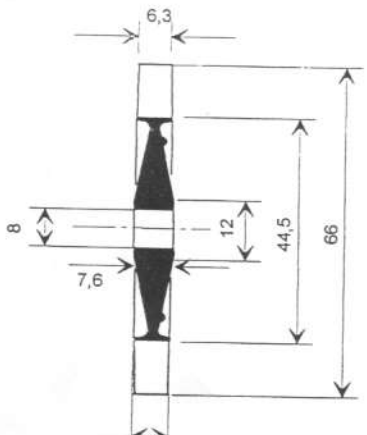
Version: 5.2.97



1.2

<u>main dimensions, Hauptmaße</u>



1.8

KJ - 66
Blatt : Q
Version: 5.2.97

Jesús Artés De Arcos
Kurt Schreckling

Building Instructions and Plans for the

KJ-66 TURBOJET ENGINE

1. Preface

Special recommendation: **Before machining any components, fully read the building instructions!**
The design of the ***KJ-66*** is based on 10 years experience and development in model turbojet engine construction. The following plans and building instructions contain full details on how to build and assemble a fully working ***KJ-66.*** This project is intended for the experienced home shop machinist with access to precision metal cutting bench lathes and milling machines. Aside from the turbine disk, completed and partially machined components are available directly from the designers. These high quality components are machined to very tight tolerances, using the best materials available, in specialized shops using state of the art metal cutting technologies (CNC, EDM, etc. ...) The list of available components will eventually be enlarged but for the time being the designers do not intend to offer completed units off the shelf.

2. Specifications

Engine type	Single stage radial flow compressor, axial flow turbine
Outer diameter	111mm
Full length	240mm
Net weight	930g (depending on choice of materials)
Max. sustainable thrust	75N 16.8lb
Max. rpm	117K rpm
Pressure ratio	2.2 : 1
Airflow	0.22 Kg/s
EGT	570° C
Fuel consumption	260 ml/min. at full throttle
Oil consumption	5 ml/min.
Min. sustainable thrust	7N
Idle rpm.	36K rpm
Acceptable fuel types	Jet A1, Kerosene, Diesel/Unleaded mix
Oil	Aeroshell 500 or equivalent

3. Choice of materials

Apart from the compressor and the turbine disks, you can successfully complete the other engine components following the instructions and plans provided. Some components are rather difficult and time consuming to machine and for this reason the option of purchasing from the designers certain components, is open to each individual. A separate price list for finished, and partially finished, high quality components has been prepared.

4. Machining details

4.1 Rotating components

Compressor nut [1.1], this component must be turned from high tensile Al alloy. In order to avoid any imbalance of the assembled components, the unfinished nut, **compressor [1,2], distance ring [1.3]** and **bearing C [1,4]** are assembled to the shaft and the shaft itself is used as a mandrel held dead on center using a four jaw chuck or precision spring collets.

Compressor wheel [1.2] is a KKK manufactured spare part for automotive turbochargers. It is delivered ready to use and no machining or balancing is required.

Shat [1.5] is turned from tool steel. For higher accuracy and long term performance the shaft should be ground and lapped to the specified tolerances. Any good quality tool steal will be adequate. It is extremely important that all the specified diameters be turned **concentric to each other** maintaining very tight tolerances at all times. Failure to do so would cause serious balancing problems when all the components are fully assembled.

Distance ring C [1.3] and **Distance ring T [1.7]** are machined using the same high grade tool steel used for the shaft. Tempering is recommended for these components. **Very important**: the contact surfaces to the shaft and disks must be plane parallel.

Turbine disk [1.8] This high quality cast turbine (INCONEL 713) may be purchased directly from the designers as a ready to use completely finished component or as a blank. The latter must be bored, turned down to the specified diameter and balanced. The back side of the disk shows the **ARTÉS KJ-66** logo and a thin ring protruding from the surface (small amounts of material will be ground off this ring to balance the turbine disk). In order to bore the turbine disk, high grade split point drills must be used (tin coated or similar). The unfinished bore must be reamed within 0.01mm of the specified diameter. The correct bore diameter is a slight press fit on the shaft. The easiest way to obtain this tolerance is by polishing the shaft until the fit is correct.
Turn down the tip diameter on the lathe using high grade cutting tools with a low spindle speed setting. For this, the turbine disk as well as the distance ring T, the turbine nut and an old ISO 608 bearing, must be assembled on the shaft. The correct tip diameter is 0.3mm less than the inner diameter of the external vane holder. For an accurate fit, the final cuts should only be made once the external vane holder assembly is completed. The reason for this will be fully explained and understood further on.
If you have no access to sophisticated balancing equipment, fear not! With your very own fingers, compressed air, and some pieces of heavy duty duct tape, you'll be able to balance the turbine using my "**Finger Tip Method**". Assemble the turbine disc as per the previous paragraph but this time using a clean bearing. Hold the assembled components by the bearing's outer sleeve between two of your most sensitive fingers. Spin the rotor by blowing compressed air on the turbine blades; start with small puffs of air. You should feel the vibration caused by the unbalance between the different components through your fingers. Stick a patch of tape to the disc (any spot will do for now) so that it'll act as a balancing mass; about 2 cm^2 will do nicely. Repeat the process and change the position of the pad of tape to a point opposite its current position and repeat the process. If you cannot feel any difference keep changing the position of the tape alternating within a rectangular line when compared to the first trials. When you have pinpointed the location where the balancing mass has the best compensating effect, seal the bearing using an old cloth rapped as tight as you can and grind a small amount of mass off the balancing ring at a point opposite the tape. Repeat the above procedure using a smaller and smaller piece of tape until there is no noticeable vibration. For this balancing method, a piece of tape of about 6 x 6mm should give a considerable response. I you run out of patience trying to balance the turbine using this method, you ought to consider giving up the idea altogether and consider the purchase of a production engine!

Turbine nut [1.9] is machined from heat proof steel in order to avoid metal fatigue. If you don't have access to this material, use SS 310 or similar.

<u>4.2 parts 2.1 to 2.3</u>

The **shaft tunnel [2.1]** should be turned to the diameter shown using the same high tensile Al alloy used for the compressor nut. The fit of **ball bearing T [1.6]** must allow certain amount of axial slip when applying low force. The **pre tension spring [2.2]** must deliver a minimum axial tension of 40N. The finish of the outer surface of the **sleeve [2.3]** must be very smooth in order to give good contact of the faced surfaces even during high rpm's.

4.3 Front parts [3.1] to [3.3]

The **intake nozzle** [3.1] and the **front cover** [3.3] are spun using soft grade Al sheet. The thickness, specially for the cover, must not drop below 1.5mm. Over the counter Al sheet is generally to tough as delivered for this sort of spinning. Anneal the sheet to a temperature of about 350°C for several minutes. Rapid cooling after this will not be necessary.
The outer contour of the mold should have the same profile and dimensions as the inner surfaces of the components that we need to spin. These molds can easily be turned down to the needed shape using hard plywood or MDF board. As a spinning tool, use a suitable length of square hard wood. Always use plenty of lubricant when spinning. The intake nozzle and the cover are held together with epoxy glue. This joint is reinforced with the **ring [3.2]**.
The correct clearance between the diffuser blades and the compressor wheel and cover is 0.2mm. This can only be checked once all the rotating components have been assembled to the **casing [11]**. If the fit between the **front cover** [3.3] and the **casing** [11] is not tight enough, reduce the outer diameter of the mold and re spin the cover. Do not attempt to reduce the clearance between the front cover and the compressor below 0.2mm as this will not improve the engine's performance. Drill the 3.2mm hole through the front cover using the **compressor diffuser** [4] as a template.
If you rather turn the front cover and intake nozzle in one piece from solid Al alloy, keep the all around thickness within 1.5mm.

4.4 Compressor diffuser [4]

You will need access to a milling machine in order to machine this component.

4.5 Combustion chamber part [5.1] to [5.9]

The indicated thickness for these sheet parts are considered as minimum. Using thicker material will not affect the all around performance of the engine but only its total weight. An excellent material for these components is Inconel 600 sheet. If you cannot find this type of material, any other equivalent will do (such as SS 310). In order to hold the combustion chamber together, TIG welding will undoubtedly give far better results than spot welding.
The **vaporizer sticks** [5.4] can be made out of SS 6 x 0.3mm tubes. These can easily be attached to the **combustion chamber back part** [5.5] using a spot welder. Alternatively, they can also be TIG welded.
If no ignition is desired, two instead of one **comb. struts** [5.7] must be mounted at opposite points of the **combustion chamber exterior part [5.3].**
The assembly of these components is completed using 6 **wire loops [5.0].**

4.7 Fuel pipe assembly parts [7.1] to [7.4]

The **fuel connector** [7.1] can be turned from any M4 screw. The **fuel injectors [7.4]** can be made out of stainless steel tubes. The internal diameter should be between 0.5mm and 0.7mm. Other dimensions of this assembly are less critical. Verify the correct operation of this assembly before attaching it to the combustion using a low flow of starting gas. The length and shape of the flames coming out of each injector should all be the same.

4.8 Starting gas pipe assy. parts [8.1] to [8.4], oil pipe assy. parts [9.1] to [9.4]

The assembly procedure of these components is similar to 4.7

4.9 Exhaust gas vane system. Parts [10.1] to [10.4]

These components can be made using heat resistant alloys (such as 25% Cr., 20% NI., 2%Si.) If you use SS (18% Cr., 10% Ni.) the thickness of the turbine **guide vanes [10.1]** should be augmented from 0.7mm to 0.8mm. Cut out the blades using the profile outlined in the drawings. Sharpen the trailing edges to form a sharp knife edge between the "tip" line and the "root" line. Chamfer the leading edge of the same surface. Bend each vane as per the drawing. These radii are less critical.

The most difficult machining part is cutting the slots required for the vanes at the **ext.** and **inter. vane holders** [10.2], [10.3]. These slots should be 0.1mm thicker than the vanes and 0.5mm longer than the shown "root section" and "tip section". If you have no access to special cutting equipment, such as EDM, cut the required rings from sheet metal as per the drawings. TIG welding is preferred to MIG welding for the final assembly of these parts.

Cut the required slots using a fret saw. Bend the tips over to the rings and weld the diagonal seams formed. Clean the joint.

To turn the outside of the ext. vane holder on the lathe, press it on a 66.35mm o.d. mandrill. Retouch the slots with a small portable grinder.

Turn the centering ring but bore the i.d. to 25.5mm rather than 26mm. Adjust the central ring **[10,4]** to the internal vane holder **[10.3]** using the centering device and hold these together with 15 welding spots. These spots should fall between the slots of the internal vane holder.

Additionally, press the **external vane holder** [10.2] on the centering device. Press the **vanes** [10.1] from the outside through the slots cut into **[10.2]** until their smaller edges (10mm) find their way into the slots cut in **[10.3]**. Shorten the excess material of these vanes **[10.1]** to about 0.5mm outside of **[10.2]**. Weld the vanes from the outside of **[10.2]** and inside of **[10.3]** as far as possible. Touch up the outer welds on the lathe. Remove the entire unit from the centering device and complete the welding between the vanes **[10.1]** and **[10.3]**.

Center this unit on the lathe in such a way that you can turn the i.d. to 66.4mm of the external van holder **[10.2]** and 26mm of the central ring [10.4]. It is important that the 26mm be a tight sliding fit with the shaft tunnel **[2.1]**. It makes no difference if the 66.4mm diameter is 0.1-0.2mm larger than the tip diameter of the vanes **[10.1]** If the final diameter of [10.2] is a little larger than 66.4mm turn the final o.d. of the turbine to this size. This is why the final o.d. of the turbine disc should not be turned down until these components have been completed.

4.10 Casing [11]

Before attempting any work whatsoever on the CV 470 cartridge, make absolutely sure that it is empty!

It is only necessary to remove the factory paint work from the "hot" end of the cartridge. These are the lathe steps necessary to convert the CV 470 to a **KJ-66** turbine **casing** [11]. Cut a hole of 67mm first. Cut the casing to the correct length. Open out the diameter to 68mm using a 45° bull nose dead center of suitable size. To accomplish this correctly, grip a ring of aprox. 70mm i.d. in the chuck. Hold the Gaz canister between centers pressing the bull nose dead center against the canister to obtain the correct casing shape as per the drawings. The holes for parts **[7.1]**, **[8.1]**, **[9.1]** and the **oil pressure connector** [15] may be drilled at any position of the circumference 16mm from the front edge. If no glow plug is to be used, the 6.5mm hole is reduced to 3.2mm.

4.11 Flange A, flange B [12.1], [12.2]

See supplied drawing.

4.12 Exhaust nozzle parts [13.1] to [13.3]

You can use Inconel 600 instead of SS if you have access to this material. To form the shape of the **external exhaust nozzle** [13.1] turn the adequate molds first. The external shape of these molds should be the same as the inner shape of the desired cone. For these molds, mild steel will do nicely. The other parts are made very much in the same way.

Cut the developed view from the selected sheet metal. Bend it to form a cone shape. TIG weld and clean the seam. Press the formed shape onto the corresponding mold and hold it in place with a revolving bull nose center. Spin the thicker end to shape. If you turn the mold 1mm shorter than the cone at the smaller end it will be easier.

The final length of the nozzle and the cone can be cut to the correct length with an abrasive disc or a slitting saw. TIG weld (or spot weld) these parts to the three cone holders [13.2].

5. Final Assembly

Carefully follow the assembly instructions detailed in the following paragraphs.

Press the exhaust guide vanes from inside the casing until the angled rim of part **[10.2]** touches the casing. (See sheet P step c, d). Drill out the holes for the **M3 screws [14.3]** using the **flange B [12.2]** as a template. Put **flange A [12.1]** on the EGV. Press the part together using 12 M3 x 20mm screws right up to step d. Replace the longer M3 screws one by one with the **M3 [14.3]** screws

Clip the fuel pipe assembly and the starting gas assembly to the combustion chamber. Adjust the **injector tubes [7.4], [8.4]** into the **sticks [5.4].** These injectors should be inserted touching the walls of the tubes some 3mm from the front. Bend the **fuel pipe [7.2]** and the **starting gas pipe [8.3]** to form an S loop so that the connectors **[7.1]** and **[8.1]** come close to the corresponding holes of the casing **[11].** Insert the combustion chamber into the casing and secure it in place using the M3 **screws [14.4]** and the glow plug. Pass the connector **[7.1]** and **[8.1]** through their corresponding holes and secure them with washers and nuts.

Fit the oil pipe to the **shaft tunnel** [12] as shown in Sheet C1. Check the oil connections by pressurizing to about 0.1 bar an oil container connected to the pipe. You should see oil oozing into the shaft tunnel after several seconds.

Insert the **ball bearing C** [1.4] into the shaft tunnel. Assemble the unit to the **compressor diffuser** [4] using the M3 **screws [14.2];** apply a chemical thread locking compound such as Locktite to the threads of these screws. Bend the oil pipe to form a S shaped loop. Slightly lubricate the inside of the casing where the compressor diffuser will be fitted. Insert the whole assembly into the casing as far as it will go. Pull the oil connector through its hole. Press the assembly centrally into the casing. Make sure that the four outer M3 threads of the compressor diffuser mate their corresponding holes in the casing. If you cannot do this, insert a 21mm plastic rod from behind into the shaft tunnel. Gently, strike the plastic rod with a small hammer; this may take several blows. Secure the cover using the M3 **screws [14.1].**

This is the moment to do all the final adjusting and turning as described in chapter 4.1. Check the clearance between the tip of the turbine blades and the ext. vane holder [10.2] The recommended all around clearance is 0.15mm

Check the fit of the front cover to the casing and retouch as necessary.

Insert the **pre tension spring** [2.2] and the **sleeve** [2.3] into the shaft tunnel. Push the shaft with **the ball bearing T, distance ring C** and turbine completely assembled into the shaft tunnel. Insert the **distance ring C** into the shaft tunnel. Preheat the compressor wheel to about 50° C with a hair dryer. Push the compressor wheel into the shaft and secure in place with the compressor nut. This is best done using a 3mm piano wire inserted into the nut hole acting as a tommy bar and holding the shaft from the other end with a socket wrench. Make sure that the rotor assembly does not touch any internal component imparting a gentle spin with a hair dryer or similar blower.

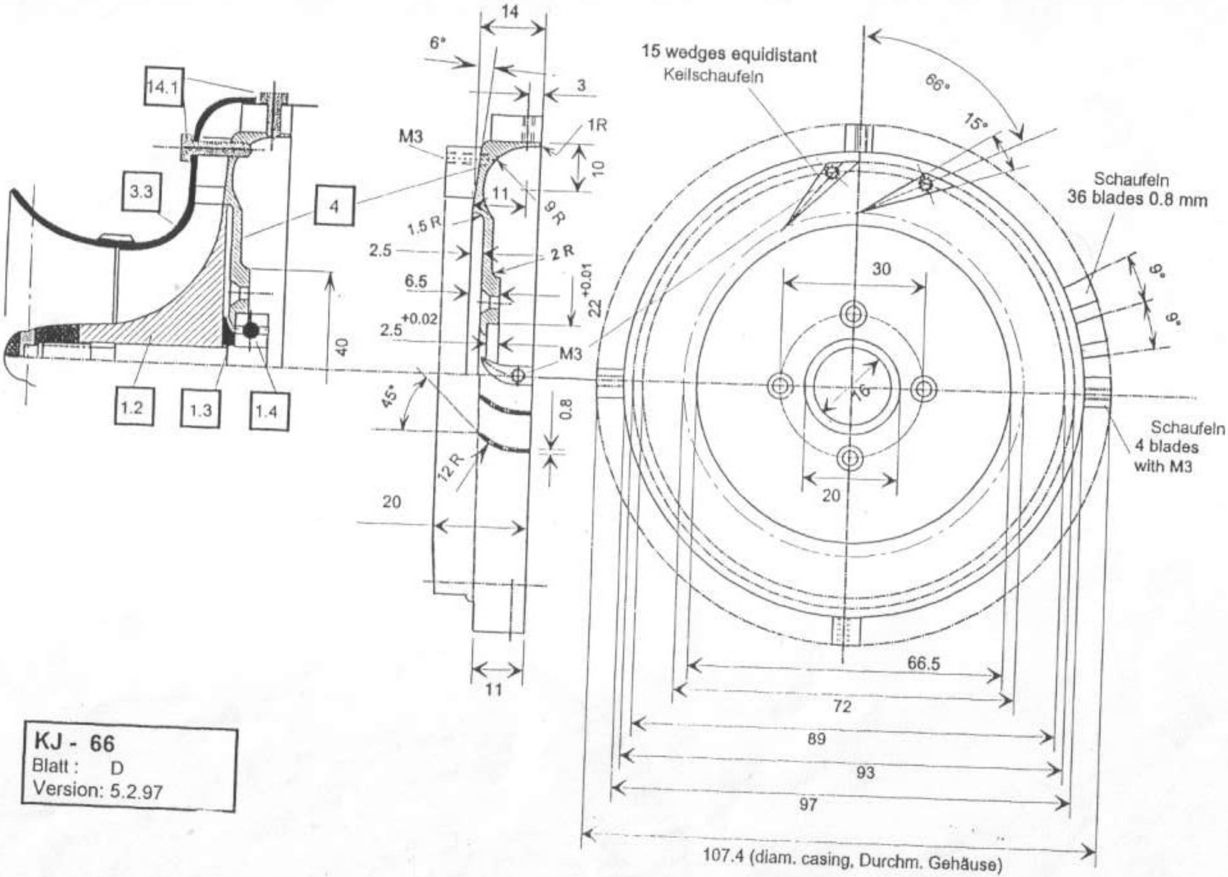
Assemble the front components of the engine. Check again the clearance between the compressor and the front cover.

Seal the fit between the front cover and the casing as follows: take out the front screws [41.1] about 1mm. Pull the front cover against the back part of these screws. Apply a thin bead or silicon rubber. As soon as the seal cures, the engine is ready for its first test run. The exhaust nozzle should not be mounted for the time being.

6. Test run

If you have no experience whatsoever in the operation of miniature gas turbines, you should seek experienced guidance. You can seriously damage the internal components of the engine if you do not observe the standard start up procedures for miniature gas turbines.

To be continued...



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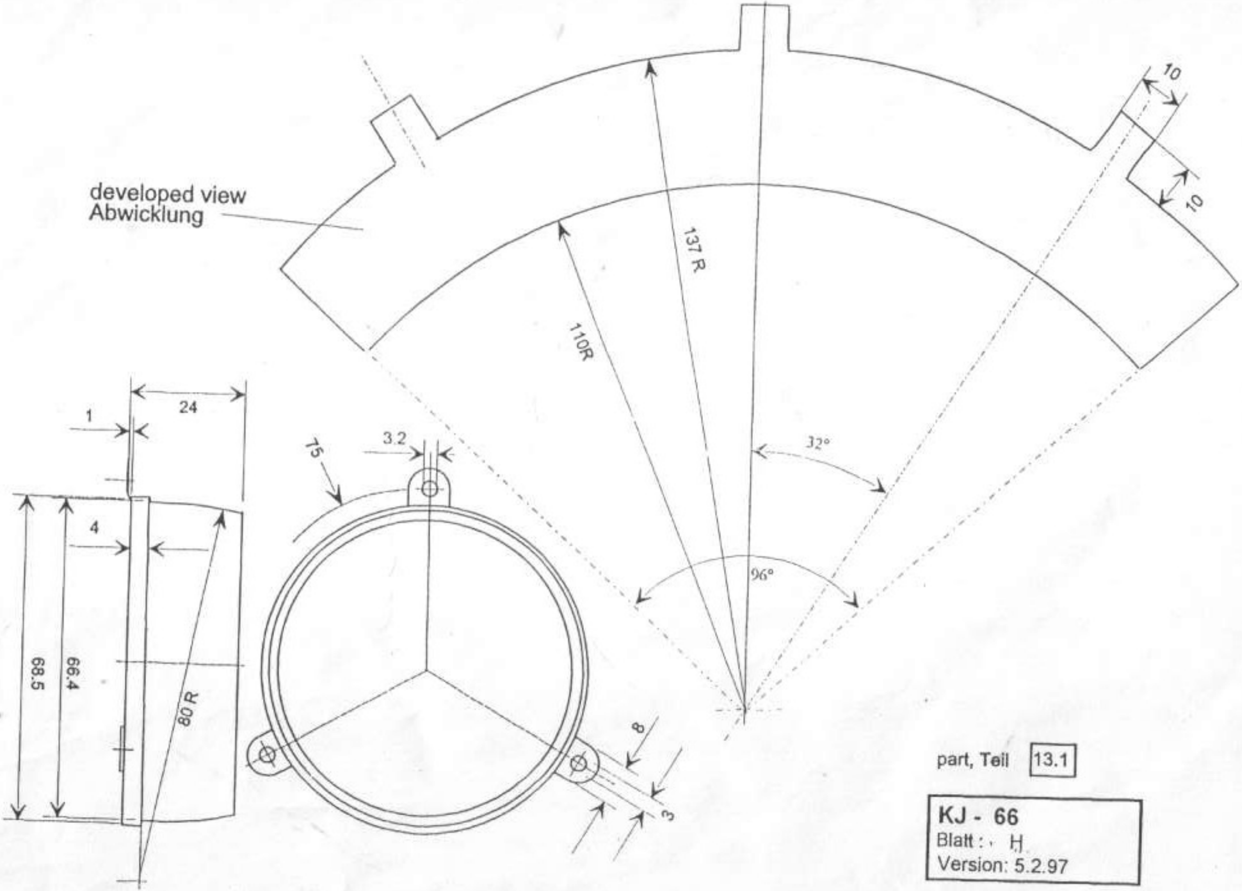
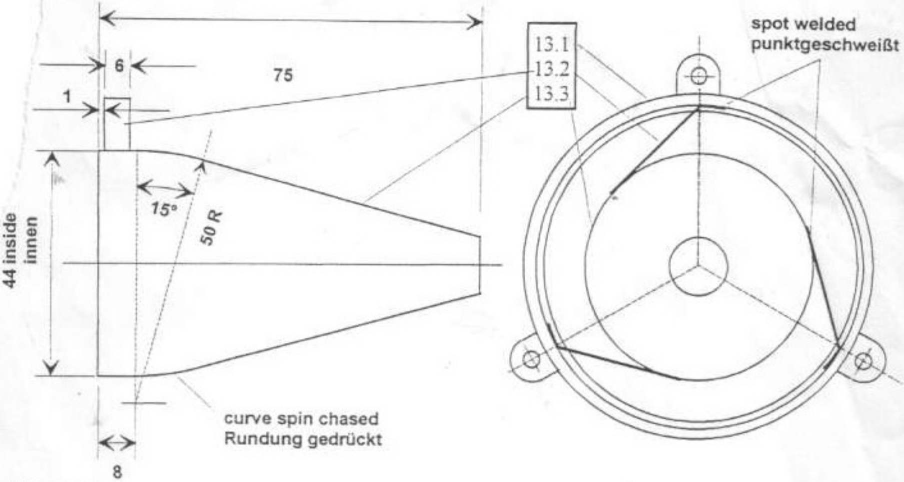
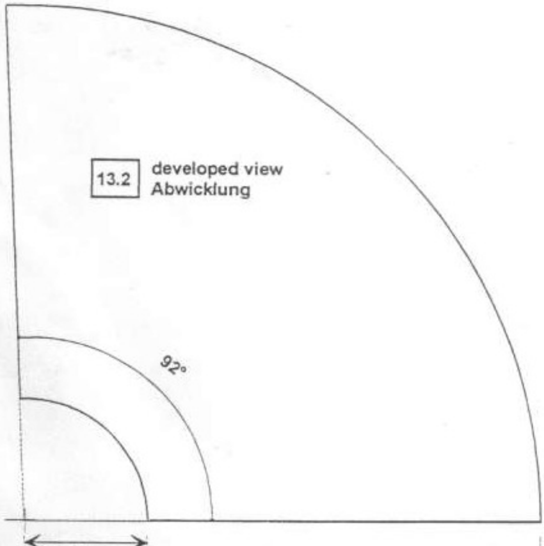
Version: 5.2.97



part, Teil 13.1

KJ - 66
Blatt : H
Version: 5.2.97





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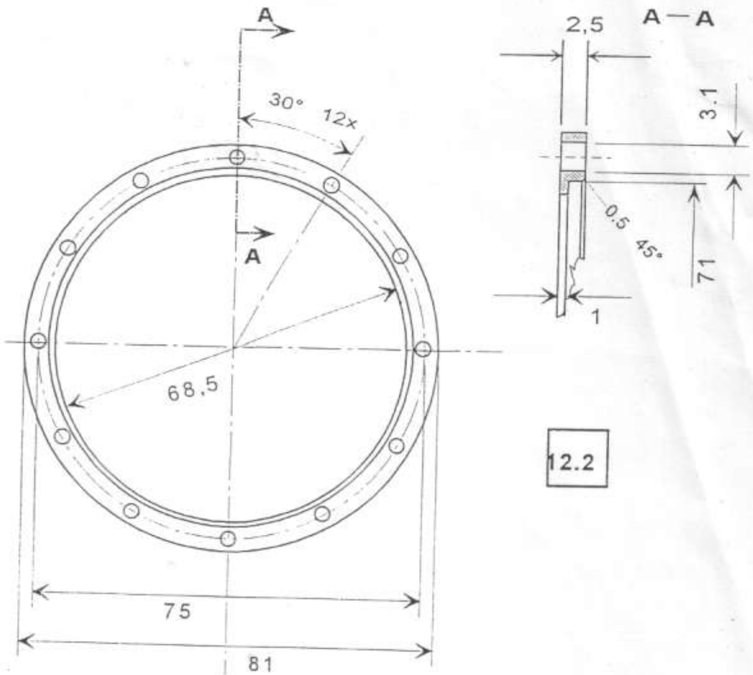
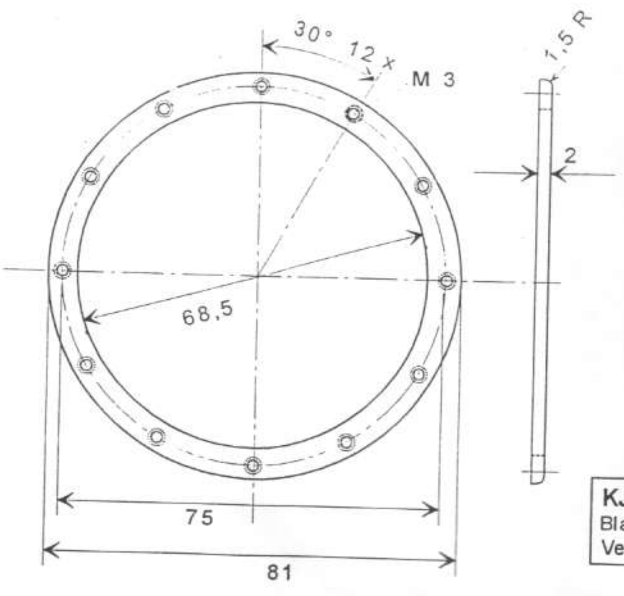
Version: 5.2.97



12.2



12.1

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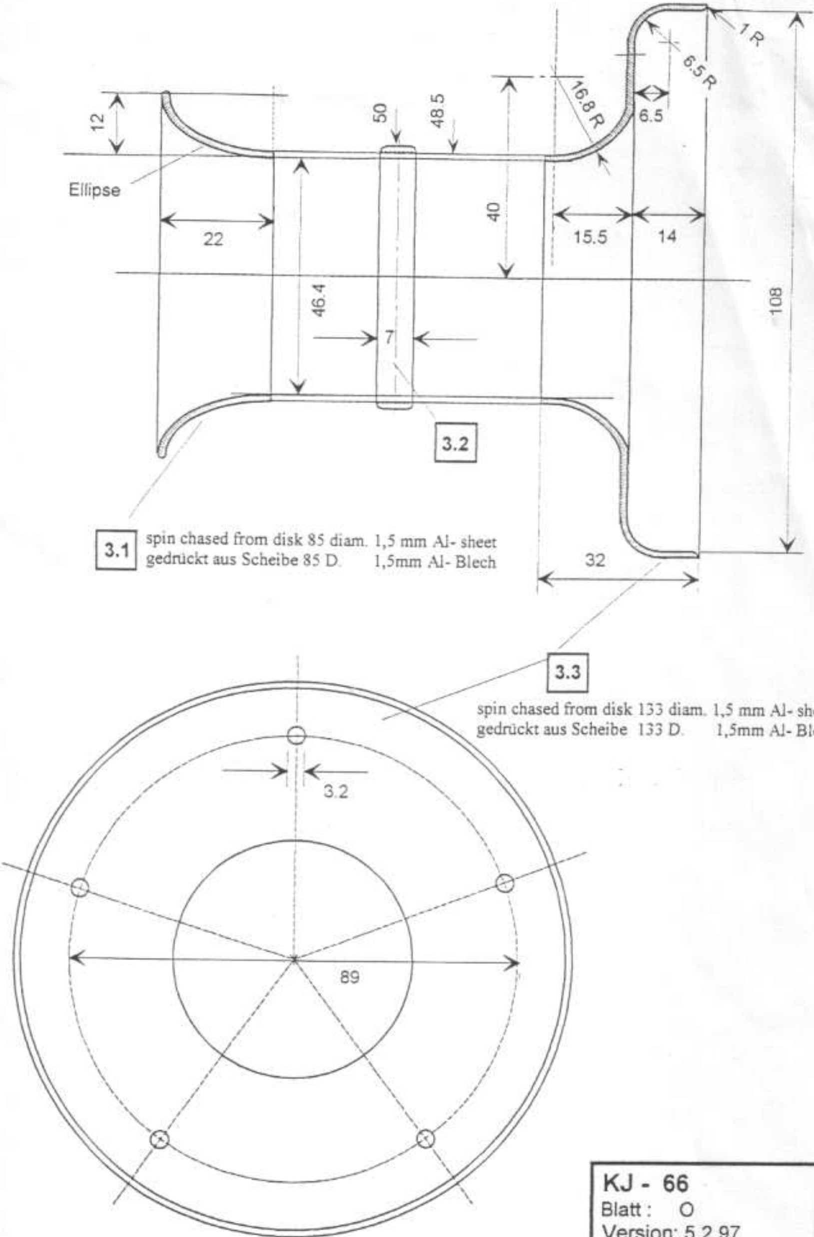
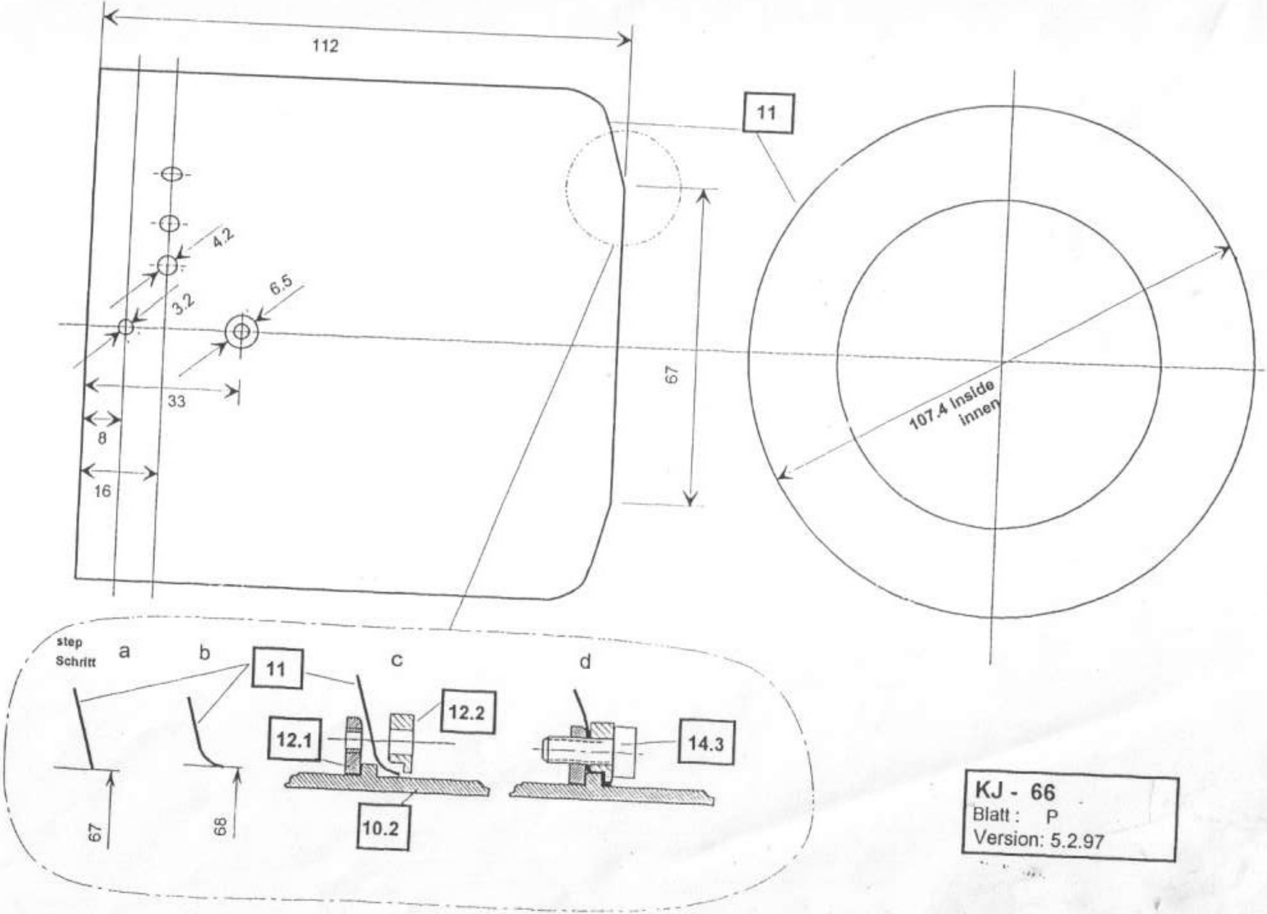
Blatt NR: M
Version: 04.02.97ing



3.1 spin chased from disk 85 diam. 1,5 mm Al- sheet
gedrückt aus Scheibe 85 D. 1,5mm Al- Blech

3.3 spin chased from disk 133 diam. 1,5 mm Al- sheet
gedrückt aus Scheibe 133 D. 1,5mm Al- Blech

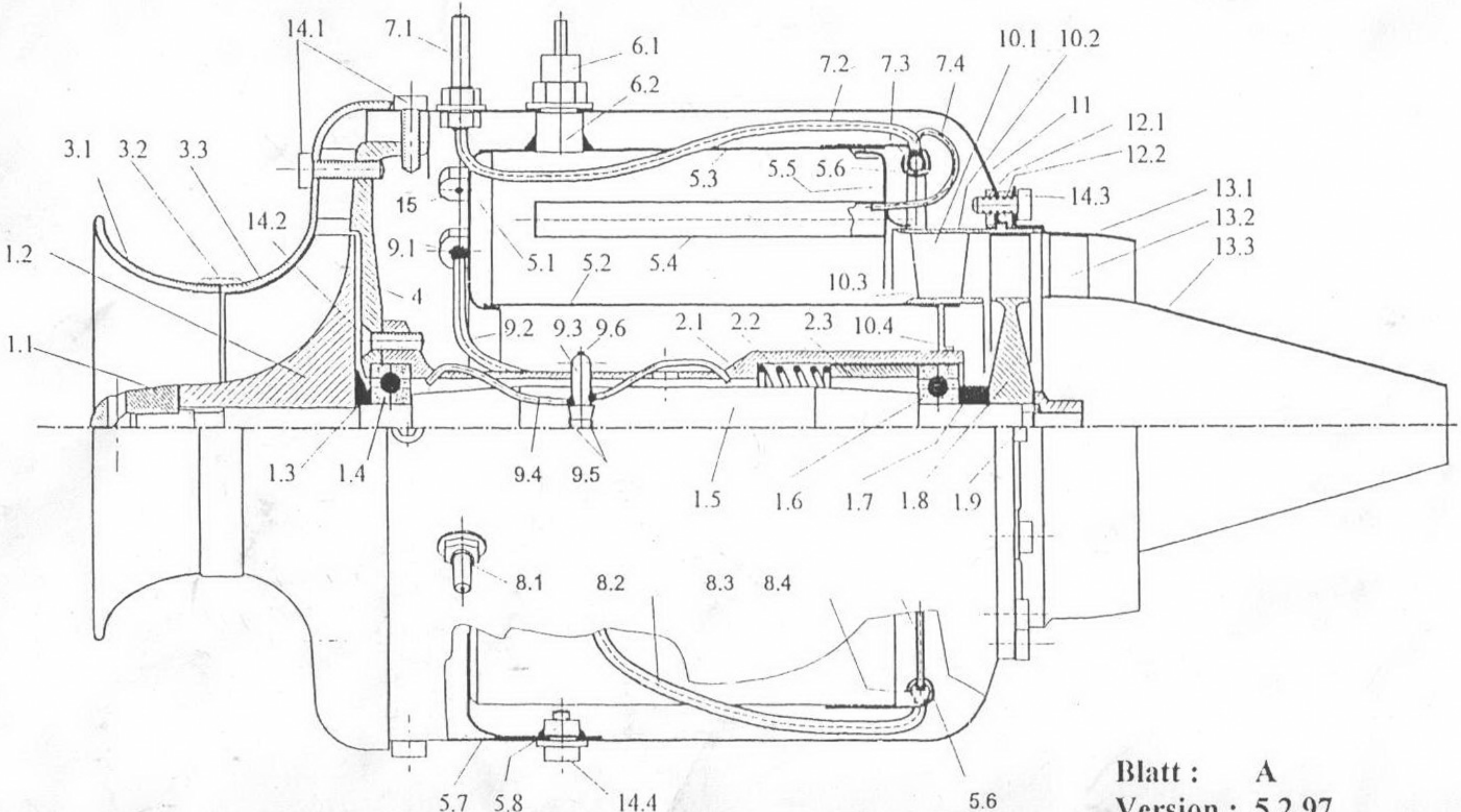
KJ - 66
Blatt : O
Version: 5.2.97



KJ - 66
Blatt : P
Version: 5.2.97

Turbostrahltriebwerk
Tubojet Engine

KJ - 66



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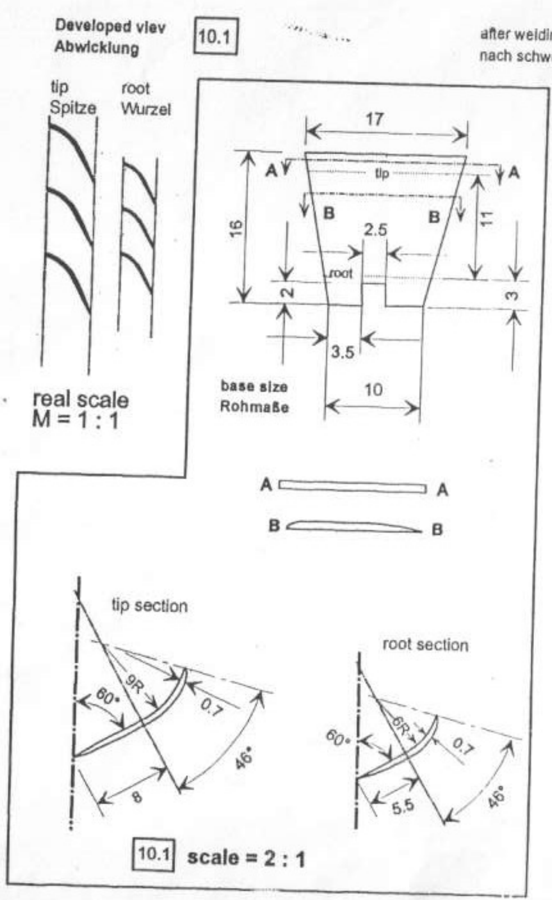
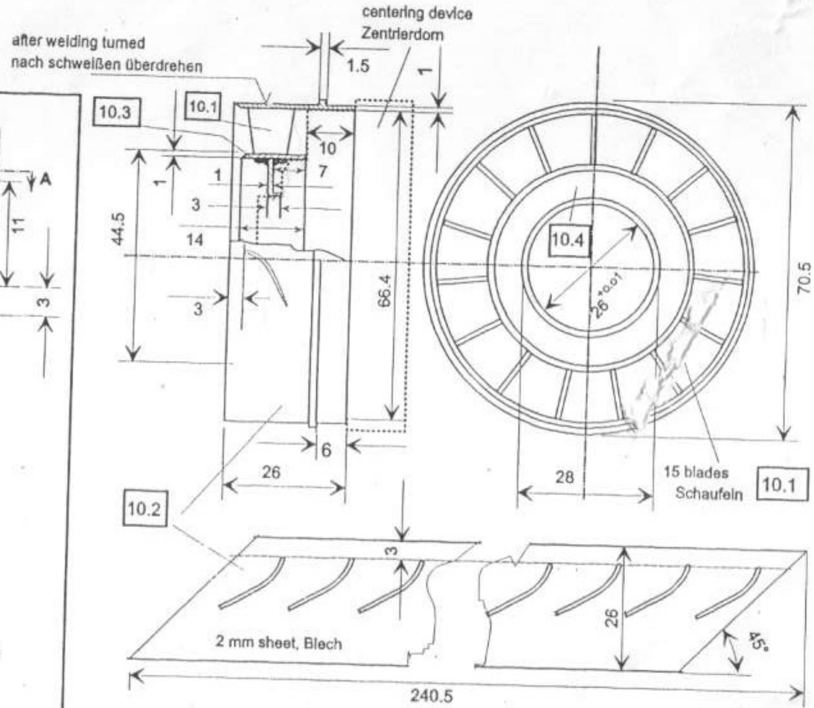
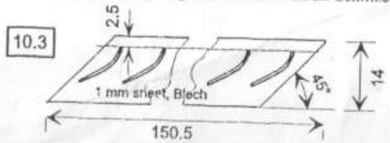




Making the rings from sheet material: Cut the slots for the blades first. Bend strip to a ring. Weld diagonal edges. Retouch slots to the right dimension.

Herstellung der Ringe aus Blech: Zuerst Schlitze für Schaufeln ausschneiden, dann Streifen zu einem Ring biegen und verschweißen. Schlitze nacharbeiten.



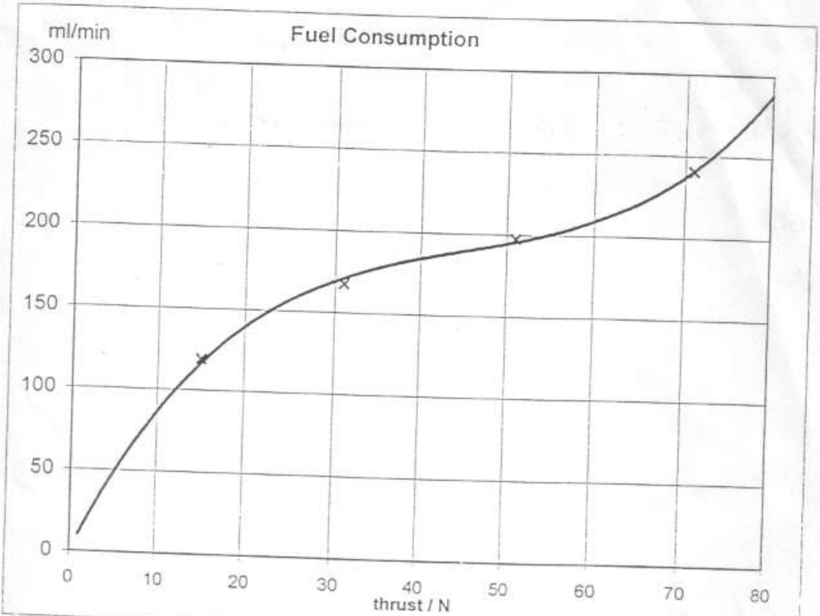
KJ - 66
Blatt : L
Version: 15.2.97

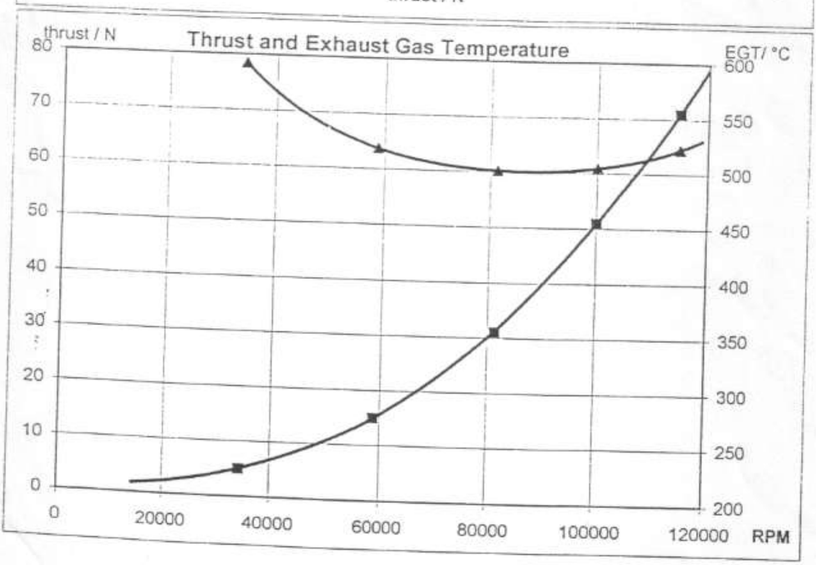
	Turbojet Engine KJ - 66			*list of parts page 1 from 2*		
pos.	*designation*	*mount*	*type of alloy*	*half finished parts*	*Code for finished part*	*dim. draw* *Blatt*
1,1	compressor nut	1	AlZnMgCu	round stock 15mm	1.1shaftset*	B
1,2	compressor wheel	1	Al alloy		K26-2670GA Nr.53261232019	Q
1,3	distance ring C	1	tool steel	round stock 20mm	1.3 shaftset*	B
1,4	ball bearing C	1			ISO 608 C3 with plastic - fibre cage	
1,5	shaft	1	tool steel	round stock 20mm	1.5 shaftset*	B
1,6	ball bearing T	1			ISO 608 C3 with plastic - fibre cage	
1,7	distance ring T	1	tool steel	round stock 15mm	1.7 shaftset*	B
1,8	turbine disk	1	Inconel 713		1.8 ARTES KJ- 66*	Q
1,9	turbine nut	1	st. heat proof	round stock 15mm	1.9 shaftset*	B
2,1	shaft tunnel	1	AlZnMgCu	round stock 40mm	2.1 shaftun*	C
2,2	pre- tension spring	1	spring steel		2.2 shaftset*	C
2,3	sleeve	1	tool steel	round stock 25mm	2.3 shaftset*	C
3,1	intake nozzle	1	Al 99.9	sheet 1,5 mm	3.1 frontset*	O
3,2	ring	1	AlMg	round stock 60mm		O
3,3	front cover	1	Al 99.9	sheet 1,5 mm	3.3 frontset*	O
4	compressor diffuser	1	AlZnMgCu	round stock 120mm	4 compdif*	D
5,1	comb. front	1	INOX	sheet 0,4 mm	5.1 combuset*	G
5,2	comb. interior part	1	INOX	sheet 0,3 mm	5.2 combuset*	E
5,3	comb. exterior part	1	INOX	sheet 0,3 mm	5.3combuset*	F
5,4	stick	6	INOX	tube 6 x 0.5 mm	5.4 combuset*	G
5,5	comb. back part	1	INOX	sheet 0,4 mm	5.5 combuset*	G
5,6	clip	5	INOX	sheet 0,4 mm	5.6 combuset*	K
5,7	comb.strut	1	INOX	sheet 0,4 mm	5.7 combuset*	K
5,8	nut	1	INOX	round stock 15mm	5.8 combuset*	K
5,9	wire loop	6	INOX	wire 0.6 mm	5.9 combuset*	F
6,1	glow plug	1			any standard brand	
6,2	glow plug nut	1	mild steel	round stock 10mm		K
					*** available from designers**	

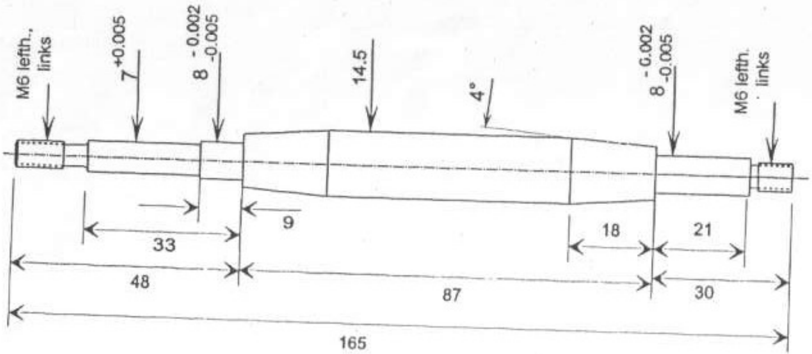
				list of parts page 2 from 2		
7,1	fuel connector	1	brass	round stock 10mm		J
7,2	fuel pipe	1	brass	tube 2x0.4 mm		J
7,3	fuel distributor	1	brass	tube 3x0.4 mm		J
7,4	fuel injector	6	brass	tube 1x0.2 mm		J
8,1	suppl. gas connector	1	brass	round stock 10mm		J
8,2	suppl. gas pipe	1	brass	tube 2x0.4 mm		J
8,3	suppl. gas distributor	1	brass	tube 3x0.4 mm		J
8,4	suppl. gas injector	2	brass	tube 1x0.2 mm		J
9,1	oil connector	1	brass	round stock 10mm		C
9,2	oil pipe	1	brass	tube 2x0.4 mm		C
9,3	oil distributor	1	brass	tube 3x0.4 mm		C
9,4	oil injector	2	brass	tube 1x0.2 mm		C
9,5	wire loop	1	INOX	wire 0.6 mm		C
9,6	pin	1	steel	piano wire 1mm		C
10,1	turbine guide vane	15	Inconel 600	sheet 0,7 mm		L
10,2	ext. vane holder	1	INOX	sheet 2,5 mm		L
10,3	int. vane holder	1	INOX	sheet 1 mm		L
10,4	centering ring	1	INOX	sheet 4 mm		L
11	casing	1	steel		Camping Gas cartridge CV 470	P
12,1	flange A	1	INOX	sheet 2 mm		M
12,2	flange B	1	INOX	sheet 3 mm		M
13,1	ext. exhaust nozzle	1	INOX	sheet 0.4 mm		H
13,2	cone holder	1	INOX	sheet 0.6 mm		N
13,3	exhaust cone	1	INOX	sheet 0.4 mm		N
14,1	screw	9	st. high grade	hex. socket M3x10		
14,2	screw	4	st. high grade	flat head M3 x 10		
14,3	screw	12	INOX	hex. socket M3x10		
14,4	screw	1	st. high grade	hex. socket M3x5		
15	oil pressure connector	1	brass	round stock 10mm		J

Turbojet Engine KJ-66

(test results 1013 mb, 8°C)







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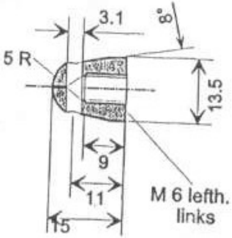

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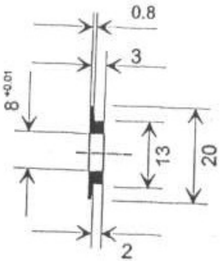

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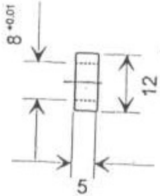

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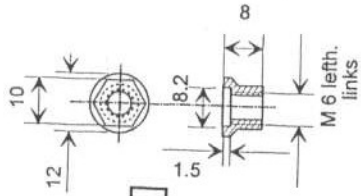
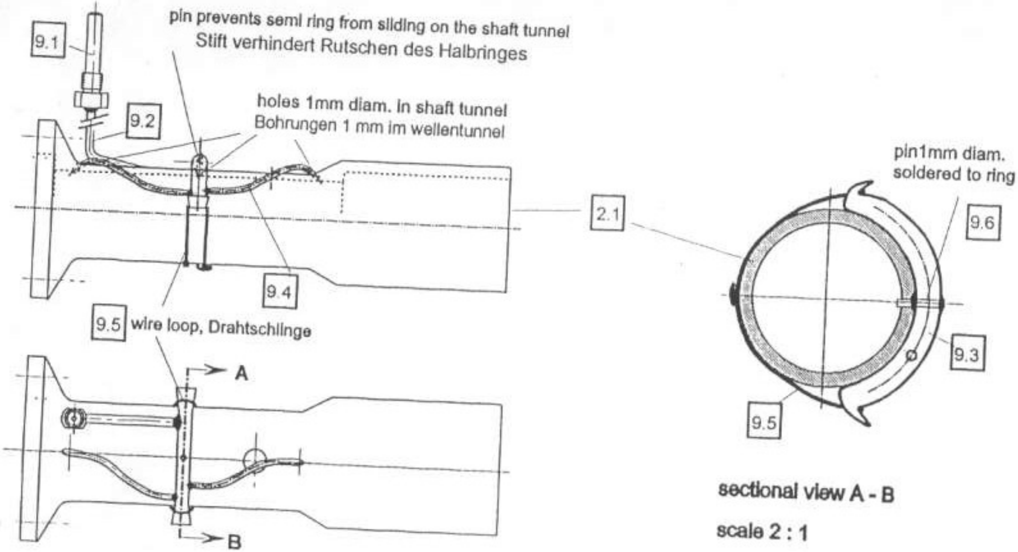


1.9

KJ - 66
Blatt : B
Version: 15.2.97 welle

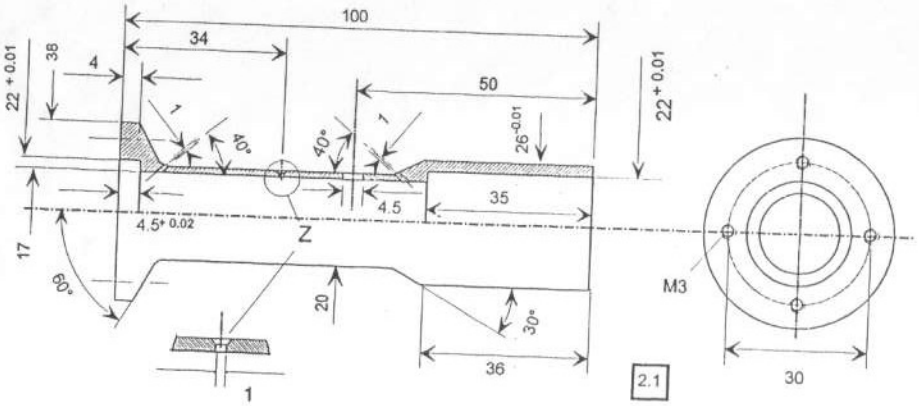
Assembling the oil distributor to the shaft tunnel
Zusammenbau Ölverteiler mit Wellentunnel

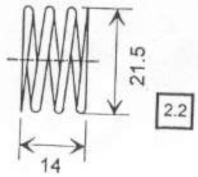


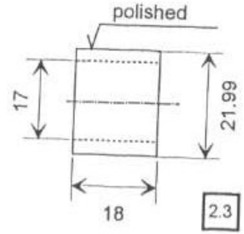
sectional view A - B

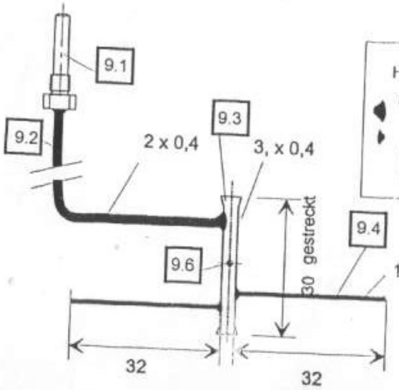
scale 2 : 1

KJ - 66	
Blatt :	C 1
Version: 5.2.97	Olmont



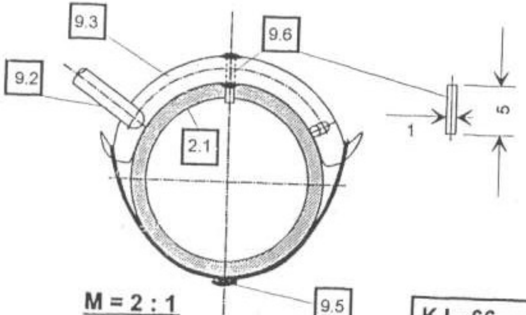






Hartlötverbindungen
alle Rohre MS

hard- soldered
all tubes brass



M = 2 : 1

KJ - 66
Blatt : C
Version: 15.2.97

Set-up procedure and Start-up procedure for a my KJ66

I wrote this to help give beginners an idea of a typical set-up for a KJ66, I don't give this information as the definitive answer to the meaning of life but just a simple guide to give some basic ideas, f you find any mistakes then I apologise now.

The KJ66 has a single stage centrifugal compressor as used in car turbochargers, an annular combustion chamber with 6 reverse flow fuel burners and an axial turbine, the basic engine weighs in the region of 2 to 3 LBS and has a rotational speed of 30,000 RPM @ idle and between 100,000 and 120,000 @Max RPM, these figures vary according to the accuracy of balance of the engine.

Some of the things you will need are:
Fire extinguisher, Electronic speed controller, propane/butane gas can or brazing can for silver soldering, electric motor with coupling and on/off switch or suitable blower fan, Radio control gear, ignition source of some kind, suitable test bench to strap the engine to, it's a good idea to have this securely fixed down. Pressure gauge reading 0 to 3 BAR or 0 to 30PSI

Some basics
The KJ66 uses a speed controller from an electric flight aircraft to power the fuel pump and vary the speed of the fuel pump, when you increase the fuel flow to a gas turbine the engine RPM increases.
The KJ66 uses small injector pipes for its burner tubes, these do not atomise the liquid fuel so the engine uses a flammable gas to preheat these burner tubes before the liquid fuel is sent into the engine, you'll need a can of propane or butane or propane/butane mix, this is used for starting the engine only, once the engine is heated and them running on liquid fuel this preheat gas is disconnected.
This gas is fed into the combustion chamber and ignited, there is then a flame inside the combustion chamber that is heating the burner tubes, when liquid fuel touches the insides of these burner tubes it vaporises into an ignitable gas.
The KJ66 is spooled and started up using either an electric motor diving the spinner on the front of the compressor or a blower fan/compressed air to blow the compressor round, either way is ok.
I use a blower to start my engine, this is a fan heater blower from a car, I have modified this with a nozzle to accelerate the air which is a plastic pop bottle and use 2X 12v batteries in series to give 24volts to power this blower.
To lubricate a KJ66, oil I pumped to the bearings, I use 6 to 8% two stroke oil which is mixed with the fuel (paraffin/kerosene/JET A1/white spirit) in the fuel line there is a T-junction that splits the fuel pipe in two, one pipe goes to the injector pipes and the other goes to the oil inlet pipe to feed the bearings tis fuel/oil mix,
After the bearings this fuel/oil is passed back into the engine to burn.

Setup
Ensure all fixtures and fittings are secured in place, a fuel pipe disconnecting and spraying you or the engine with neat fuel is NOT a good thing to have happen!
Ensure that the test bench is held down, a KJ66 or any other engine has enough power to topple a bench over.
Has the fuel got oil in?
Has the fuel been filtered? Any little piece of grit etc will block fuel and oil lines, it only takes a split second of fuel/oil starvation and a bearing fails.
Are all batteries charged?
Are all spectators clear of the engine? This is probably one of the most important safety issues that I can state here:
When (if) a turbine disintegrates the shrapnel goes in a direction perpendicular to the rotation of the turbine, so anyone standing in the plane of rotation when (if) it shreds a blade or worse has a disc separation/disintegration may get those hot metal parts stuck in them, even if the engine is at idle speed the engine is still running fast enough for these parts to become a major hazard! YOU HAVE BEEN WARNED! NO ONE stands inline of the turbine.
FACT: a KJ66 at idle speed is doing around 30,000 RPM and at max is doing in the region of 100,000 to 110,000 RPM
120,000 RPM if the owner has balls of steel and the rotor is well balanced!
ROTOR: when the rotor is mentioned this means the moving part of the turbine, this is the compressor, shaft and turbine, these parts combined form the rotor, these parts are tightened together and rotate as one. The bearings supports the rotor.

I have seen video footage of an engine that did have a disc explode and the only way I can describe what I saw was ‘BLOODY TERRIFYING!’ there was a sound similar to a rifle shot and objects were seen to impact against a wooden fence.
Is everything out of the way of the intake? If something gets ingested into the compressor it can write off an engine, and while I’m on the subject make sure no one puts there hand anywhere near the intake, one of my friends lost the tip of his middle finger by accident, it was gone in a millisecond!
He was removing the gas pipe and placed his middle finger in the intake by accident!!
The exhaust, make sure no one puts there hands near here, the temperature of a turbine running at idle is somewhere in the region of 500 deg C
Fuel tank filled?
Got a frequency that doesn’t clash with anyone else? Or anyone else that’s on the same frequency knows not to switch on? It’d be a shame to be testing at the flying sight and someone switches on the same channel and goes to full throttle when you weren’t expecting it!
Gear switched on and checked? Everything connected?
Is the engine flooded? Its easy to do, if you travelled with full tanks there is a chance that fuel could’ve leaked past the pump into the engine so when you light the engine all this fuel is vaporised and there is a chance that the engine could run away. i.e. rev up and up and up and up until something gives.

Start up.
This isn’t how everyone does it but this is how I do it.
Check and double check everything, especially fuel lines
Bring throttle stick and trim to fully down i.e. towards you
Switch on transmitter
Switch on speed controller and receiver
Slide the throttle trim slowly forward until fuel pump begins to hum then a little more until it begins to slowly pump fuel, watch as fuel reaches engine and disappears out of sight, wait about a second more, this should have primed the fuel lines pumping fuel almost all the way into the engine, the reason for doing this is so when you have lit the gas and are spooling the engine and begin to pump the fuel to the engine there is no delay in flare up, more of this in a minute.

Ok fuel lines primed, spectators out of the way and nothing small and loose near the intake.
Fireman briefed and at the ready?
There should be someone with a fire extinguisher ready to put out any fire that may arise, now you should let him know that there may be a few flames coming out the exhaust and that this does not give him the right to dowse the engine in white powder or what ever you have to hand. Even a bucket of water is better than nothing! He should only extinguish the fire if it is the fuel tanks or anything else that is on fire .

Ok, I think we’re ready, lets try a start
Turn on the gas (or ask your helper! And tell him/her to keep it upright else you’ll have liquid gas in the engine and if this ignites then you have either a fireball or a rapidly accelerating engine)
So turn on the gas in the propane preheat bottle that is connected to the engine, spool the engine up for a second so that it is just turning over at about 1000 RPM and ignite he gas at the exhaust, I use a cigarette lighter but you may have followed the plans completely and use a glow plug that extends into the combustion chamber, if so connect this to a 2v battery, the propane preheat will now ignite with a pop and the flame should go into the engine, if it doesn’t ignite then either the engine is spooling to high in which case let it spin down a little more and try again or there isn’t enough gas so open the valve a little more you’ll know when there is a flame there by the sound.
Now the gas has ignited spool the engine with what ever method you are using and begin to move the trim on the throttle stick SLOWLY to start the fuel pump running SLOWLY, I say slowly cos. if you pump too much fuel in too early then not all the fuel burns and you have a fireball of unburned fuel out the back.
When the fuel enters the engine you will hear it flare up and the engine revs will increase rapidly, keep moving the trim forward slowly and watch the pressure gauge that is connected to the case of the engine, this pressure gauge shows what the engine is doing,
So keep moving the trim forward while spooling the engine, when the gauge starts to show a pressure of about 1 or 2 PSI you should be able to disconnect the spool up device and the engine should keep running on its own, this will probably be its self sustain speed, you’ll need to bring this speed up a little higher than this to its idle speed, a gas turbine won’t accelerate very well from sustain speed to that is

why the idle speed is a little higher, you’ll have to work this one out on your own, basically it’ll speed up better at idle speed than sustain speed.
Now you can turn off and disconnect the preheat gas supply.

Your engine is now running,
To shut down its best to bring the engine to idle and stop the fuel pump, then attach the spool up device and keep the engine turning over to cool it down to prevent anything warping

All the details given here are given in good faith and you follow these at your own risk,
So you can’t hold me responsible if it goes wrong!
WATCH THOSE EYEBROWS AND KEEP UP THE THRUST!