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REPORT

CD NO.

COUNTRY USSR (Kuybyshev Oblast)

SUBJECT Activities of the Junkers Group at Zavod No. 2, Upravlencheskiy, near Kuybyshev

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[redacted]

PROJECTS WORKED ON AT ZAVOD NO 2

JUMO 022

General:

3. The original design for the JUMO 022 turbo prop engine was started in the early part of 1948 by order of the Soviet War Ministry. Prior to the order, some theoretical work was performed under the direction of Dr Vogts. The first engine was fabricated by the fall of 1949 and a total of ten were completed by the time of my departure in September 1950. Each engine was numbered, one through ten consecutively. The first three engines were designed as the 022 and the engines from four through ten were designated as 022A. The variations in the ten engines were those found necessary through tests. All engines were built at Zavod No 2, including the standard hardware such as nuts and bolts, normally supply items.

4. Engine models that were contemplated but never built were the 022C and D. The 022C was planned by the design department and worked out by Dienhardt, Chief of the Compressor Group. It was to have only eight stages. The 022D was planned by the Experimental Department.

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5. [redacted] an 022F engine was in the stage of construction. This was to be an improved model and its objective was to achieve a specific fuel consumption of less than 300 g/hp/hr. [redacted] The specifications for the 022F [redacted] called for a maximum power of 5000 hp with a specific fuel consumption of 320 g/hp/hr. [redacted]

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6. [redacted] engines numbered eight and nine were set aside for the state acceptance run [redacted]

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Leading Particulars and Performance:

7. The following is a summary of leading particulars and performance of the 022A as of September 1950:

Fuel: Parrafin — Specific Gravity .823 - .828; Heat Content 10,000 k cal/kg

Compressor: Rotor - 14 stages*
Stator - 13 stages*

Turbine: 3 stages*

Compression ratio: 1:5 or 6

Turbine Temperature: 1st stage entry - 1105° Kelvin*
3rd stage exit - 750° Kelvin*

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RPM: Takeoff 7700*
Cruise 7000

Power (Maximum): 4500 HP (at propeller)*

Residual Thrust (Maximum): 960 kg*

Specific Fuel Consumption: 308 gr/hp/hr (at maximum power, summer 1950)*

Oil Consumption: Not known

Fuel Pressure: Not known

Oil Pressure: 5 - 6 atmospheres

Mass Air Flow: 29 - 30 kg/sec*

Dimensions: Length 6 - 7 m
Diameter (Max) 1050 mm*
Weight 1650 kg (with accessories and prop)
C G - with prop about 9th stage

[redacted] 50X1-HUM

Compressor Assembly:

8. /Enclosure (A) is [redacted] sketch of the compressor assembly of the 022A [redacted] Major changes that may have occurred [redacted] would possibly be in the blade angle settings./ [redacted] 50X1-HUM

9. The compressor casing consisted of a cylindrical shell made of sheet steel with a 2 mm thickness. The casing divided along a horizontal plane to form two half shells which were bolted together at longitudinal flanges spot welded to the casing half shells. /See Enclosure (B), Sketch No 1./ All parts of the casing were made of steel having the Russian designation 30ХГСА. Six channels ran longitudinally along the outer casing. These channels enclosed the accessory drive shafts and lines. The assembly also consisted of fourteen solid rotor rings and thirteen split stator rings. Flanges were welded to the half portions of the stator rings and on assembly bolted to flanges on the outer casing. /See Enclosure (B), Sketch No 2./ The rotor rings were held in position by channel rings which also were divided at the horizontal plane of attachment. The channels were in turn attached to the outer casing by a rolled seam weld. /See Enclosure (C), Sketch No 1./ The guide vanes for the first 6 or 8 stages were spot welded to the outer stator and inner stator rings /as shown in Enclosure (C), Sketch No 2/ while the guide vanes for the remaining stages were seam welded to the outer stator ring. The inner stator rings were machined with slots corresponding to the guide vane profile and set loosely over the guide vanes being held only by the guide vanes themselves. /See Enclosure (C), Sketch No 3./ [redacted] The stator blades were made of steel stampings. [redacted] The exact settings changed from time to time as a result of test findings. 50X1-HUM

10. Each of the compressor rotor wheels were made of steel and attached to the adjacent wheel by bolts and lock nuts through matching flanges. Before assembly of the rotor, each wheel was balanced separately by drilling away material. A final balance was made on assembly. There were no particular problems involved in assembly and balance. The rotor blades were made by stamping and final machining. The blades of the first six or eight stages were made of an aluminum alloy called Pantal, while the blades of the last stages were made of a steel similar to 30ХГСА. The profiles of the rotor blades were taken from the Goeppingen series [redacted] Herr Steudel, formerly from Junkers and still in Kuybyshev, knew the exact composition of the material used since he was head of the materials laboratory. The compressor rotor was supported in the front by means of a roller bearing that permitted a 3 - 5 mm axial movement of the rotor. The rotor shaft was attached to the propeller reduction gearing by means of a splined joint. The rear of the compressor rotor was supported by a radial bearing and was attached to the turbine shaft by means of a splined joint. In addition a through bolt from the turbine assembly was fixed to the compressor rotor. /See Enclosure (D) showing the turbine assembly./ The rear compressor bearing carried an axial thrust load of 4000kg as a result of the difference in the axial forces on the turbine and the compressors.

11. Two air release valves /not shown on Enclosure (A)/ were located at the fifth and sixth stages of the stator rings. Surge and stall difficulties were encountered within the compressor at low speed of the engine. These valves relieved the pressure build-up until the engine surpassed the critical speed. [redacted] The power absorbed by the compressor is not known [redacted]

Turbine Assembly:

12. /Enclosure (D) is [redacted] sketch of the turbine assembly and combustion assembly of the 022A engine. The drawing was made to scale [redacted] and is accurate within 10%. Enclosure (E) is [redacted] sketch of the turbine flow channel of the 022A. The two sketches combined are self-explanatory and should require little or no explanation./

13. The outer casing of the turbine consisted of two solid rings that bolted to each other and in turn bolted to the combustion casing for support. They were made of steel material designated by the Soviets as ЭЯ1Т. The second and third stage stator blades were welded to the rings and could only be removed with the individual rings. The three turbine wheels butted each other at the hub and in turn were anchored to the turbine shaft by six through stud bolts that screwed into the turbine shaft. Two lock nuts on each stud were used to pull the wheels into place and secure them. The individual blades were attached to the wheels by means of a conventional fir cone profile. At first the blades were pressed into the rotor wheels with a drive fit. Later they were inserted with a sliding fit. When blade shifting occurred, safety plates were added. The turbine shaft was supported by a roller bearing and the shaft extended through the combustion assembly to connect to the compressor rotor by means of a splined joint. Two adjustable retaining nuts at the splined end of the shaft

[redacted]

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were used to locate the shaft and turbine wheels with respect to the turbine casing. An axial movement of the wheels was used to set the desired clearance between the turbine rotor blades and the tapered walls. Axial movement of the turbine wheel assembly and shaft with respect to compressor was prevented by a single through bolt that extended through the center of the turbine wheels and shaft and screwed into the compressor rotor. [redacted] the axial load of the turbine wheels was approximately 12,000 kg. This load was transmitted by the through bolt to the compressor rotor that produced a compensating load of 8000 kg. The 4000 kg difference was taken up by the radial thrust bearing supporting the compressor rotor as mentioned previously. [redacted] 50X1-HUM

14. The 022F which was in the design stage and partially constructed was to incorporate changes in the turbine assembly /as shown on Enclosure (F)/. These changes were as follows:

a. The abrupt angles of the turbine casing walls were eliminated and a smooth flow transition provided between stages.

b. The outer wall casing flanges were cut down by about 5 mm to reduce weight.

c. The flanges were reworked so that the hexagon nuts were locked in place by the flange itself.

d. The flange bolts were reworked as sheer bolts as well and tension bolts so that stress and strain from temperature differences around the casing could be equalized.

e. Due to pressure losses between turbine wheel stages, a flange was added to the downstream side of the rotor wheels of the first and second stages. In addition, a copper or bronze ring was added to the inner stator rings of the second and third stages. The copper or bronze ring was so placed that an air seal was formed between the ring and the wheel flange. [redacted] 50X1-HUM [redacted] this innovation was to be used on engines for the State Acceptance Test. 50X1-HUM

f. Reinforcing rings were added to the turbine casing to prevent warpage.

Design Procedure on Turbine Assembly:

15. The initial design and layout of the 022 engine was based on the specification set down by the thermodynamic department. From the specifications the thermodynamic department received, calculations were made which established the condition entering and leaving the compressor, combustion chambers, turbine, and exhaust nozzle. The original specifications that started the project called for a turbo prop engine that would produce 4,500 HP with a residual thrust of 90 kg. The take-off speed would be 7,700 rpm, and the airflow through the compressor would be 29 kg/sec. The calorific valve of the fuel to be used would be 10,000 k cal/kg. The engine was to have a maximum diameter of 1,050 mm. The resulting data which the turbine design group received from the thermodynamic department and on which the initial design for the turbine assembly was based was as follows for maximum power:

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t_4	- Static temp. at turbine entrance	- 850° Celsius
P_4	- Static press. at turbine entrance	- 4.8 atmospheres
C_4	- Static velocity at turbine entrance	- 120 m/sec
P_6	- Static press. at turbine exit	- Atmospheric
C_6	- Static velocity at turbine exit	- 200 m/sec

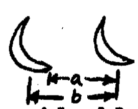
The turbine outlet conditions were based on the assumption that an adiabatic turbine efficiency $\eta_{ad\,T} = .85$. Actually the value obtained at the start of the project was .81 to .83 but by the middle of 1950, a value of $\eta_{ad\,T}$ between .86 to .87 was achieved. This was possible by dimensional changes within the turbine casing so as to provide a smoother flow of the gases.

16. With experimental values available for the contraction factor ξ of single stages, efficiencies of guide blades α and rotor blades χ, and angular deviations of flow leaving the blades ε, and with a fixed maximum diameter given, the preliminary design of the turbine flow channel, stages, etc, was accomplished by calculating the flow at the mean diameter of the channel. The turbine was designed as a reaction turbine with the degree of reaction increasing from the first to the third stage. At every point of the turbine, the condition that the design measurements times the prevailing gas condition be equal to the gas weight had to be fulfilled. That is, $D \pi l \xi \gamma c = G$ where D = diameter, l = length, γ = ratio of specific heat, and C = velocity. Later, more exact calculations took into consideration the ratio of the flow at the tip and root of the blades. For the guide vane ring, the following was valid:

$$\text{At foot } c_i = c_m \left(\frac{r_m}{r_i}\right)^{\alpha^2 \cos \alpha}$$

$$\text{At tip } c_a = c_m \left(\frac{r_m}{r_a}\right)^{\alpha^2 \cos \alpha}$$

where r = radius and α = angle between direction of fluid velocity and peripheral velocity. For the stator assembly α was assumed as .97 and the contraction factor ξ was between .88 and .92



$$\frac{a}{b} = .88 - .92$$

17. At first, all guide blades of the three stages were constructed with the same profile. The thickness of the trailing edge cut off S was 2.5 mm. To reduce outlet losses, the trailing edge of the second and third stage stator blades was reduced to $S_2 = S_3 = 1.5$ mm. However, S_1 was maintained at 2.5 mm to prevent cracks from appearing. The cracks caused by heat appeared at the tip and progressed from the trailing edge to the leading edge of the blades. The trailing edge from root to tip was maintained constant for the stator blades. The trailing edge of the rotor blades was tapered from S = 2 mm at the root to S = .5 mm at the tip. At first rotor blades of the second stage were used to provide blades for the first stage by reducing their length. Later the first stage rotor blades were fabricated separately so as to reduce their weight. The area ratio of the root profile to the tip profile was of the magnitude of 1:3 to 1:4. The contraction factor ξ for the rotor blades was .85 at the root and .97 at the tip.

18. The frictional flow losses of the rotor blades resulted in ψ fluctuating between .93 and .955. These values were plotted with reference to the curves by <u>Stodola</u> and <u>Zietemann</u>, which show the relation of ψ with respect to ς, the angle of change of flow direction entering and leaving a blade. At first the values were between the two curves but during the course of development, the values approached those of

Zietemann's. /See Enclosure (G), Sketch No 1./

19. For the final determination of the design dimensions of the turbine channel, the mass gas flow was integrated over the length of the blade, $\frac{dG}{dr} = D\pi\xi\gamma c$, and the calculated values for the root, mean, and tip profiles plotted. The points were connected by a curve and the area under the curves determined to obtain the quantity of gas. The magnitude of the gas quantity determined whether or not the blade length was to be increased or decreased. /See Enclosure (G), Sketch No 2./

20. Angular deviations ε were not considered for the stator blades until 1949. A deviation of 2° was then used. A deviation for the rotor blades was always assumed from 2° to 8° depending upon the Mach number of the flow and the angle of deflection.

21. /Submitted as a point of academic interest are Enclosures (H), (I), and (J) which are velocity vector diagrams for the 022A [redacted] They represent an approximation 50X1-HUM of values used for the initial calculations of the 022A and fail to take into consideration wall friction. The diagrams are self-explanatory./

22. When the design work was performed on the 022F, past experience was utilized in an attempt to produce a more efficient turbine unit. An attempt was made to avoid stage-jumping and to match the flow well between stages. Wall friction and zones of turbulence, which could by that time be determined, were considered. Tests made with adjustable stator blades produced valuable information on the ideal angle settings that could be used. The final outcome was bound to be an improved turbine unit for the 022F. In regard to the 022F, a difference of opinion existed between Dr Cordes and Kuznetsov, Chief of the Design Unit. Dr Cordes believed that for the rotor and stator blades a larger ratio of t/l (t = grid division and l = blade chord) should be used. He wanted to achieve a better flow friction factor with less blades and wide grid divisions and obtain the required efficiency through a larger angle deviation. On the other hand, Kuznetsov believed that the flow should be well led and this could be achieved best by narrower grid divisions.

23. In 1949 a project was started to design an 022 turbine assembly composed of two stages. To do this it was found necessary to assume flow conditions above critical, M greater than 1, at various points within the rotor and stator stages. Since there was not enough available experience in this field, the project was given up for the time being. /Enclosures (K) and (L) are the basic velocity diagrams for the two-stage project./

Fabrication of the Turbine Rotor Blades:

24. The turbine rotor blades for the JUMO 012 and the early 022 could only be made by a series of turning, milling, planing, and hand operations. A milling cutter in the shape of a truncated cone with a radii of r_1 and r_2 was fed in a manner perpendicular to the blade base profile. The cutter was fed several times to approximate the shape of the profile. Finally the blade was hand-filed to match a pattern and polished. This was a time-consuming operation and limited the form that the blade could take. /See Enclosure (M), Sketch No 1./ Later a

completely new method of fabrication of blades was developed in the workshops at Zavod No 2. The method permitted a blade to be produced with any desired form necessary to obtain successful flow conditions. Dr Bredendieck, still in the USSR, developed the method for the inner side of the blade. With his method, the entire inner side of the blade from leading edge to trailing edge was formed in one operation. He proposed using a cylindrical face milling cutter with a radius r. /See Sketches 2 and 3 of Enclosure (M)./ The blank blade was mounted horizontally with inner side up on a balancer set at some desired drift correction "a". The predetermined contours of the root and tip profiles were projected and duplicates or copy curves were worked up as guide tracks. With the cutter in a fixed position, the balancer was fed horizontally and vertically following the contoured guide tracks. The single operation for the inner side which produced a blade requiring a minimum of hand work took approximately 45 minutes. A later innovation provided for a balancer that could be rotated and thus vary the degree of drift "a" during the process. The process not only provided the desired contours over the entire inner blade surface but also permitted the center of gravity of the individual profiles to be located so that movements resulting from centrifugal and gas forces were a minimum. The system used for milling the outer contour was proposed by Mr Singer, one of thirty engineers repatriated to Dessau and then returned to the USSR again. [redacted] a copy milling machine was used and several operations were involved. [redacted] rejects as a result of fabrication were not excessive. The material used for the rotor blades was Nimonic with the Russian designation ЭИ 415. The exact composition or the source of the material is not known [redacted] Kuznetsov occasionally spoke of the possibility of ceramics for blades and stated that he was interested in this for blades; but [redacted] no work was ever performed on ceramic blades at Zavod No 2.

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Exhaust Nozzles:

25. Three of my drawings /Enclosures (N), (O), and (P)/ show in detail three variations of the exhaust nozzles used on the 022 turbo prop engine. [redacted] The first /Enclosure (N)/, was one of the first designs used on the 022. Not shown on the drawing was an additional outer casing made of dural that started over the middle of the turbine casing and extended approximately 60 mm beyond the end of the outer casing. By means of an ejector effect of the exhaust gases, air was sucked between the two casings and thus produced a cooling effect on the turbine casing and exhaust nozzle. This additional casing was similar to the system used on the JUMO 012. However, during the drive to reduce the overall engine weight, the outer casings were eliminated and the exhaust nozzle shown /in Enclosure (O)/ was developed. The nozzle was considerably lighter in weight and was the one to be used in the planned acceptance tests. One of [redacted] sketches /Enclosure (P)/ shows a variation used during test to increase the exhaust velocity. All parts of the nozzles were made of an austenitic steel designated by the Soviets as ЭЯ1Т.

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26. Another nozzle that was designed and tried [redacted] was one that incorporated a newly-developed starter unit within the exhaust cone. The starter produced 70

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 [redacted] 50X1-HUM

horsepower and was cooled by a fan attached to the end of the turbine wheel and sucked cooling air in through the nozzle struts. The whole unit was promising but [redacted] it was dropped by the Germans because it was more comfortable to do so. Should any difficulties have arisen, it would have meant trouble with the Soviets. One way of avoiding trouble was to refrain from having new ideas. One of the peculiarities of this engine was the vibration set up on the last stage of the rotor blades, if the leading edge of the six support struts of the nozzle was located within 120 mm of the trailing edge of the blades. The vibration would cause severe cracks in the rotor blades. 50X1-HUM

27. The velocity entering the exhaust nozzles of the A engine was approximately 200 m/sec and leaving was 195 m/sec. The 022F was to have an entering velocity of 200 m/sec and an exit velocity of 230 m/sec.

Combustion Assembly:

28. [redacted] a sketch of the combustion chamber /Enclosure (D)/. [redacted] The combustion chamber was a single annulus ring with twelve individual heads welded to the ring. The chamber was supported in the front by the twelve injector nozzles and in the rear by a corrugated flange on the inner and outer walls of the chamber exit. /See View G-H, Enclosure (D)./ All parts of the combustion assembly were made of austenitic steel. (Russian designation ЭЯ1Т.) [redacted] 50X1-HUM 50X1-HUM

Accessories:

29. [redacted] the Junkers propeller control system was used [redacted] the propeller [redacted] was a hydraulically-operated counter rotating reversible propeller and [redacted] the gear ratio between propeller and engine was of the order of 1:3 or 4. The propeller design came from Zavod No 2 but, according to rumor, it was fabricated somewhere in Moscow. They were supposedly much heavier than called for in the original design. 50X1-HUM 50X1-HUM

<u>JUMO 012</u>

General:

30. The JUMO 012 project was originally started at the Junkers Plant in Dessau and was continued in Kuybyshev by the Junkers Group. [redacted] there were ten to fifteen 012 engines constructed and tested at Zavod No 2. Each subsequent engine incorporated changes found necessary through tests. An unofficial 100-hour acceptance was made on the engine which proved to be successful. An engine was then prepared for the official state acceptance test. In September 1949, with various dignitaries present, the official test was started, but during operation the plant current was shut off. This caused the external oil pumps to stop and the oil system 50X1-HUM

within the engine failed to function satisfactorily. The test was discontinued and not completed. The German personnel were of the opinion that the Soviets did this purposely in order to prevent a successful test and thus avoid paying the Germans a promised bonus. They were told that the engine was not a success and that work would not continue, since there was no plane that could use the JUMO 012. The Germans knew that the engine was a success and that all this was merely a cover [redacted] 50X1-HUM [redacted] All drawings, engines, and parts were returned to the Soviets. [redacted] 50X1-HUM 50X1-HUM Olekhnovich, Plant Manager, was finally relieved by Kuznetsov as a result of the test failure.

Leading Particulars and Performance:

31. The following is a summary of the leading particulars and performance of the JUMO 012:

Compressor:	12 stages*
Turbine:	2 stages*
Turbine Temperature:	1100° Kelvin inlet*
	800° Kelvin outlet
R P M:	7700 Maximum*
	7300 Cruise
Power:	3200 kg maximum*
Mass Air Flow:	60 - 62 kg/sec*
Specific Fuel Consumption:	Unknown
Dimensions:	
Length	6 - 7 m
Draw	1100 mm
Weight	1400 kg* (1600 kg originally; 100,000 Rubles bonus promised but never received for each 100 kg reduction)

* Denotes values which are accurate rather than approximate.

Description: 50X1-HUM

32. [redacted] The compressor casing of the 012 was originally conical; but, upon arrival at Kuybyshev, the design was changed to a cylindrical form similar in principal to the 022, already discussed. [redacted] the original design called for a bleed-off of the third stage which provided cooling air to circulate through hollow turbine blades. However, this system was given up when new high strength heat-resistant materials were obtained. Although surge problems were encountered on this engine also, no pressure bleed valves were provided. The turbine assembly was similar to the assembly of the 022 engine but provided only two stages. /Enclosure (Q) is a schematic layout of the 012 turbine channel. Dimensions are reasonably accurate./ The through bolt arrangement, described on the 022, anchoring the turbine wheels to the compressor rotor was used on the 012 with the addition of a support located near the mid-span. /Enclosures (R) and (S) are velocity vector diagrams submitted to indicate the magnitude of velocity valves./ A schematic drawing [redacted] /Enclosure (T)/ shows an approximation of the exhaust nozzle used on the JUMO 012.

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[redacted]

Additional Projects

Nene Exhaust Nozzles:

33. During the last six months [redacted] in Zavod No 2, jet nozzles for an engine other than the 012 or 022 were fabricated in the workshops. It was said that the nozzles were for the Nene engine, which was rumored to be in production in some plant in Kuybyshev. There was a total of about 15 nozzles constructed and delivered to Kuybyshev. [redacted] 50X1-HUM 50X1-HUM

Tushino Group:

34. A group of engineers at Junkers was working on a pulse jet at the time of my departure to the USSR. This group was transferred to Tushino and later transferred to Zavod No 2 in 1949. [redacted] these engineers [redacted] did little but loaf all the time they were there. They made a few improvements on the JUMO 224 but, since research work on this engine was nearly completed in Dessau, they had little to improve. No one knew what became of the pulse jet project. 50X1-HUM 50X1-HUM

PLANT LAYOUT

35. /Enclosure (U) is [redacted] of the layout of Zavod No 2./ As of September 1950, there were approximately 700 Germans and 1800 Soviets employed there. The only connection Zavod No 2 had with outside plants or agencies [redacted] was with the Air Ministry, which provided financial backing. A General Lukin of the Air Force made occasional visits. The following points /with no description, due to lack of interviewing time/ are identified [redacted] /Enclosure (U)/: 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

Point 1 Club House, Movies, etc

Point 2 Road to Kuybyshev

Point 3 Plant entrance and Guard house

Point 4 Material Analysis (Dept 17)

Point 5 Guard house

Point 6 Truck entrances

Point 7 Guard tower

Point 8 Unknown building

Point 9 Main machine shops

Point 10 Assembly and tear-down shop

Offices were located on the second floor.

Point 11 Carpenter shop

Point 12 Heat treatment shop

Point 13 Accessories, test stands, starter, etc

Point 14 Generator house

Point 15 Sheet metal shop plus other small shops

Point 16 Ware house

Point 17 Design office

(Main building)

Point 18 Guard house

(Admittance to test stand area)

Point 19 Old test stand

Point 20 Work shop for test stands

Point 21 New test stands

Point 22 Open area

Point 23 Row of new trees

Point 24 Dispensary

Point 25 Former fire equipment building

(This building was later destroyed.)

Point 26 Askania Group work shop *

Point 27 Storage building for materials

Point 28 Fence

(Wooden, 2 m high; it was 3 m high in the vicinity of the test stands.)

Point 29 Transformer station

This station had high power transmission lines. (Power from Kuybyshev - exact location of lines and transformer unknown.)

Point 30 Test building

(Air flow over blades.)

*The Askania Group conducted instrument research, the nature of which was not known [redacted] Waldmann, one of the group, had a son residing at Windmuehlenstrasse. Dessau, who told [redacted] that the group was transferred on 10 Sept 50 to Moscow and presented with four-year contracts.

36. Future plans of Zavod No 2 are not known [redacted] as long as the German personnel are present, research and development of aircraft engines will be performed.

ORGANIZATION AND LEADING PERSONALITIES AT ZAVOD NO 2

37. The organizational breakdown /as shown in Enclosures (V), (W), and (X)/ became effective when Kuznetsov became Chief of Development. At this time, a new plan for the work process,

especially for design, was introduced. The group leader was responsible for the accuracy of all details within the group. The construction office had a fixed budget which paid for little errors in construction. Major mistakes in drawings, which led to faulty fabrication, had to be paid for by the responsible group leader (sometimes one-third of one's monthly salary). All drawings had to be submitted to the group leader. The group leader in turn had to submit all drawings to the department chief and his Soviet deputy. Afterwards, all drawings were channeled to the norm control office, the chief metallurgist, and the chief for work planning or their deputies. The drawings were then submitted to the chief construction engineer and his deputy for approval. Only when all these offices had no further objections against the design and the fabrication procedure and each chief had signed approval could the group leader dare to present the drawings to the chief technical designer or to his deputy. And only after their signature were the workshops allowed to work with these drawings. The complexities of the organization are hard to imagine. However, the greatest difficulty for the group leaders was the fact that all work and running around had to be accomplished in an incredibly short time. In many cases, the deadlines were in practice impossible. Furthermore, all necessary work in the sheet metal shop, turning section, milling shop, assembly and test stand, had to be co-supervised by the group leader because he was also responsible in the event of failures. Generally speaking, the employee in the USSR had many duties but no rights. Some of the leading personnel were as follows:[1]

<u>Kuznetsov</u> (Soviet):

Chief Technical Designer. [redacted]

<u>Kvasov</u> (Soviet):

At first Kvasov was only in charge of BMW work. Despite BMW's later integration into the Junkers organization (in the spring of 1948), [redacted]

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[redacted]

Semënov (Soviet):

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[redacted]

At first Semënov was in charge of Junkers alone. He then became Brandner's left hand and Kuznetsov's right hand.

Scheibe, Dr (Officially Chief of all German specialists):

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[redacted]

At first, the workers received approximately 2000 rubles per month, a sum equivalent to office employee wages. By 1950, only a few very skilled workers received over 1000 rubles per month. However, Dr Scheibe was paid his regular monthly income of 7000 rubles--the wages of a chief technical designer--after August 1949, when he stopped working in that capacity.

Brandner:

He was the man who divided the German specialists in Kuybyshev into two fields: one under himself and one under Dr Vogts.

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[redacted]

Vogts, Dr (Chief of the Research Department):

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[redacted] He developed the theoretical data for the JUMO 012A and for a 70 hp starter in Kuybyshev. [redacted]

Heinrich, Dr:

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A mathematical genius.

Lorenzen:

For decades Lorenzen was the chief of the propeller development and construction department at Junkers. [redacted]

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Leipert:

A turbine expert.

Schneider:

A compressor expert and Dr Vogts' deputy. Monthly salary: 3800 rubles.

Pawlowitsch:

Formerly main interpreter (Russian-German) at BMW.

Schulze, Dr:

Chief of the thermodynamics department, a good theoretician and physicist. His family returned to the Soviet Zone of Germany in December 1951. Salary: 4000 rubles per month.

Kuemmel:

Dr Schulze's deputy. Kuemmel was an excellent flow expert from BMW. Salary: 4000 rubles per month.

Maas, T. Dr:

[redacted]

Zocher:

Returned in 1950 [redacted]

Schwabe, Dr:

Came to Jena in 1950, botanical research institute.

Prestel:

Chief of Testing Department: He was first chief technical designer at BMW and for that reason had a monthly salary of 7000 rubles. [redacted]

Pohl:

Evaluation. Salary: 4000 rubles monthly. A former Air Force captain who had studied in Moscow and spoke better Russian than the Soviets. Chief interpreter at Junkers. [redacted]

Korb:

Returned in July 1951 to Sachsen. Worked on jet design since 1944. Salary: 4000 rubles monthly.

Wagner:

From BMW. Salary: 4000 rubles monthly.

Leuthold:

Experienced propeller specialist and control instrument specialist.

[redacted]

50X1-HUM

Werner, Reinhard:

Group leader of the BMW control group. Salary: 4000 rubles.

Vietze:

The man who designed controls at BMW.

Greuzburg:

Head of the Junkers control group. He also partly developed the control unit for the piston engine JUMO 213. Salary: 4000 rubles.

Deinhard:

Chief of compressor department. Salary: 4000 rubles monthly.

Schroeder, Dr:

Deinhard's deputy, the man who produced the theoretical data for the compressor development and improvement. Salary: 4000 rubles monthly.

50X1-HUM

Faust:

A [redacted] theoretician and [redacted] flow expert. 50X1-HUM

Cordes, Dr: 50X1-HUM

Chief of the turbine and thrust nozzle department. [redacted] Cordes had 50X1-HUM worked on propeller development and was also a flow expert. Salary: 4000 rubles. The following reliable calculation engineers worked with him: Hahnel (his deputy, whose monthly salary was 3000 rubles); Stadelmann, Rademacher, Dickel. [redacted] 50X1-HUM

Muecke:

Brandner's German deputy and more of a fabrication specialist. More interested in operational demands than the design aspects. Salary: 3500 rubles.

Bake:

A personal friend of Muecke and also originally a work planning man. So were Sablinski and Hartleib, both from the compressor construction group X. These last four specialists were concerned more with workshop duties rather than design.

Schueler:

Originated the idea of the spiral combustion chamber for the starter unit.

Scheinost, Dr:

Chief of the stress and vibration department. Monthly salary amounted to 4500 rubles. [redacted] 50X1-HUM the most important stress calculations were performed by the department of Dr Scheinost. This applies especially to the recalculations of the compressor and turbine rotors and the rotor blades.

[redacted]

Stubel and Schmidt, Dr:

Specialized in vibration calculations.

Mages, Twrdy, and Riedel:

From the stress department; they were repatriated in 1950 and all of them are working in the Sov Zone at People-Owned Automobile Works IFA.

Treiber:

Chief of the test stand design department; monthly salary of 4000 rubles. His department designed the test stands and also equipped them with measuring instruments.

Pfluegel:

Treiber's German deputy in the department. His monthly salary was 3200 rubles. During World War II he was at the German Institute for Aeronautical Research.

Waldmann:

In 1949 he became Gerlach's deputy. His salary was 4000 rubles monthly. At present Waldmann works at the EKM, Energy and Power Machine Works, in Dresden, Sov Zone. [redacted] of Stuttgart and is interested in returnin [redacted]

38. In autumn 1949 the Junkers-diesel group arrived in Kuybyshev. From 1946 to 1949 they had been in Tushino, USSR, a suburb of Moscow. Chief of this group was Gerlach, who took his closest co-workers, Dr Beck and Schmarje, with him to work in the combustion chamber department. Gerlach had a salary monthly of 5000 rubles. At first, the starter unit of approximately 70 hp performance was in every respect (layout, calculation, and construction) under Dr Vogts. After the first difficulties were overcome, Brandner took over the construction group for this unit, which consisted of Weckwert (salary: 2500 monthly), Schmerse, Stich, and Eberl. At the end, Eberl was still taking care of the theoretical side of the unit, especially the one-stage radial charger. [redacted]

39. The personnel which the Soviets sent to the State Research Plant in Kuybyshev, directly from colleges and institutes, was about the best available from this field. Even considering the fact that several very talented persons were among these people, [redacted] this, by far, is not sufficient to continue further research for jets independently. The Soviets can hardly be outdone in copying of power plants. However, they lack money, sufficient personnel with above-average technical intelligence, and, most of all, because of Party management, the necessary understanding for research.

[redacted]

ENCLOSURE: (A) Compressor Casing & Compressor Rotor
ENCLOSURE: (B) Compressor Casing Joints
ENCLOSURE: (C) Compressor Guide Vane Details
ENCLOSURE: (D) 022-A Turbine Casing with Combustion Chamber and Turbine Assembly
ENCLOSURE: (E) 022-A Turbine Flow Channel
ENCLOSURE: (F) 022-F Turbine Flow Channel
ENCLOSURE: (G) 022 Turbine Design Curves
ENCLOSURE: (H) 022-A Turbine Velocity Vector Diagram (Stage 1)
ENCLOSURE: (I) 022-A Turbine Velocity Vector Diagram (Stage 2)
ENCLOSURE: (J) 022-A Turbine Velocity Vector Diagram (Stage 3)
ENCLOSURE: (K) 022-A Turbine - Two-Stage Project, Velocity Vector Diagram (1st Stage)
ENCLOSURE: (L) 022-A Turbine - Two-Stage Project, Velocity Vector Diagram (2d Stage)
ENCLOSURE: (M) Rotor Blade Fabrication
ENCLOSURE: (N) Thrust Nozzle 022-A
ENCLOSURE: (O) 022-A Turbine Extremely Light Thrust Nozzle
ENCLOSURE: (P) Exhaust Nozzle 022-A Turbine

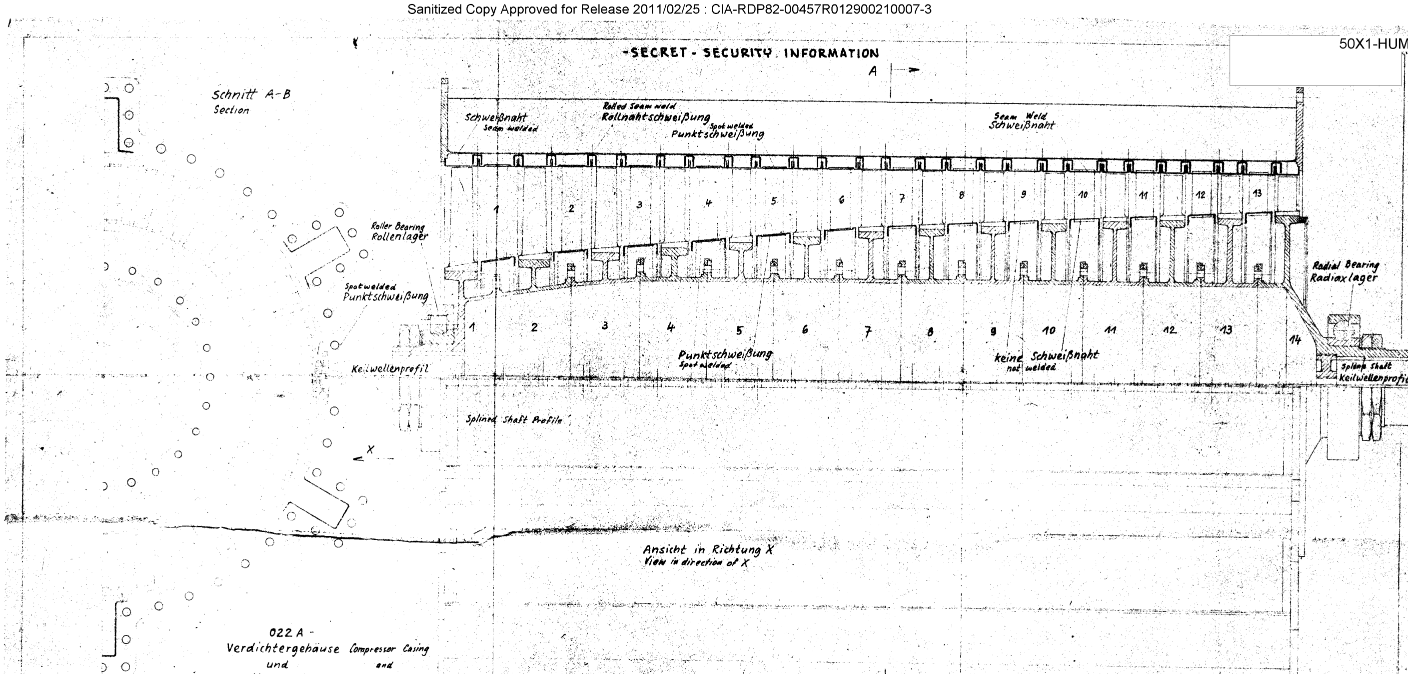
 50X1-HUM

[redacted]

ENCLOSURE: (Q) 012-A Turbine Flow Channel
ENCLOSURE: (R) 012-A Turbine Velocity Vector Diagram (1st Stage)
ENCLOSURE: (S) 012-A Turbine Velocity Vector Diagram (2d Stage)
ENCLOSURE: (T) Schematic - 012A Turbine Exhaust Nozzle
ENCLOSURE: (U) [redacted] Sketch of Zavod No 2, Kuybyshev
ENCLOSURE: (V) Organizational Breakdown Chart, Zavod No 2, Kuybyshev 50X1-HUM
ENCLOSURE: (W) Organizational Chart (Chief of Construction), Zavod No 2, Kuybyshev
ENCLOSURE: (X) Organizational Chart (Testing), Zavod No 2, Kuybyshev

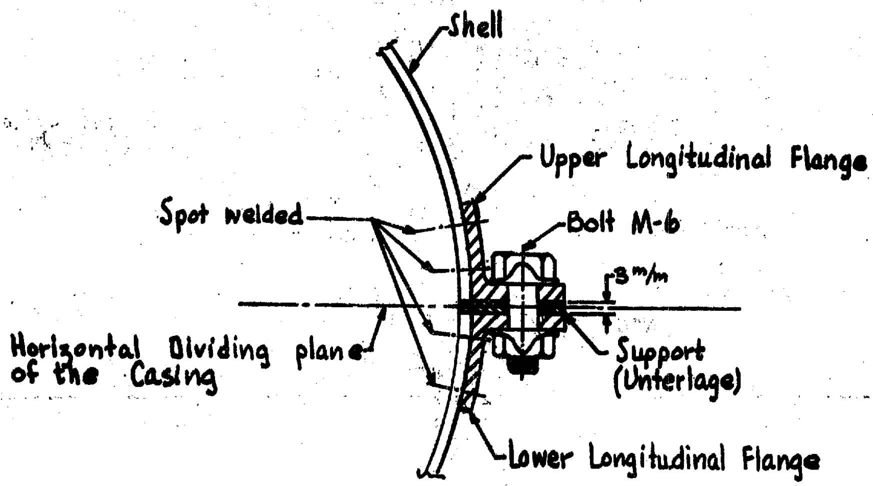
50X1-HUM

[redacted]

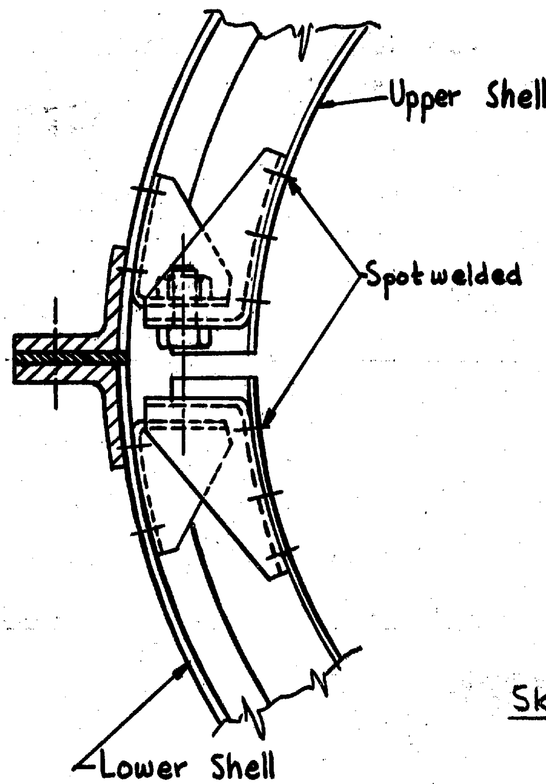

-SECRET- SECURITY INFORMATION
50X1-HUM
A
Schnitt A-B
Section
Schweißnaht
Seam welded
Rolled Seam weld
Rollnahtschweißung
Spot welded
Punktschweißung
Seam Weld
Schweißnaht
1 2 3 4 5 6 7 8 9 10 11 12 13
Roller Bearing
Rollenlager
Spotwelded
Punktschweißung
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Radial Bearing
Radiaxlager
Punktschweißung
Spot welded
keine Schweißnaht
not welded
Keilwellenprofil
Splined Shaft
Keilwellenprofil
Splined Shaft Profile
X
Ansicht in Richtung X
View in direction of X
022 A -
Verdichtergehäuse Compressor Casing
und and
Verdichterläufer Compressor Rotor
Schemazeichnung Maßstab 1: 2,5
Schematic Drawing Scale 1 : 2.5
[redacted] Enclosure (A)
Report
-SECRET-
B

Enclosure B

50X1-HUM



Sketch #1

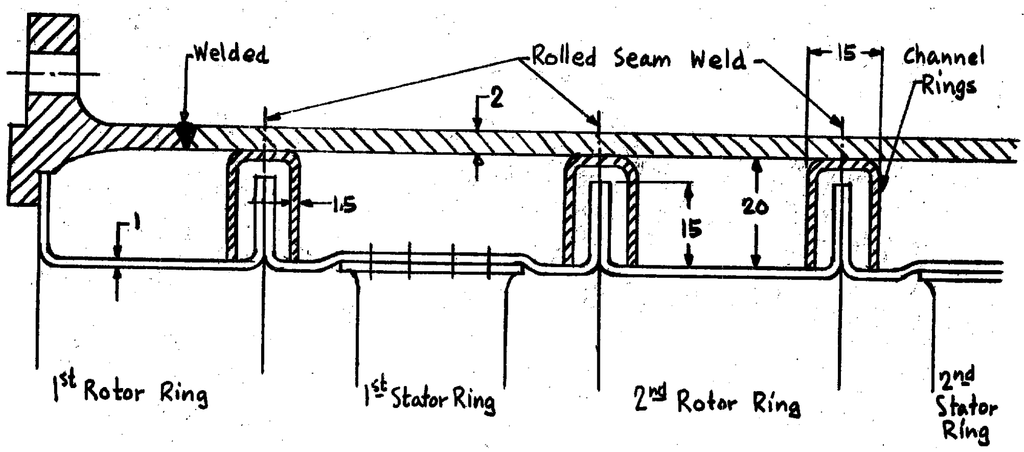


Sketch #2

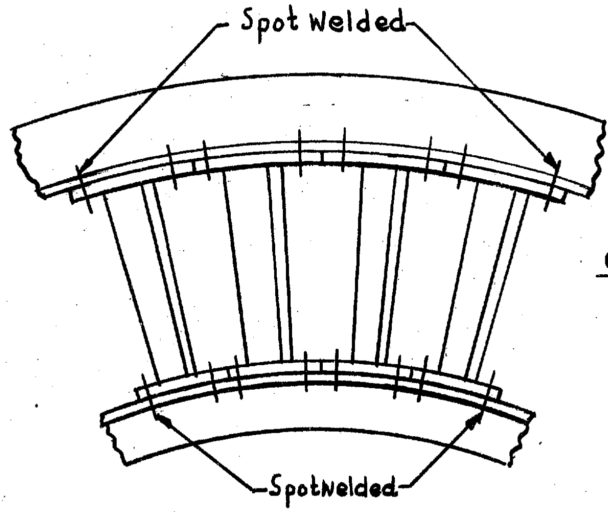
COMPRESSOR CASING JOINTS

Enclosure C

50X1-HUM

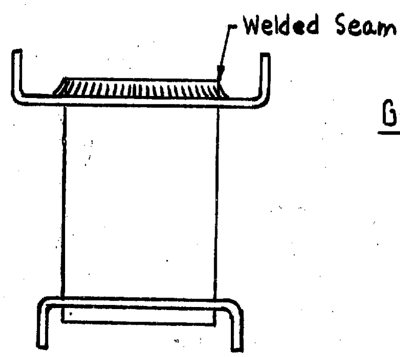


Sketch #1



Guide Vane Rings #1 to #8

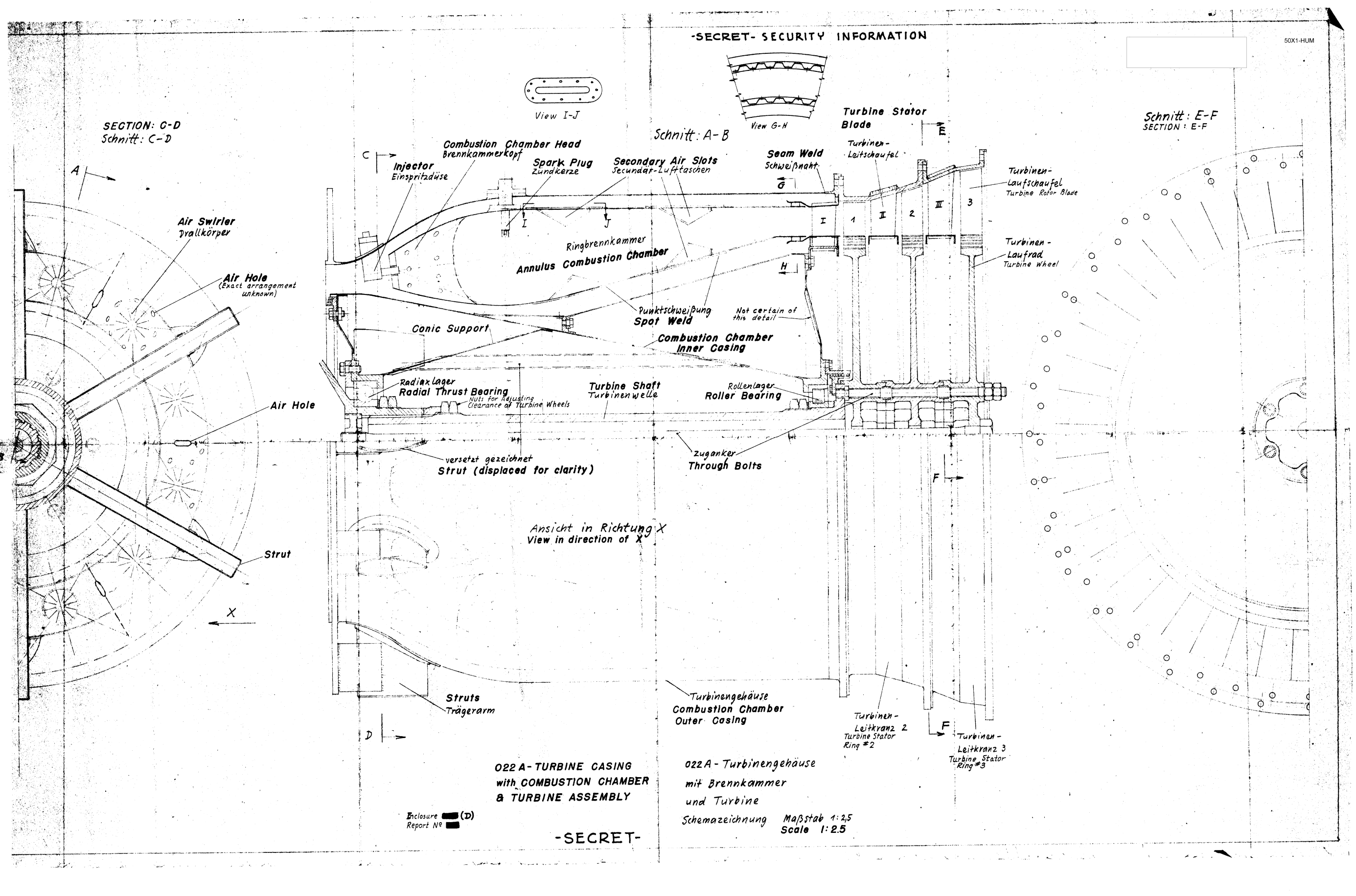
Sketch #2



Guide Vane Rings #9 to #14

Sketch #3

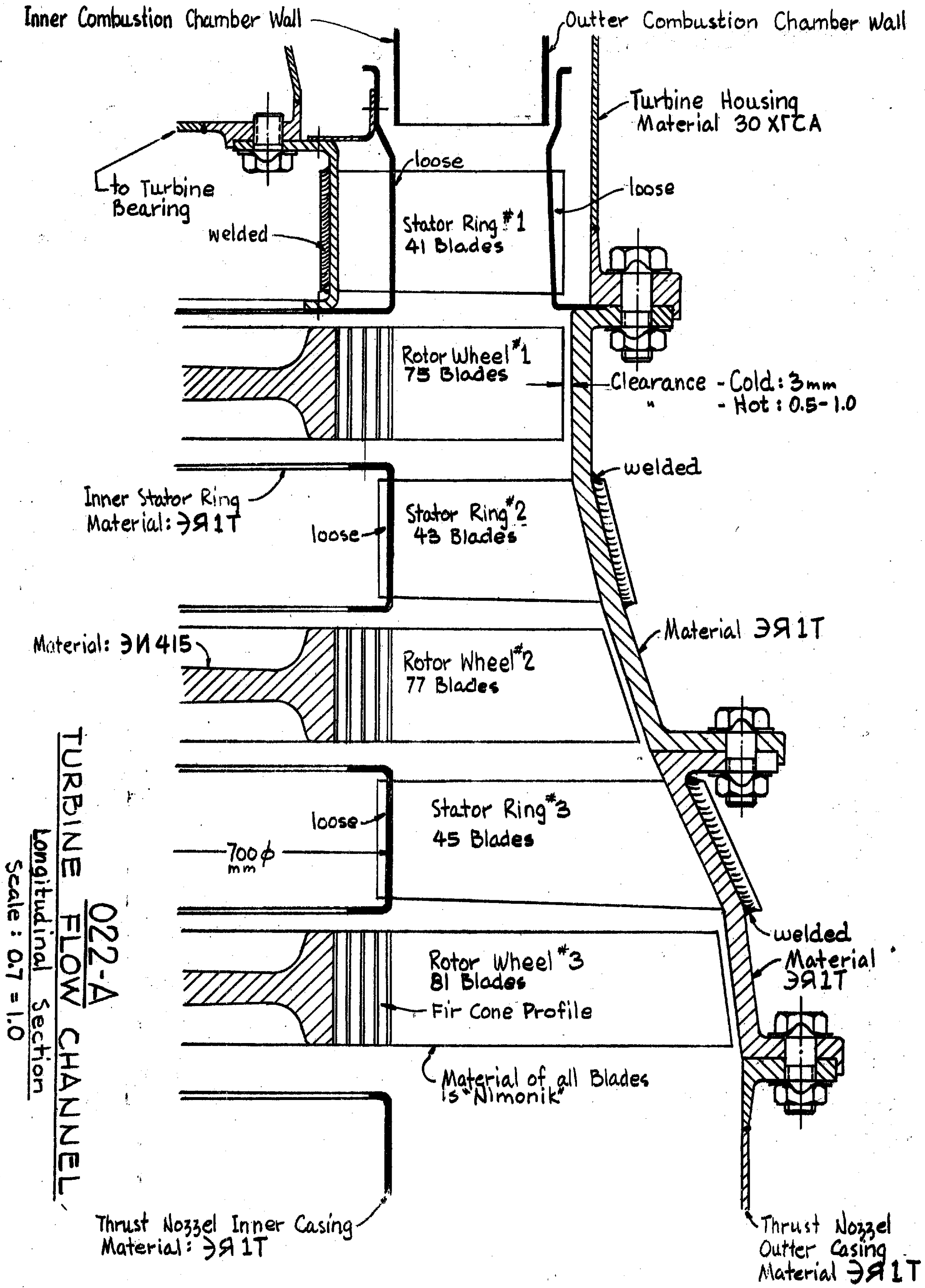
COMPRESSOR GUIDE VANE DETAILS



-SECRET- SECURITY INFORMATION
50X1-HUM
View I-J
View G-H
SECTION: C-D
Schnitt: C-D
Schnitt: A-B
Schnitt: E-F
SECTION: E-F
Turbine Stator Blade
Turbinen-Leitschaufel
Turbinen-Laufschaufel
Turbine Rotor Blade
Turbinen-Laufrad
Turbine Wheel
Combustion Chamber Head
Brennkammerkopf
Injector
Einspritzdüse
Spark Plug
Zündkerze
Secondary Air Slots
Secundär-Lufttaschen
Seam Weld
Schweißnaht
Air Swirler
Drallkörper
Air Hole
(Exact arrangement unknown)
Ringbrennkammer
Annulus Combustion Chamber
Punktschweißung
Spot Weld
Not certain of this detail
Conic Support
Combustion Chamber Inner Casing
Radiax Lager
Radial Thrust Bearing
Nuts for Adjusting Clearance of Turbine Wheels
Turbine Shaft
Turbinenwelle
Rollenlager
Roller Bearing
Air Hole
versetzt gezeichnet
Strut (displaced for clarity)
Zuganker
Through Bolts
Ansicht in Richtung X
View in direction of X
Strut
Struts
Trägerarm
Turbinengehäuse
Combustion Chamber Outer Casing
Turbinen-Leitkranz 2
Turbine Stator Ring #2
Turbinen-Leitkranz 3
Turbine Stator Ring #3
022 A - TURBINE CASING
with COMBUSTION CHAMBER
& TURBINE ASSEMBLY
022 A - Turbinengehäuse
mit Brennkammer
und Turbine
Schemazeichnung
Maßstab 1:2,5
Scale 1:2.5
Enclosure [redacted] (D)
Report No [redacted]
-SECRET-

Enclosure E

50X1-HUM



Enclosure F

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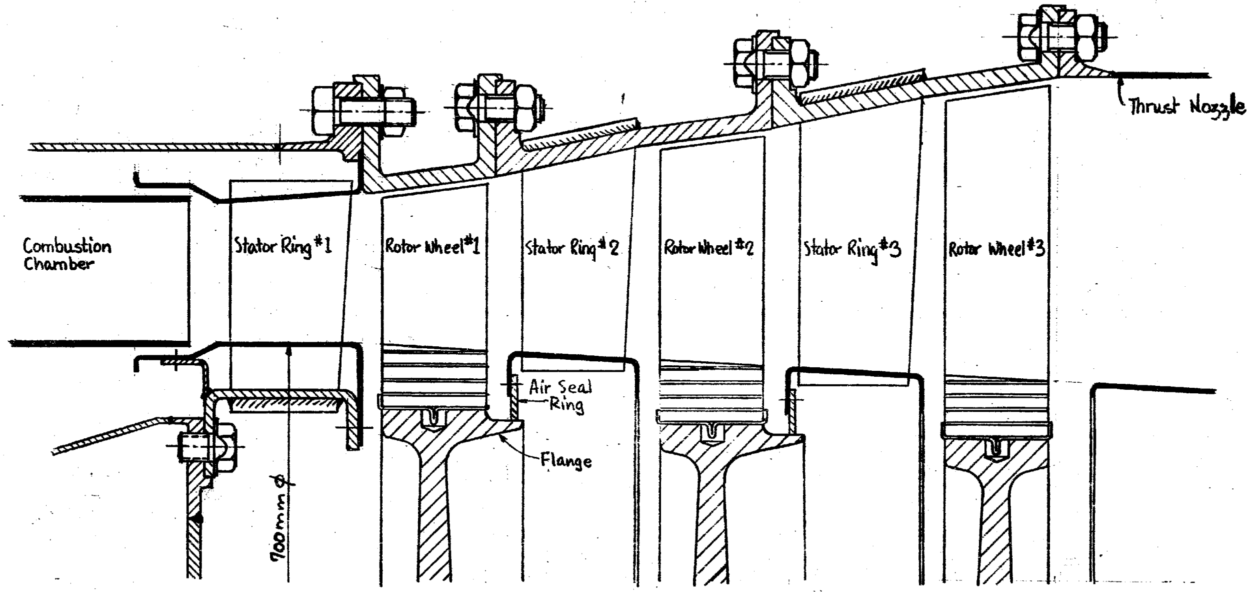

SECRET

022F - TURBINE FLOW CHANNEL

Longitudinal Section

Scale: 0.6 = 1.0

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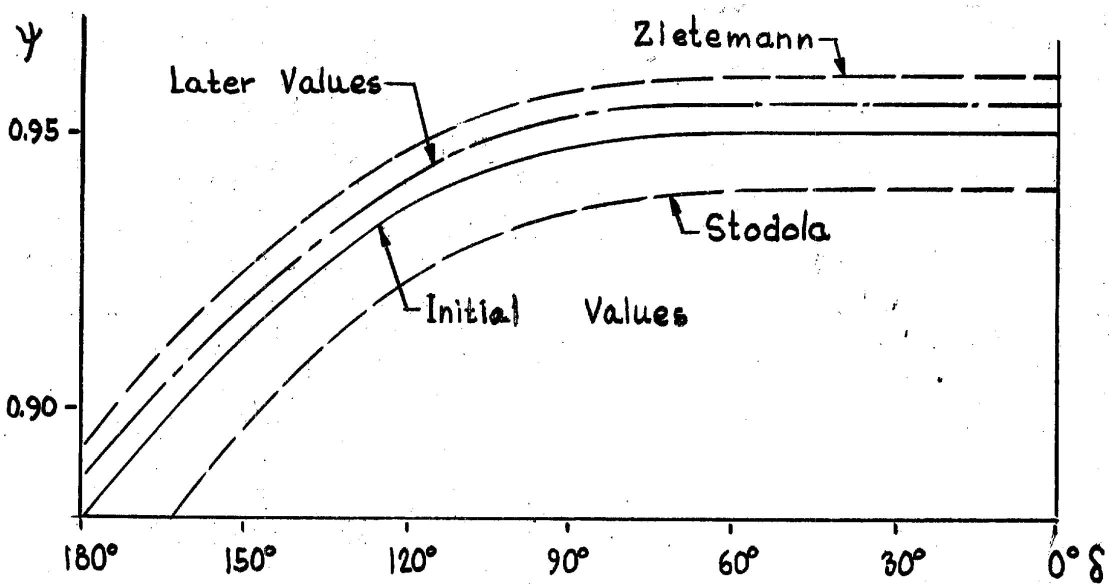
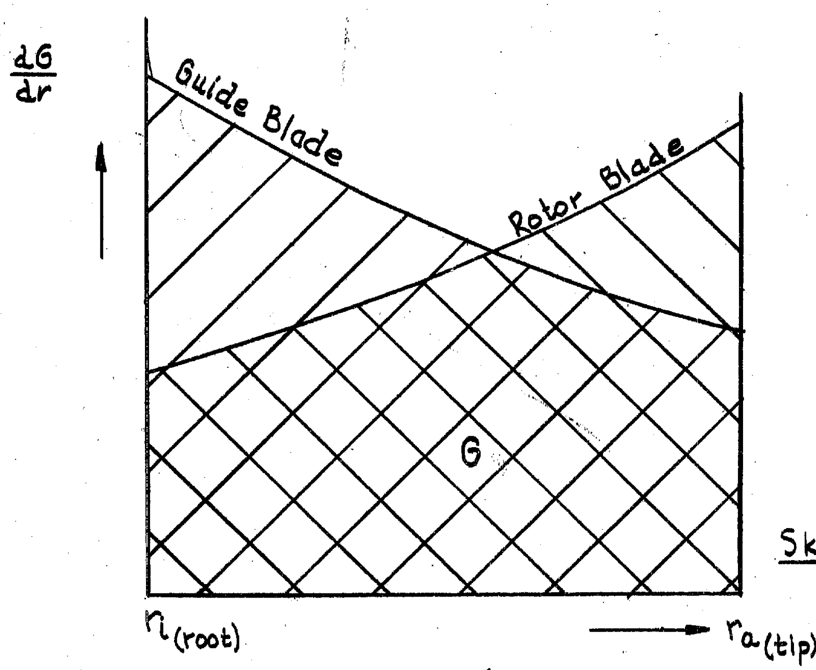
Enclosure G

50X1-HUM



Sketch #1



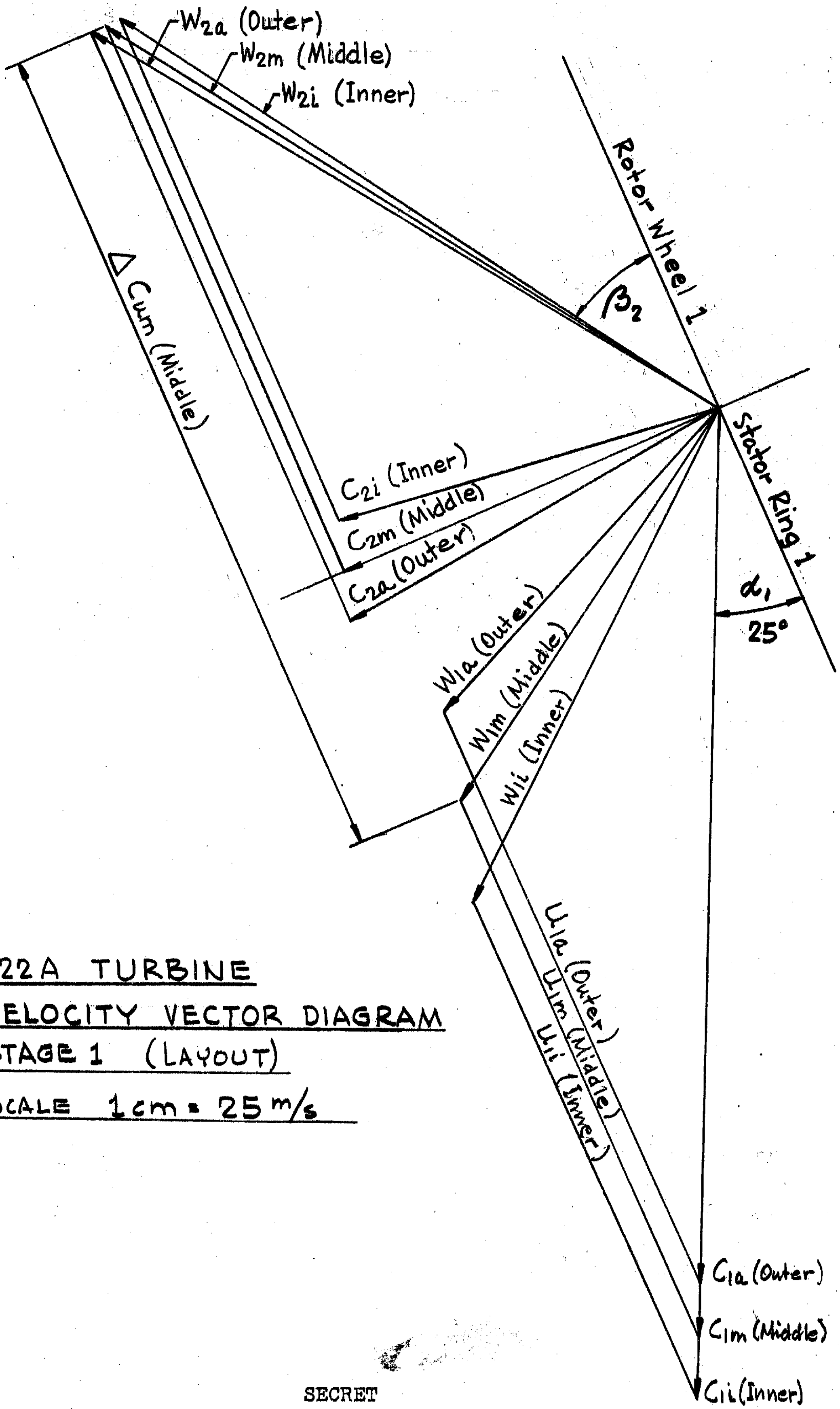
Sketch #2

022 TURBINE DESIGN CURVES

SECRET

50X1-HUM

Enclosure H



O22A TURBINE

VELOCITY VECTOR DIAGRAM

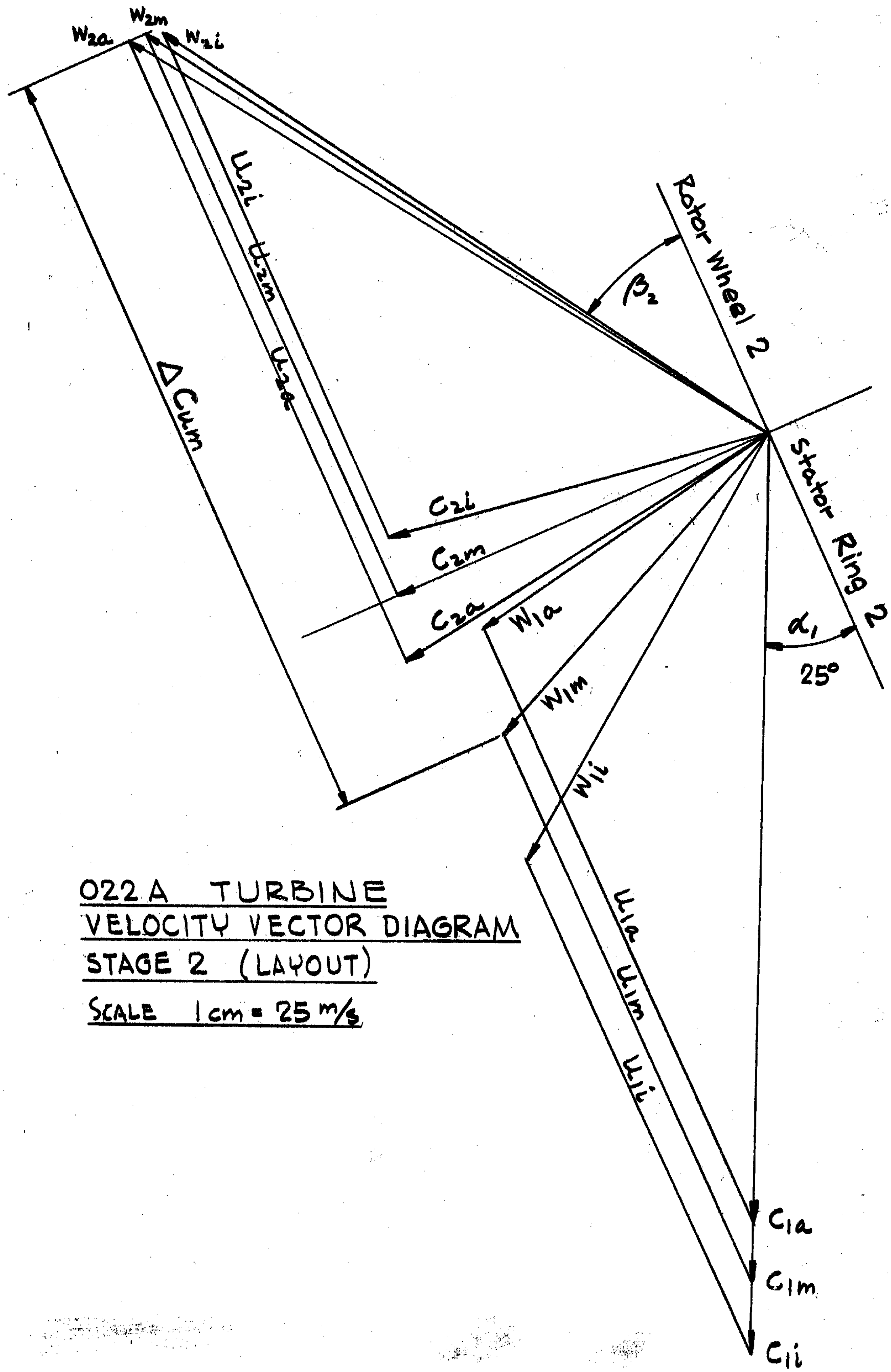
STAGE 1 (LAYOUT)

SCALE 1 cm = 25 m/s

SECRET/SECURITY INFORMATION

50X1-HUM

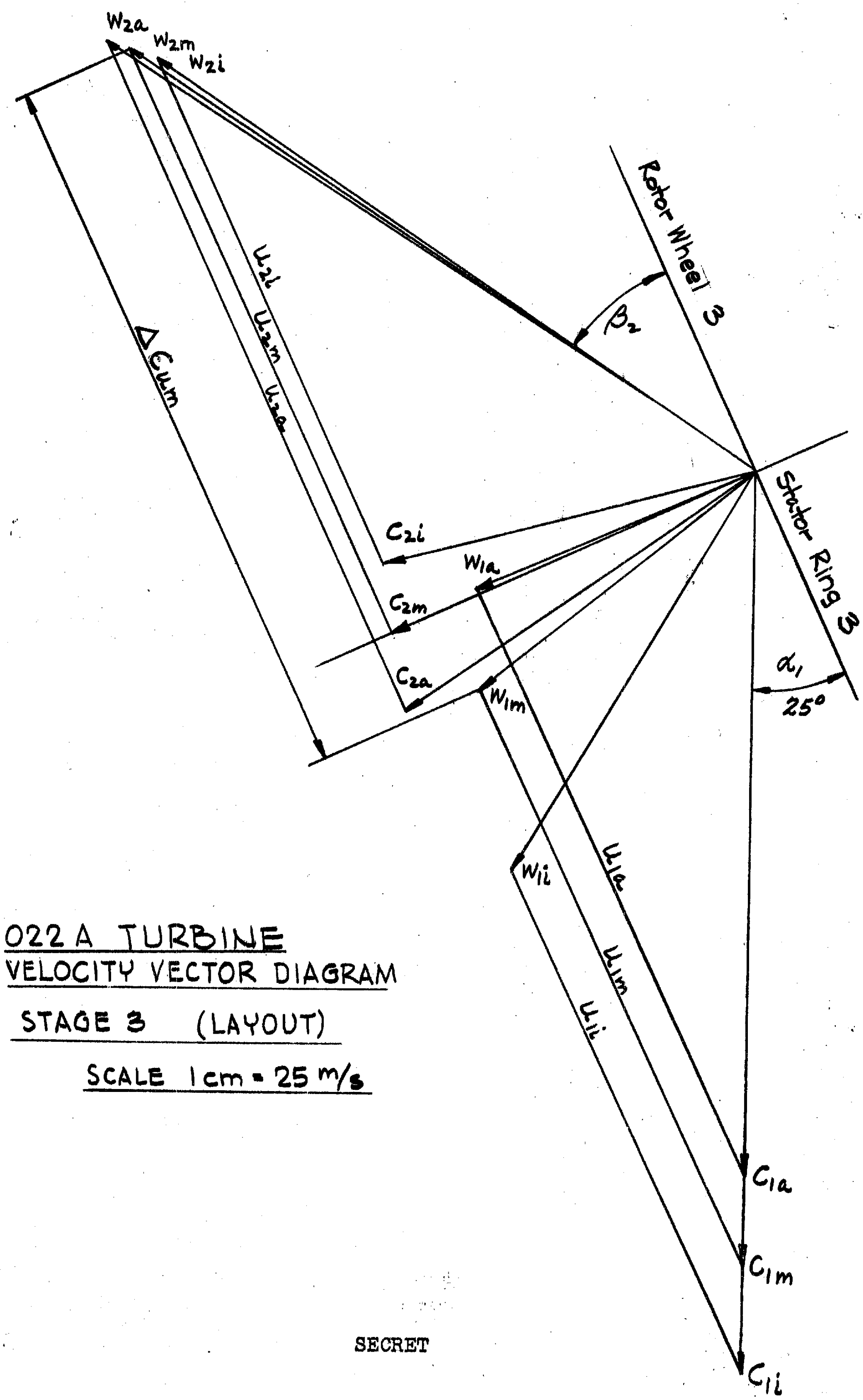
Enclosure I



022 A TURBINE
VELOCITY VECTOR DIAGRAM
STAGE 2 (LAYOUT)
SCALE 1 cm = 25 m/s

SECRET

Enclosure J

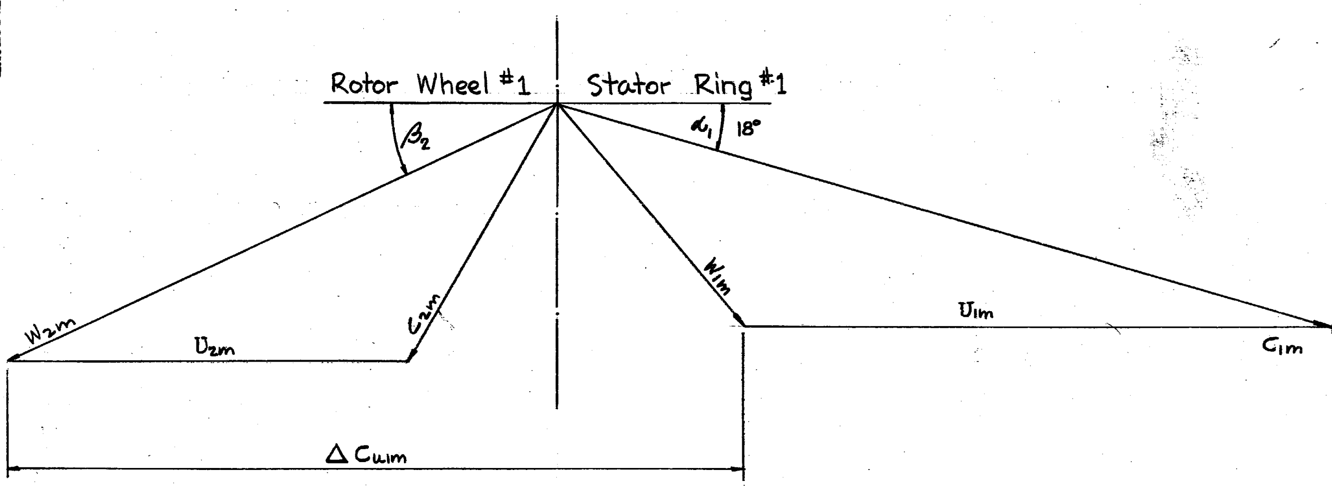


022 A TURBINE
VELOCITY VECTOR DIAGRAM
STAGE 3 (LAYOUT)
SCALE 1cm = 25 m/s

Enclosure K

50X1-HUM

SECRET/SECURITY INFORMATION



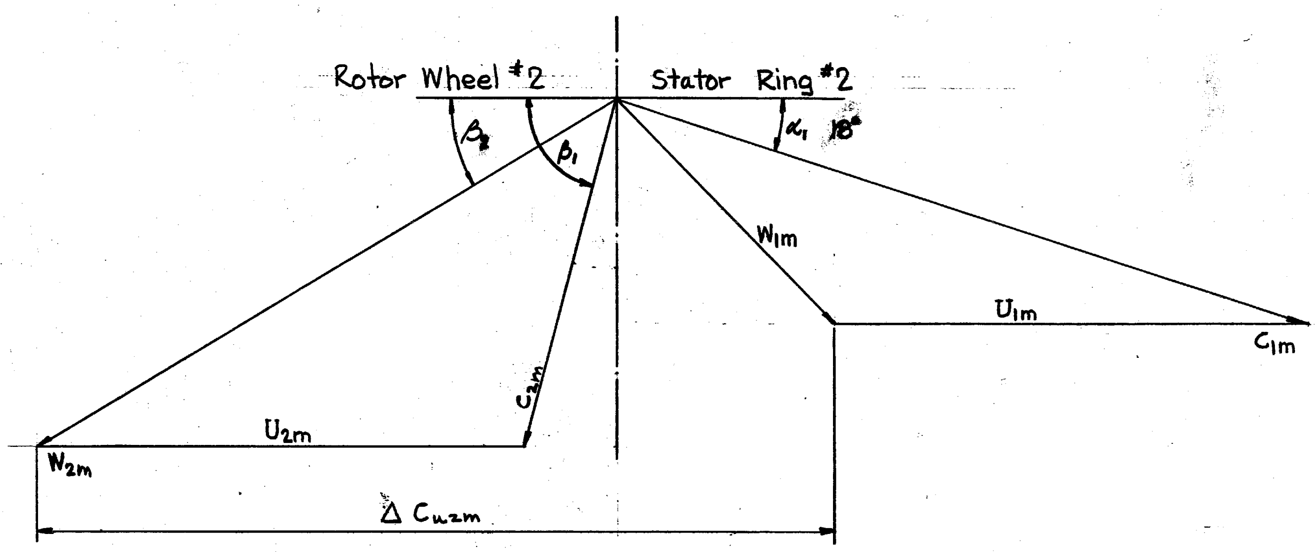
SECRET

022A TURBINE - TWO-STAGE PROJECT

VELOCITY VECTOR DIAGRAM - Longitudinal Section - 1st STAGE

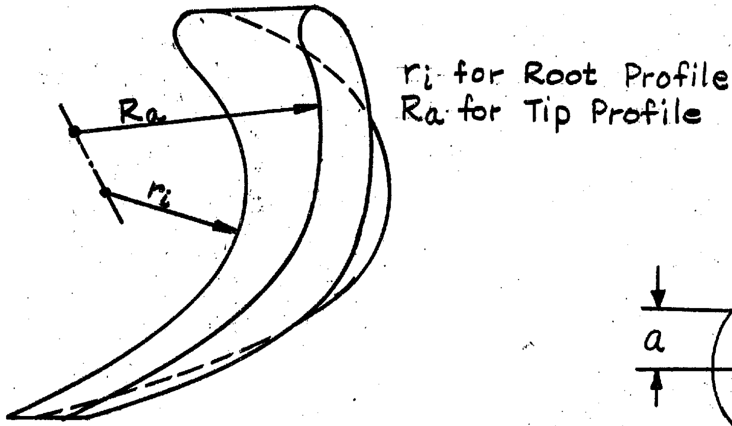
Scale: 0.7cm = 25 m/s

Enclosure 1

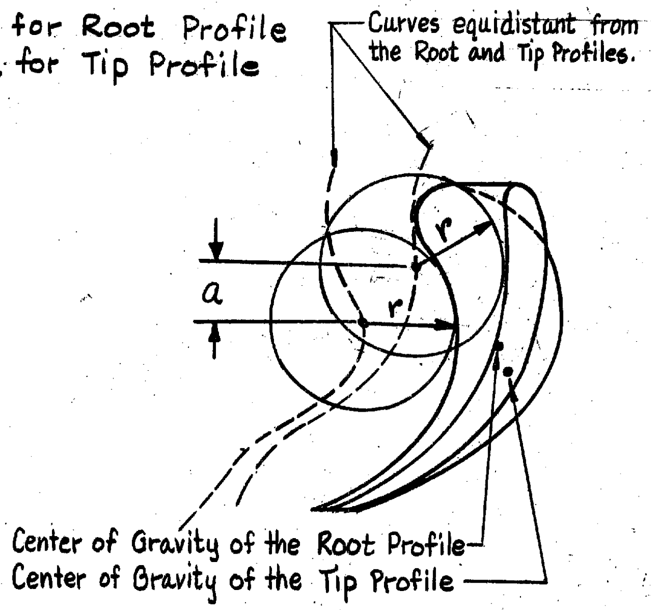


022A TURBINE - TWO-STAGE PROJECT
VELOCITY VECTOR DIAGRAM - Longitudinal Section - 2nd STAGE
Scale : 0.8 = 25 m/s

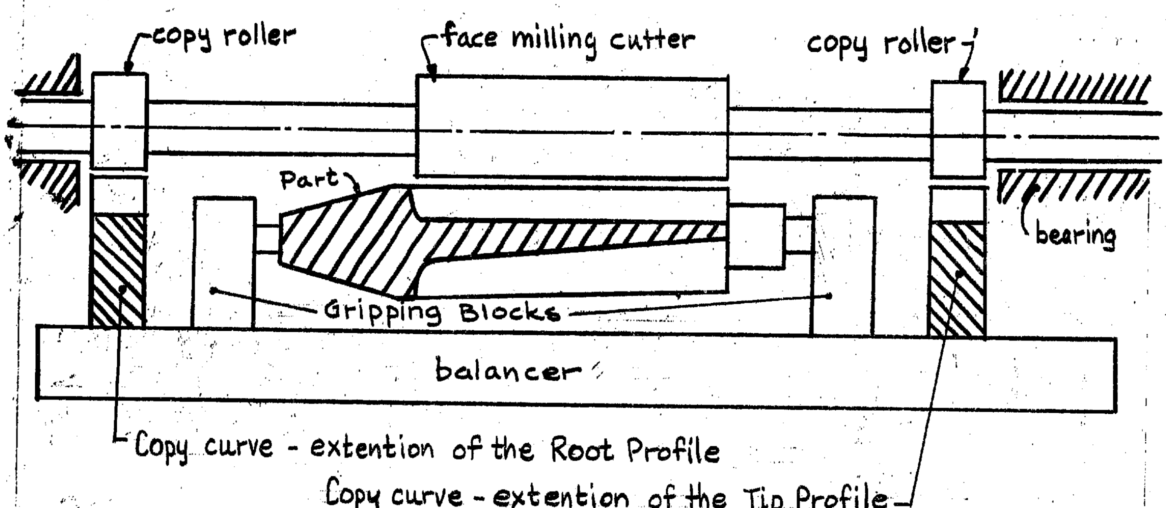
Enclosure M



SKETCH 1

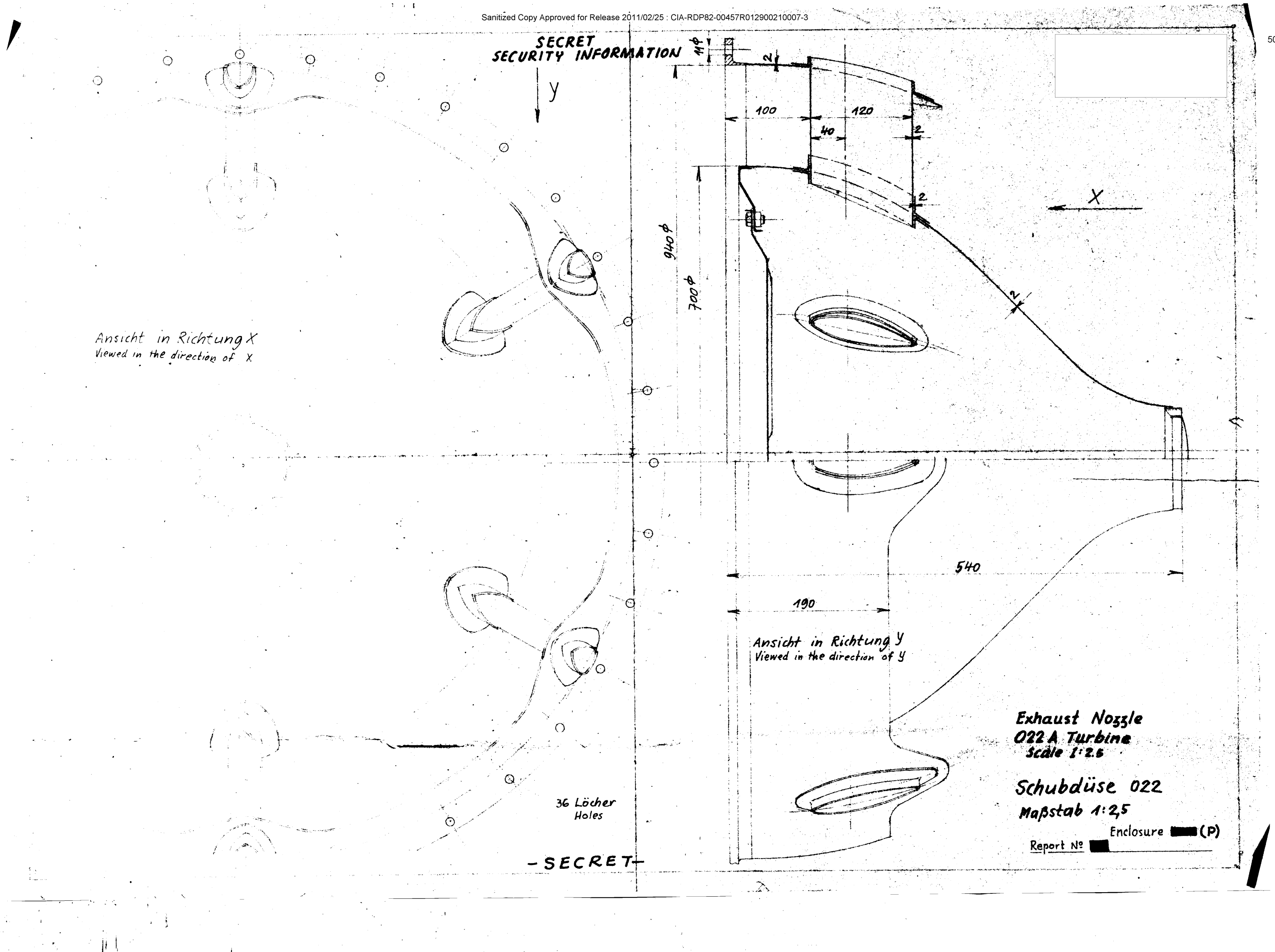


SKETCH 2

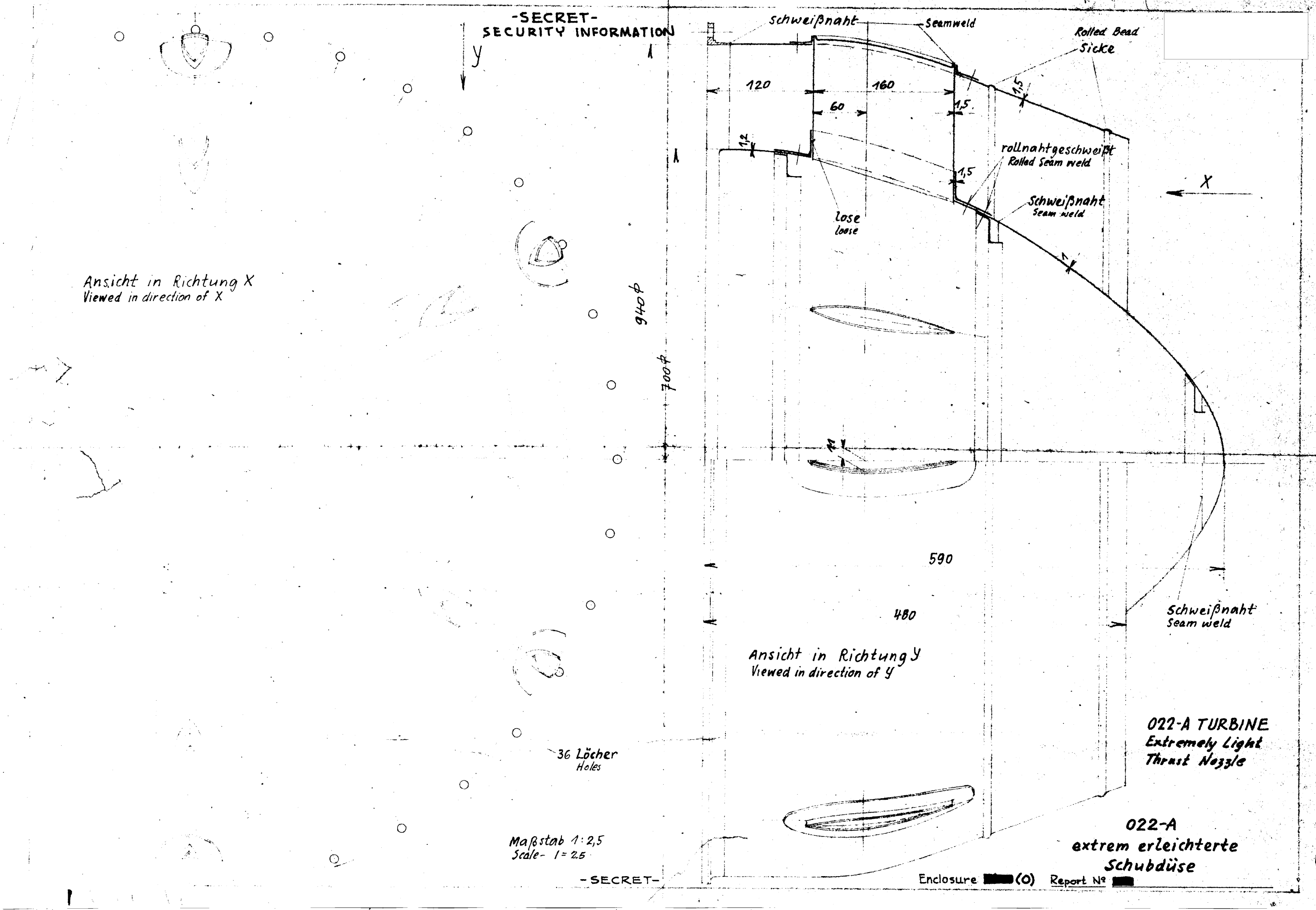


SKETCH 3

ROTOR BLADE FABRICATION


SECRET
SECURITY INFORMATION
y
100
120
40
2
X
940 ϕ
700 ϕ
Ansicht in Richtung X
Viewed in the direction of X
540
190
Ansicht in Richtung y
Viewed in the direction of y
Exhaust Nozzle
022 A Turbine
Scale 1:2.5
Schubdüse 022
Maßstab 1:2,5
36 Löcher
Holes
Enclosure [redacted] (P)
Report № [redacted]
-SECRET-

-SECRET-
SECURITY INFORMATION



022-A TURBINE
Extremely Light Thrust Nozzle

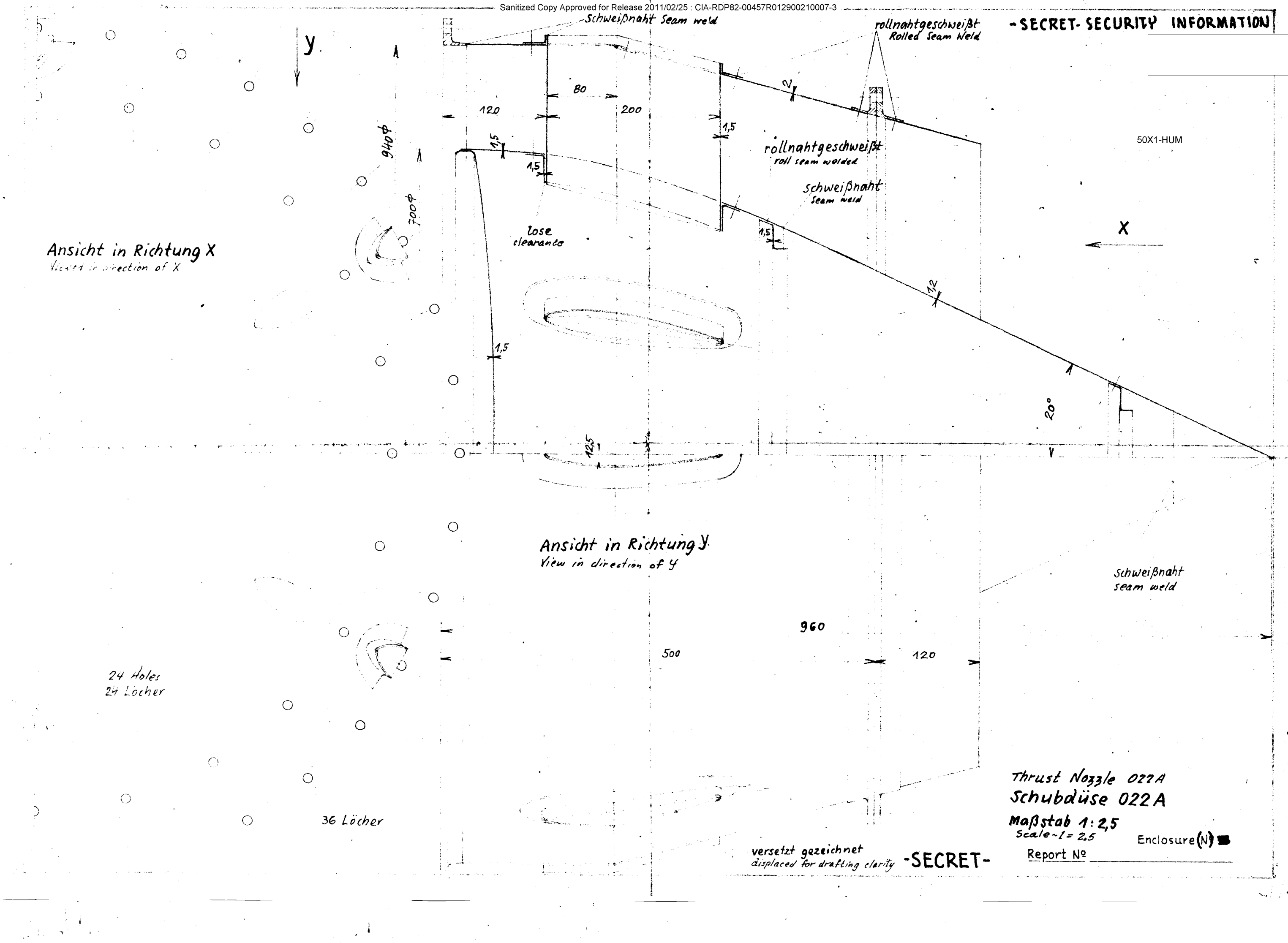
022-A
extrem erleichterte Schubdüse

-SECRET-

Enclosure [redacted] (O) Report Nº [redacted]

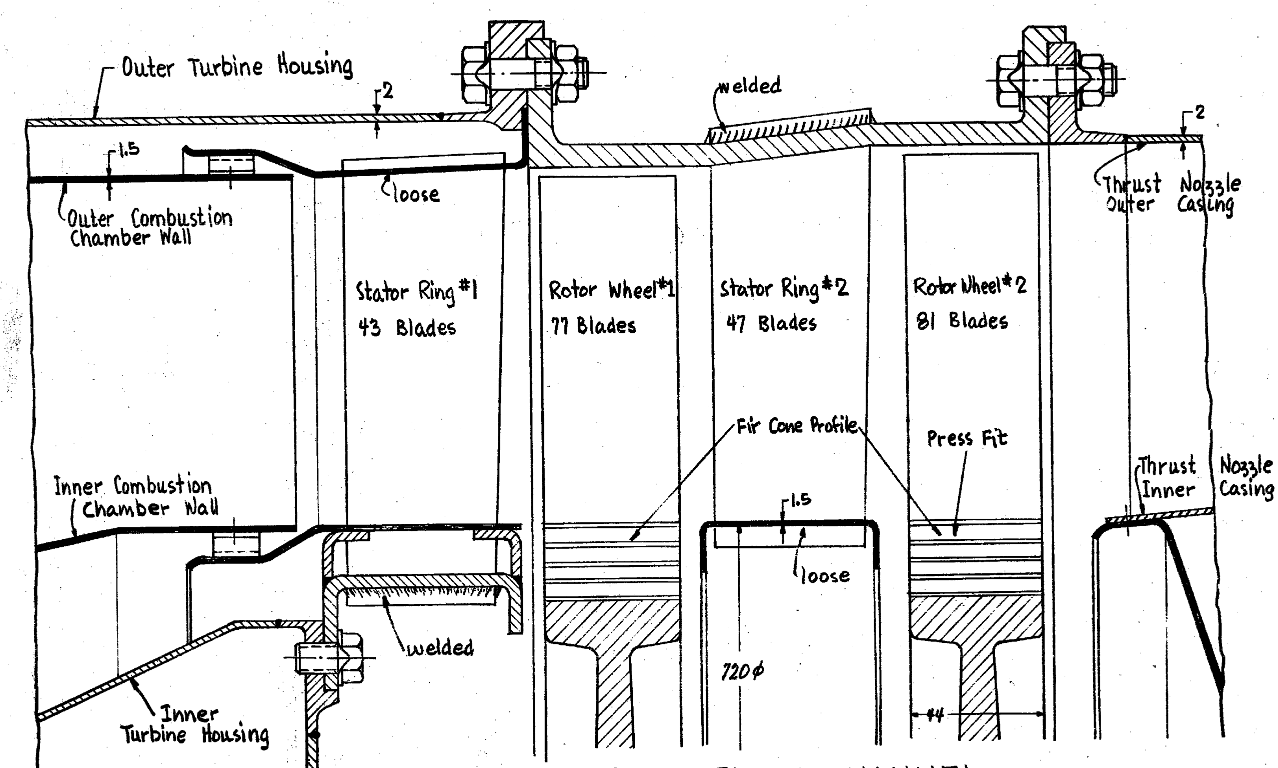
-SECRET- SECURITY INFORMATION

50X1-HUM



-SECRET-

Enclosure Q



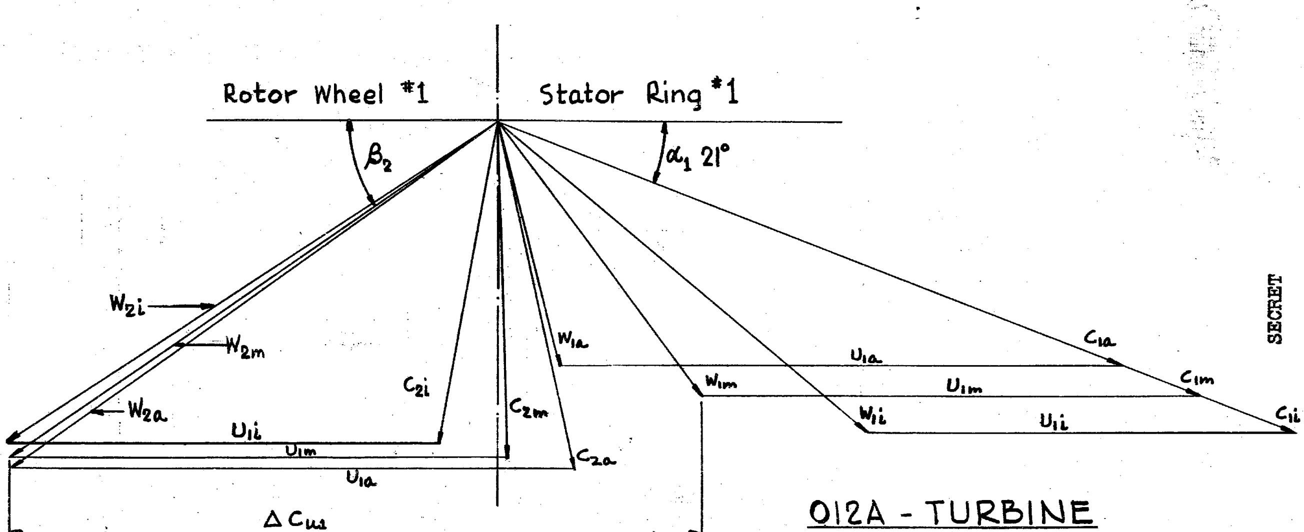
012A TURBINE FLOW CHANNEL

SCALE: 1 = 1.5

Enclosure R

50X1-HUM

SECRET/SECURITY INFORMATION

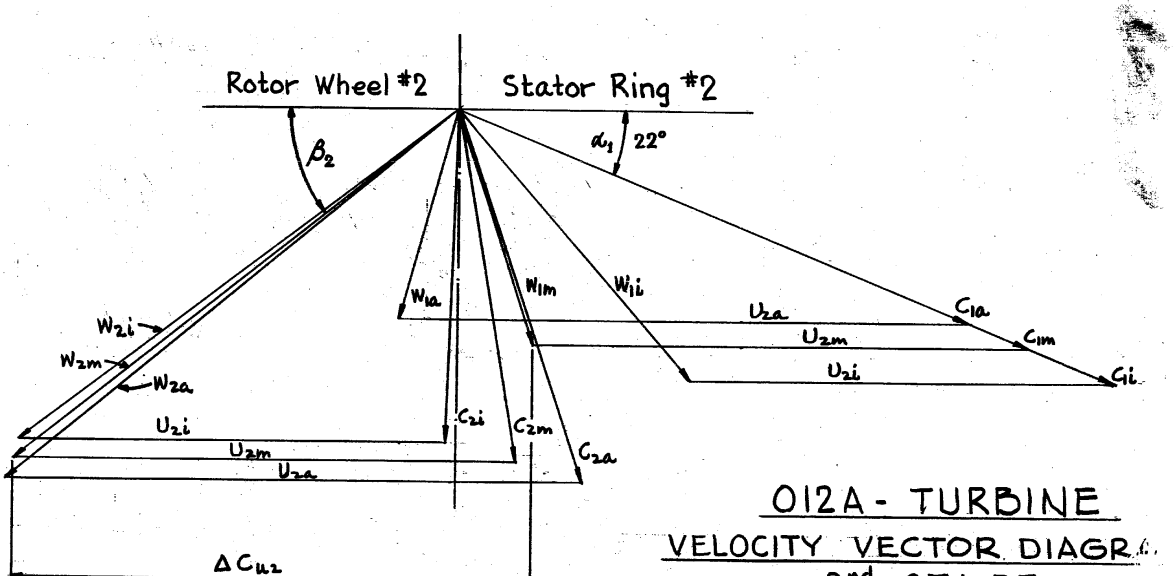


SECRET

012A - TURBINE
VELOCITY VECTOR DIAGRAM
1st STAGE
Scale 0.8 cm = 25 m/s

Enclosure S

SECRET/SECURITY INFORMATION

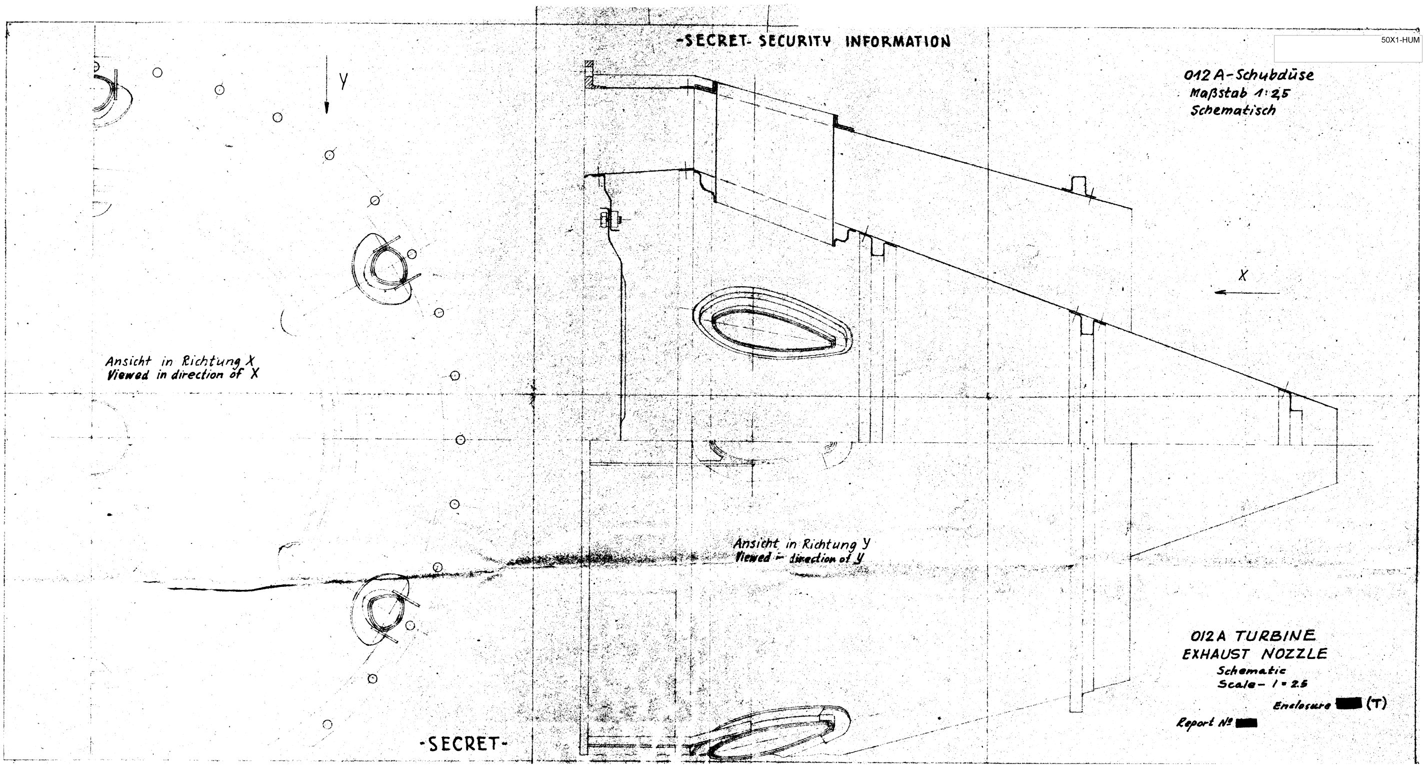


O12A - TURBINE

VELOCITY VECTOR DIAGR...

2nd STAGE

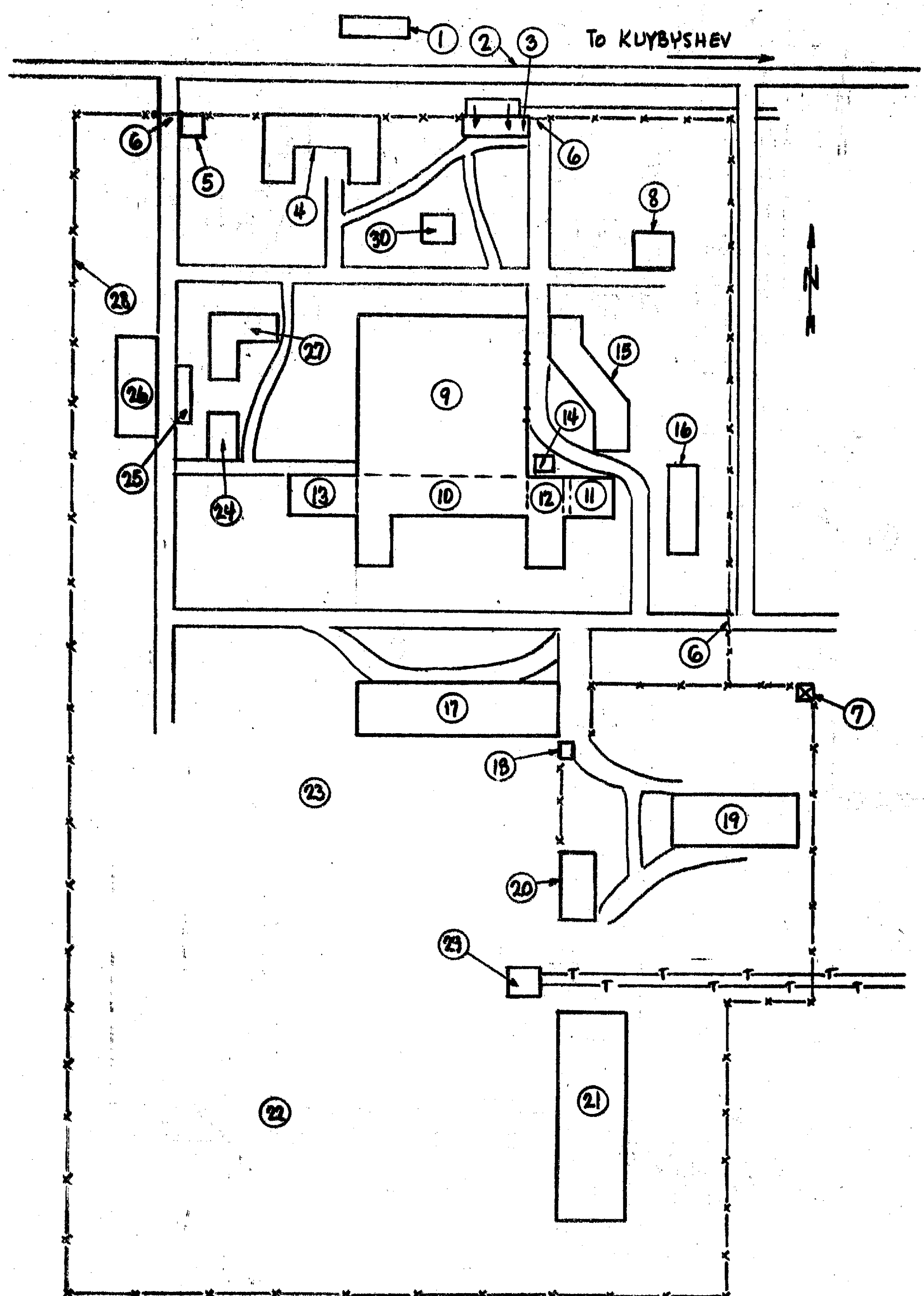
Scale 0.8 cm = 25 m/s


-SECRET- SECURITY INFORMATION
012 A-Schubdüse
Maßstab 1:2,5
Schematisch
Y
X
Ansicht in Richtung X
Viewed in direction of X
Ansicht in Richtung Y
Viewed in direction of Y
012A TURBINE
EXHAUST NOZZLE
Schematic
Scale - 1 : 2.5
Enclosure [redacted] (T)
Report № [redacted]
-SECRET-

SECRET/SECURITY INFORMATION

50X1-HUM

Enclosure U



Sketch of ZAVOD #2 - KUYBYSHEV

50X1-HUM

(See report, Para. 35, for Key)

SECRET

Enclosure V

50X1-HUM

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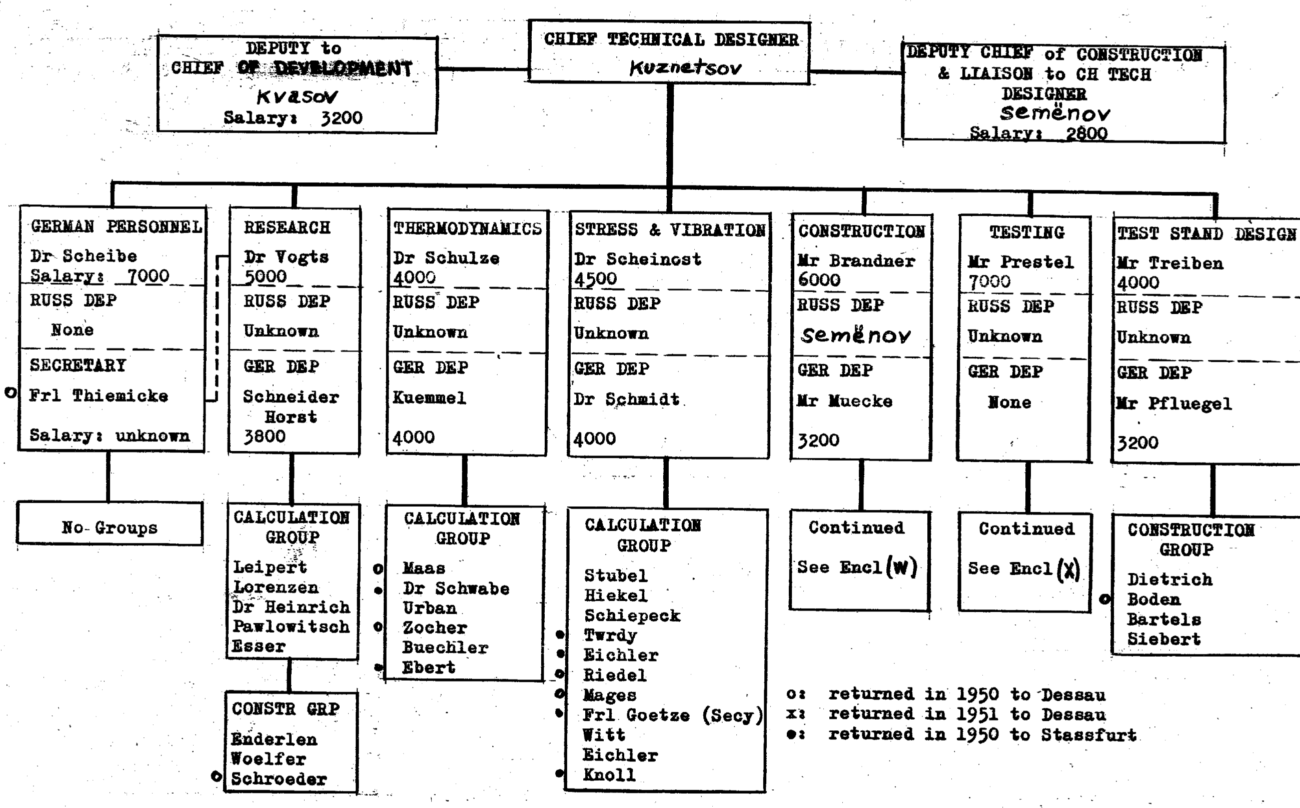


Organizational Breakdown Chart, Zavod No 2, Kuybyshev

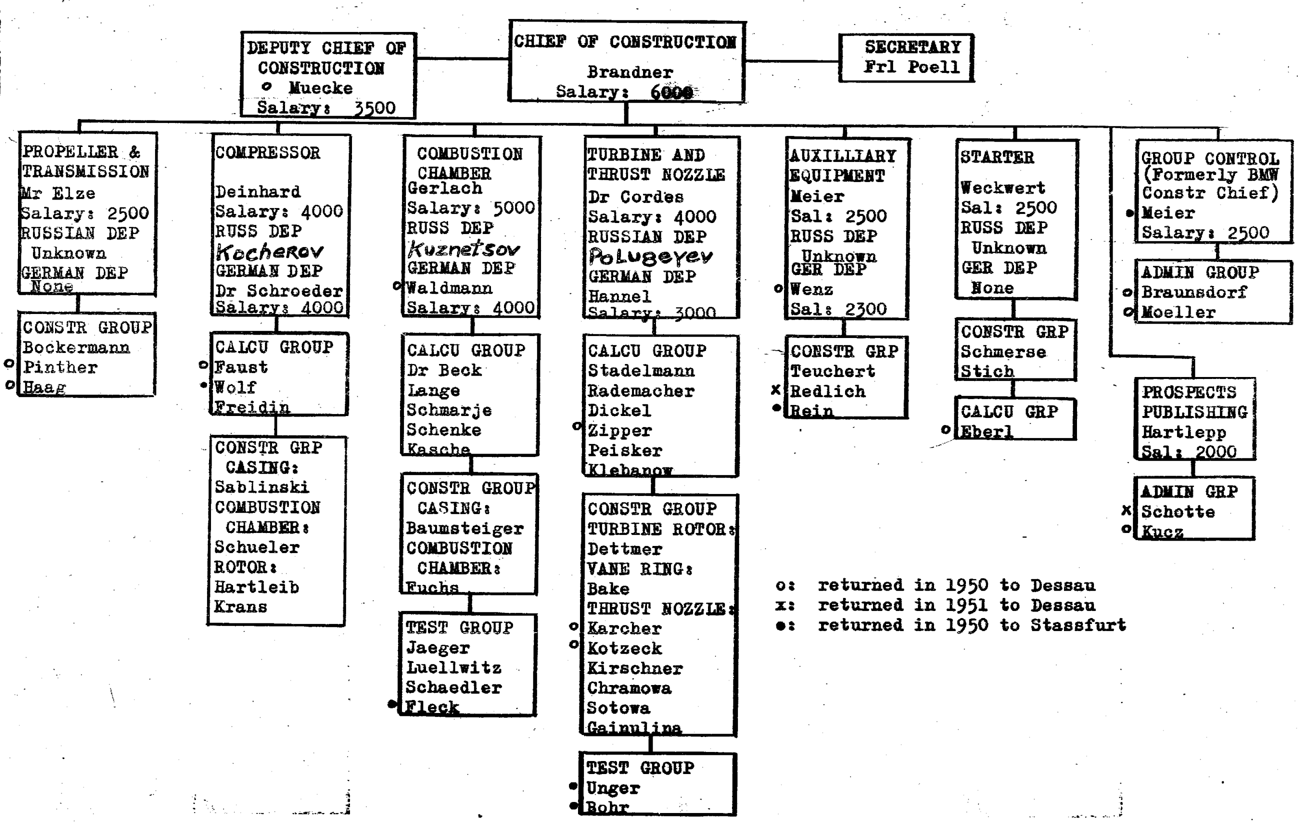
SECRET

50X1-HUM

SECRET/SECURITY INFORMATION

Organizational Chart, (Chief of Construction), Zavod No 2, Kuybyshev

SECRET



50X1-HUM

Enclosure X

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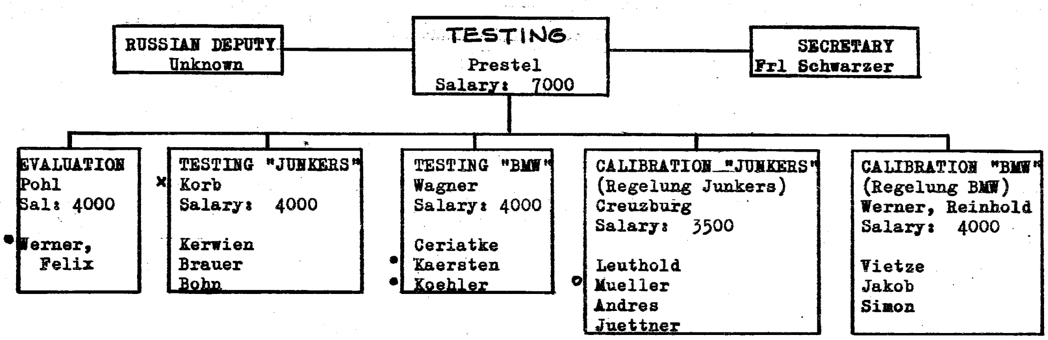
Organizational Chart, (Testing) Zavod No 2, Kuybyshev



o: returned in 1950 to Dessau
x: returned in 1951 to Dessau
●: returned in 1950 to Stassfurt

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