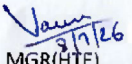
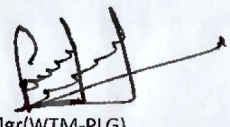


ANNEXURE -A ,PI-220260042	
DESCRIPTION:- MCG OF RUNNER BLADES TO DRG 22040722503 REV 00, PROFILE DRG 02040083701	
A) SCOPE OF WORK	
1	Raw material as Runner Blade casting (drg no 22040722506) will be issued from BHEL Bhopal after submitting Bank Guarantee by the vendor.
2	60 nos stainless steel runner blade casting to be finished mcd all over as per drg 22040722503 and profile drg 02040083701. This generally required 5 axis CNC machines. However, vendors are free to machine above blades on 3 axis CNC machine, but final dimensions should be as per finished m/cg drg & 3D model. 3D model will be provided only after PO placement.
3	The material of runner blade casting is 13:4 cr:Ni (ASTM A 743CA6 NM) and machining allowances on tool point to all over shall be about 10 mm which is to be machined off.
4	Grinding shall be carried out on all surfaces after final machining to achieve surface finish of 3.2 micron.
5	Edge preparation and related parameter will be followed as per technical requirement of drg 22040722503 Rev 00.
6	Vendor shall provide the 3D scanning report for one blade casting before start of m/cg to ensure no shortage of material required for m/cg.
7	Vendor shall provide the 3D scanning report for each blade after final m/cg.
8	Vendor shall provide the surface finish report for each blade after final m/cg.
9	Vendor shall provide the surface inspection report for each blade after final m/cg as per inspection sheet 42040083702.
10	Before start of runner blade m/cg, vendor to ensure the latest revision of drg from BHEL-Bhopal(HTE) .
11	Drg/Sketch of Checking Template for profile to be made by vendor in consultant with BHEL-Bhopal(HTE). Vendor shall manufacture 2 set of templates and one set template to be supplied with 1st supply of machined Runner blade.
12	Delivery required 10 no. Blades in 45 days from each vendor after issue of materials.
13	R/M wt will be 1410KG and final wt will be 1060KG. Total scrap wt will be 350KG. Scrap will be free of cost and vendor has to pass on the benefit while quoting the rate. Only GST on scrap will be deducted, for this calculation scrap rate will be Rs 65/KG
B PRE QUALIFICATION CRITERIA:- FOLLOWINGS ARE REQUIRED FOR TECHNICAL QUALIFICATION	
1	Vendor should have requisite 5 axis CNC Machines/3 axis CNC machines to accommodate the runner blade. Machine make with spec & photo are required.
2	Vendor should have experience for machining of francis Hydro Turbine runner blade/hydro pump Impeller blade profile on 5 or 3 axis machine and they have to submit the Purchase order with experience and completion certificate with drg. The PO and completion certificate should be of within seven year. Cut off date will be tender opening date(Techno-commercial). However in case of partial completion of PO, Lot completion certificate is required.
C COMMON POINTS	
1	QA plan is applicable as per inspection sheet.
2	Required tools, fixtures, 3D Scanner & surface measuring equipment to be arranged by supplier.
3	Any checking gauge/measuring gauge required, will be arranged by supplier.
4	Inspection will be done at vendor's work by QC- BHEL-Bhopal or TPI as per QAP/inspection sheet 42040083702. All required design value will be provided after PO placement. MDCC will be required before dispatch.
5	After m/cg, runner blade should be identified by permanent marker pen with drg no and PO no.
6	Qty to be distributed among three vendors with 3:2:1 ratio. In case of two vendors, distribution will be 3:2 ratio otherwise full qty ll be given to L1 vendor. In case of vendor not able to meet the our requirement than qty may be diverted to other vendor as per requirement and action will be taken accordingly.
7	Transportation to & fro will be in vendor scope.
8	Rate to be quoted on the basis of drg 22040722503 Rev 00.
 Sr. Mgr(WTM-THX)  Sr. Mgr(HTE)  MGR(HTE)  Sr. Mgr(WTM-PLG)	

A-FORM



BHARAT HEAVY ELECTRICALS LIMITED - BHOPAL **MM DEPARTMENT**

ESTIMATE SHEET FOR ISSUE OF MATERIAL/COMPONENTS FROM BHEL

A-FORM NO : A202D69
 REV NO : 0
 A-FORM DATE : 09-JUL-26
 PRINT DATE : 09-JUL-26
 PAGE : 1 / 1

FORM NO BP-0021

CHECKLIST

DEPARTMENT : 202 PROJECT : NHPC PO NO : A202D69 END PRODUCT : WTM
 INDENT NO : 220260042 WORK ORDER NO : 33316A20205 PO DATE : DELY REQD : 15092026
 INDENT DATE : 08072026 MATERIAL ISSUE DIV : 202 SUPP CODE : SUPP NAME :

DETAILS OF FINISHED GOODS

A-SLNO	PO IT NO	PI IT NO	QUANTITY REQUIRED	UNIT	SHOP NO	DEST CD	COST CD	H.CELL
DESCRIPTION OF SUB-ASSEMBLY/ITEM & WEIGHT/VOLUME/AREA								

FREE ISSUE MATERIAL PER UNIT OF FINISHED GOODS

MATL CODE	QTY PSL UNIT	PSL UNIT	RATE PSL UNIT	TOTAL MATL TO BE ISSUED	ISSUE PSL/UNIT	SMIV/PPMIV NO	MATERIAL VALUE	TARRIF HEAD	MATL ISSUE QTY
DESCRIPTION OF FREE ISSUE MATERIAL AND WEIGHT /VOLUME/AREA									
	1	0		1		60.000	NO	202	202
RUNNER BLADE MACHINING									
ASTM A743	1.0000	NO	1509637.000	60.00	NO	WIP	90578220.000		1.0000
SS CASTING OF ASTM A743 GR CA6NM FOR RUNNER BLADE CASTING MACHINING TO DRG. NO. 22040722503 REV 00									
R/M WT (kg) PER UNIT: 1410 F/M WT (kg) PER UNIT: 1060 Scrap Rate (Rs/kg): 65									
REMARKS NOT APPLICABLE.									
TOTAL NO OF CANCEL ITEM 0								AFORM TOTAL 90578220.000	

1 MATERIAL TO BE ISSUED ON :- FREE ISSUE BASIS
 2. TRANSPORT TO BE PROVIDED BY :- SUPPLIER
 3. EXCISE DUTY ON ISSUE MATL TO BE BORNE BY :- SUPPLIER
 4. SCRAP TO BE RETURNED :- NO
 5 INVARIABLY ISSUE WT. TO BE RECORDED ON SMIV/PMIV
 RPT-101

SIGNATURE OF INDENTOR
 NAME
 DESIGNATION
 TELEPHONE

SIGNATURE OF ASC EXECUTIVE
 NAME
 DESIGNATION
 TELEPHONE



जलीय वॉटर पॉथ HYDRAULIC WATER PASSAGE

PROJECT NAME : COE-HM/837
WORK ORDER NO : 33311 L 207 34

DIMENSIONAL CHECKS TO BE PERFORMED FOR : SHEET No.

1.	BLADE INLET PITCH AND HEIGHT	1
2.	BLADE INLET & DISCHARGE DIAMETER	2
3.	BLADE THICKNESS	3
4.	RUNNER BLADE PROFILE	4
5.	BLADE INLET ANGLE	5
6.	BLADE OUTLET ANGLE	6
7.	BLADE OUTLET OPENINGS	7
8.	BLADE WAVINESS	8
9.	SPIRAL CASING	9
10.	STAY VANE	10
11.	GUIDE VANE PROFILE & END CLEARANCE	11
12.	GUIDE VANE OPENING	12
13.	DRAFT TUBE	13

DRAWING NO : 42040083702 NO OF SHEETS : 13 SHEETS

NOTE :- FOR TEMPLATE LOCATIONS & OTHER DETAILS, REFER CORRESPONDING THEORETICAL DRAWINGS.

Draft Tube Theoretical - 02010083701
Spiral Casing Theoretical - 02020083701
Stay Vane Theoretical - 12020083702
Guide Vane Theoretical - 12030083701
Runner Blade Profile - 02040083701

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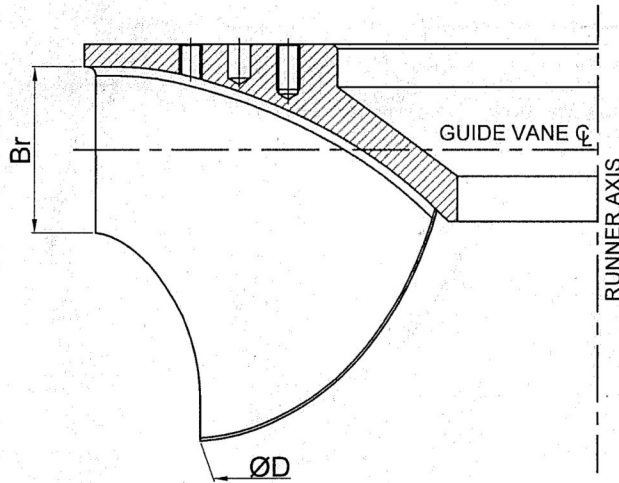
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RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

BLADE INLET PITCH AND HEIGHT



ALLOWABLE DEVIATION ON

INLET HEIGHT Br

INDIVIDUAL TO AVERAGE	± 0.1 % D
AVERAGE TO DESIGN	± 0.05 % D

	HEIGHT Br
DESIGN	726.6
1 - 2	
2 - 3	
3 - 4	
4 - 5	
5 - 6	
6 - 7	
7 - 8	
8 - 9	
9 - 10	
10 - 11	
11 - 12	
12 - 13	
13 - 14	
14 - 15	
15 - 1	
AVERAGE	
DEVIATION	

NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

INLET HEIGHT Br (DESIGN) = 726.6

PI IS TO BE MEASURED ON PLANE PASSING THROUGH GUIDE VANE CENTERLINE.

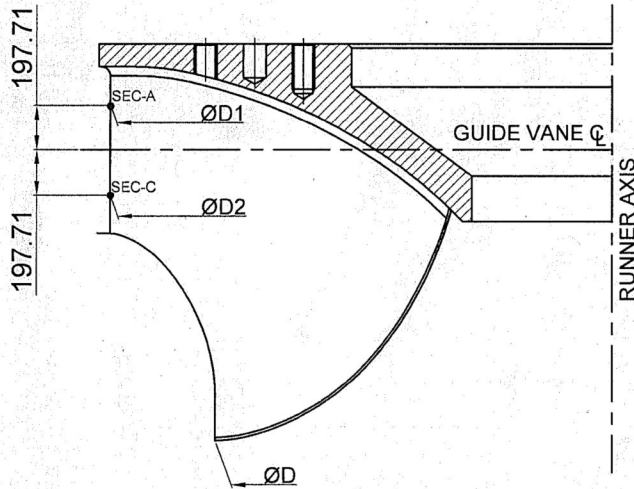
	NAME	SIGNATURE	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
ISSUED BY				
INSPECTED BY				WORK ORDER NO : 33311 L 207 34
APPROVED BY		14		DRG. NO. 42040083702
WITNESSED BY				SHEET 1 OF 13 SHEETS



RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

BLADE INLET AND DISCHARGE DIAMETER



ALLOWABLE DEVIATION ON

INLET AND DISCHARGE DIAMETER

AVERAGE TO DESIGN	± 0.125 % D
INDIVIDUAL TO AVERAGE	± 0.5 % D

DISCHARGE DIAMETER	
	D
DESIGN	3460
WITNESSED	
AVERAGE	
DEVIATION	

INLET EDGE DIAMETER AT			
SECTION		SECTION - A ØD1	SECTION - C ØD2
DESIGN		4377	4377
INDIVIDUAL	BETWEEN BLADE Nos	ALLOWABLE MAX	
		ALLOWABLE MIN	
		1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		AVERAGE	
AVERAGE		ALLOWABLE MAX	
		ALLOWABLE MIN	

NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

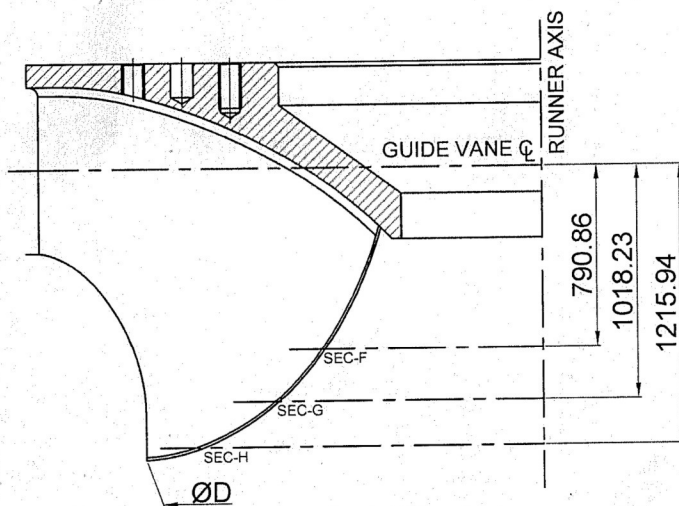
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ISSUED BY				
INSPECTED BY				WORK ORDER NO : 33311 L 207 34
APPROVED BY		15		DRG. NO. 42040083702
WITNESSED BY				SHEET 2 OF 13 SHEETS



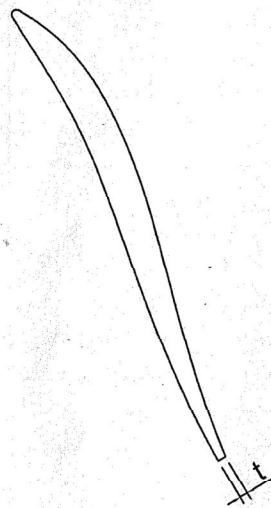
RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

BLADE THICKNESS



ALLOWABLE DEVIATION ON BLADE THICKNESS NEAR OUTLET EDGE	
AVERAGE TO DESIGN	± 7.5 %
INDIVIDUAL TO AVERAGE	± 15.0 %



THICKNESS OF BLADE AT OUTLET EDGE			
SECTION	F	G	H
DESIGN Thickness	t=13.6	t=16.32	t=43.88
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
AVERAGE			

NOTE :

t IS THE THICKNESS OF BLADE AT OUTLET EDGE FOR A PARTICULAR SECTION.

DISCHARGE DIAMETER D (DESIGN) = 3460

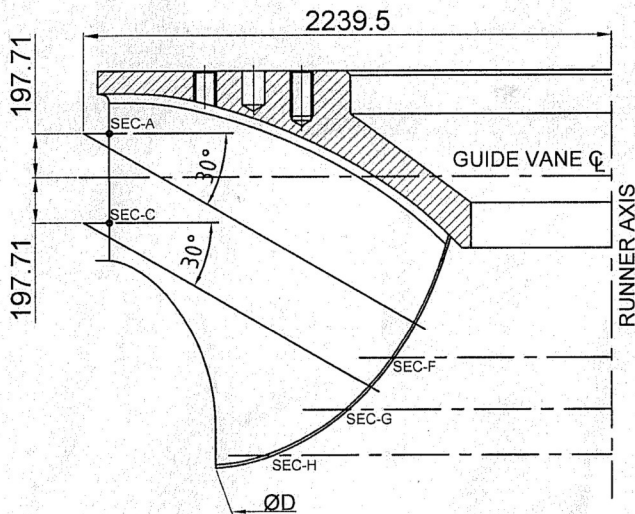
	NAME	SIGNATURE	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
ISSUED BY				
INSPECTED BY				WORK ORDER NO : 33311 L 207 34
APPROVED BY		16		DRG. NO. 42040083702
WITNESSED BY				SHEET 3 OF 13 SHEETS



RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

RUNNER BLADE PROFILE



ALLOWABLE DEVIATION ON RUNNER BLADE PROFILE

AT INLET & OUTLET EDGE :

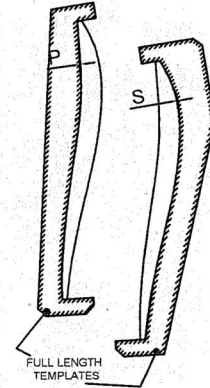
INDIVIDUAL TO AVERAGE = $\pm 0.1\% D$

AVERAGE TO DESIGN = $\pm 0.05\% D$

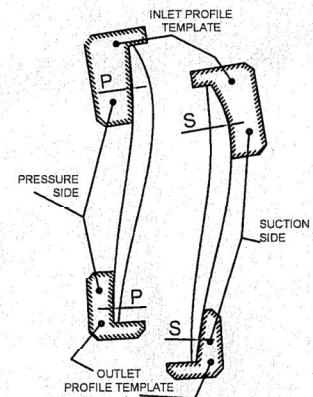
REMAINING PART OF THE SURFACE :

INDIVIDUAL TO AVERAGE = $\pm 0.2\% D$

AVERAGE TO DESIGN = $\pm 0.1\% D$



BLADE No.	INLET PROFILE				OUTLET PROFILE						INCLINED SECTIONS	
	SECTION - A		SECTION - C		SECTION - F		SECTION - G		SECTION - H		INC-1	INC-2
	Pressure	Suction	Pressure	Suction	Pressure	Suction	Pressure	Suction	Pressure	Suction		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												



NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

ENTIRE BLADE PROFILE IS TO BE MEASURED ON ALL BLADES ON VARIOUS SECTIONS AS PER BLADING DRAWING.

SECTIONS TO BE MARKED ON ALL BLADES ON PRESSURE AND SUCTION SIDES BY SCRIBING A LINE MARKING LENGTH 775 mm.

DIMENSION P AND S ARE THE MAXIMUM GAP BETWEEN BLADES AND TEMPLATES.

2 INLET PROFILE TEMPLATES AT SECTIONS A & C OF LENGTH 500 MM ARE TO BE MANUFACTURED.

2 OUTLET PROFILE TEMPLATES AT SECTIONS F & G OF LENGTH 400 MM ARE TO BE MANUFACTURED.

1 OUTLET PROFILE TEMPLATE AT SECTION H OF LENGTH 200 MM ARE TO BE MANUFACTURED.

TWO FULL LENGTH TEMPLATES ON INCLINED SECTION (AS SHOWN) TO BE MANUFACTURED.

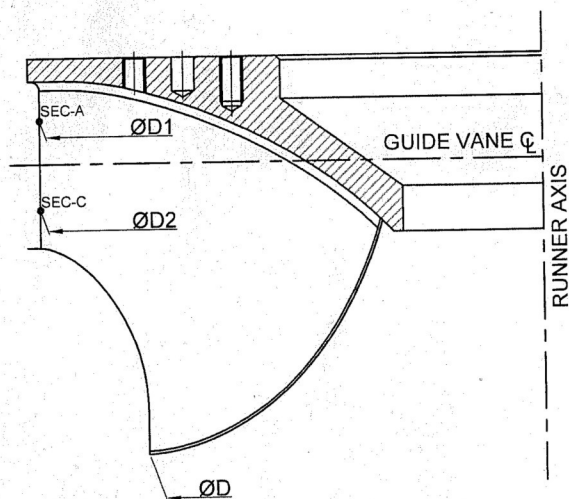
	NAME	SIGNATURE	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
ISSUED BY				
INSPECTED BY				WORK ORDER NO : 33311 L 207 34
APPROVED BY		17		DRG. NO. 42040083702
WITNESSED BY				SHEET 4 OF 13 SHEETS



RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

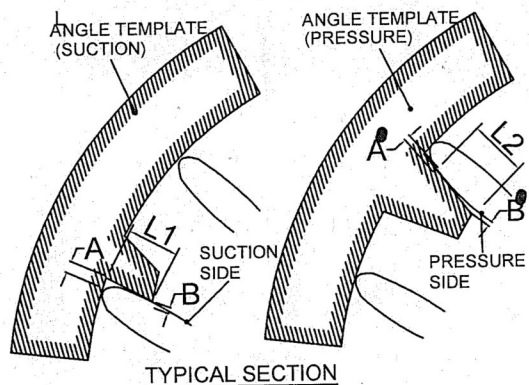
BLADE INLET ANGLE



ALLOWABLE DEVIATION ON

BLADE INLET ANGLE

AVERAGE TO DESIGN	± 0.5°
INDIVIDUAL TO AVERAGE	± 1.0°



BLADE NO	SECTION - A					SECTION - C				
	L1 = 500		L2 = 500		ANGLE DEVIATION ±Δβ°	L1 = 500		L2 = 500		ANGLE DEVIATION ±Δβ°
	A	B	A'	B'		A	B	A'	B'	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
AVERAGE ±Δβ°						AVERAGE ±Δβ°				

NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

A, B, A' & B' ARE MEASURED GAPS BETWEEN THE TEMPLATE AND BLADE PROFILE AT EITHER ENDS OF THE TEMPLATE.

$P = A - B$ & $P' = A' - B'$. ANGLE DEVIATION = $0.5 * [(P/L1) - (P'/L2)] * 57.3$ Degrees

TEMPLATES ARE TO TAKE REFERENCE AXIS OF RUNNER DIAMETER.

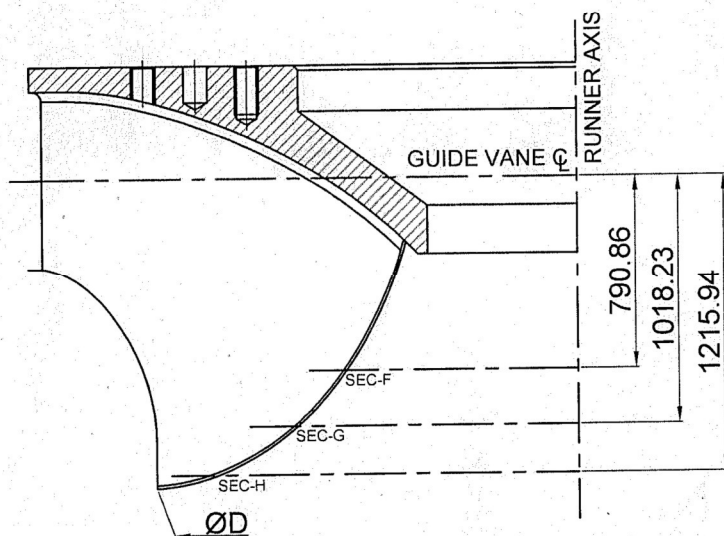
ISSUED BY	NAME	SIGNATURE	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
INSPECTED BY		18		WORK ORDER NO : 33311 L 207 34
APPROVED BY				DRG. NO. 42040083702
WITNESSED BY				SHEET 5 OF 13 SHEETS



RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

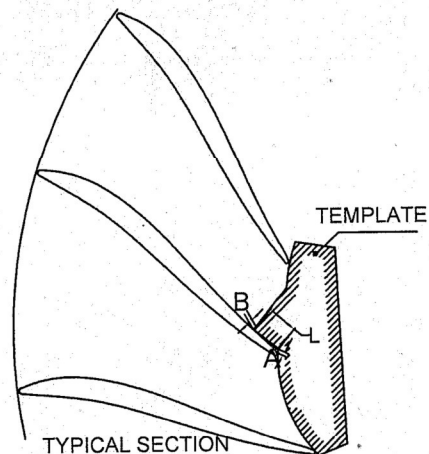
BLADE OUTLET ANGLE



ALLOWABLE DEVIATION ON

BLADE OUTLET ANGLE

AVERAGE TO DESIGN	± 0.5°
INDIVIDUAL TO AVERAGE	± 1.3°



BLADE OUTLET ANGLE									
	SECTION -F			SECTION -G			SECTION-H		
	L (DESIGN) = 400			L (DESIGN) = 400			L (DESIGN) = 200		
BLADE NO	A	B	ANGLE DEVIATION	A	B	ANGLE DEVIATION	A	B	ANGLE DEVIATION
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
	AVERAGE			AVERAGE			AVERAGE		

NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

ANGLE DEVIATION = $[(A - B)/L] \times 57.3$ Degrees.

TEMPLATES ARE TO TAKE REFERENCE AXIS OF RUNNER DIAMETER.

A & B ARE MEASURED GAPS BETWEEN THE TEMPLATE AND BLADE PROFILE AT EITHER ENDS OF THE TEMPLATE.

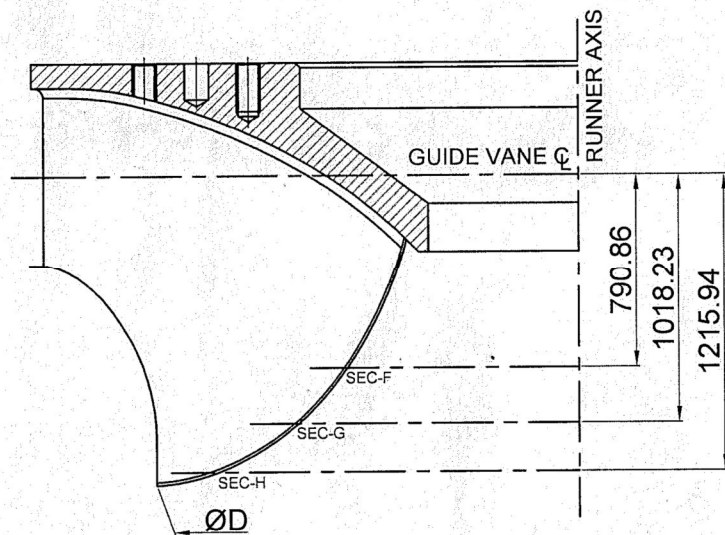
NAME	SIGNATURE ¹⁹	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
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RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

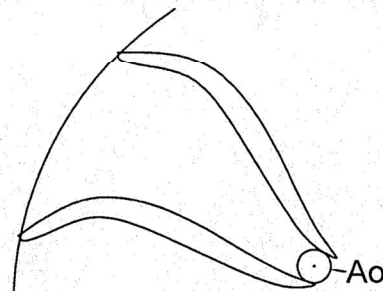
BLADE OUTLET OPENINGS



ALLOWABLE DEVIATION ON

BLADE OUTLET OPENINGS

AVERAGE TO DESIGN	+ 1.0 % - 0.5 %
INDIVIDUAL TO AVERAGE	+ 3.5 % - 2.0 %



MINIMUM OUTLET OPENING (Ao)				
	SECTION	F	G	H
	DESIGN	163.7	177.6	202.2
INDIVIDUAL	ALLOWABLE MAX			
	ALLOWABLE MIN			
BETWEEN BLADE NOS	1-2			
	2-3			
	3-4			
	4-5			
	5-6			
	6-7			
	7-8			
	8-9			
	9-10			
	10-11			
	11-12			
	12-13			
	13-14			
	14-15			
	15-1			
	AVERAGE			
AVERAGE	ALLOWABLE MAX			
	ALLOWABLE MIN			

NOTE :

DISCHARGE DIAMETER D (DESIGN) = 3460

Ao = MINIMUM OUTLET OPENING AT TRAILING EDGE FROM PRESSURE SIDE OF ONE BLADE TO SUCTION SIDE OF ADJACENT BLADE.

NAME

SIGNATURE

DATE

ALL DIMENSIONS ARE IN MM.

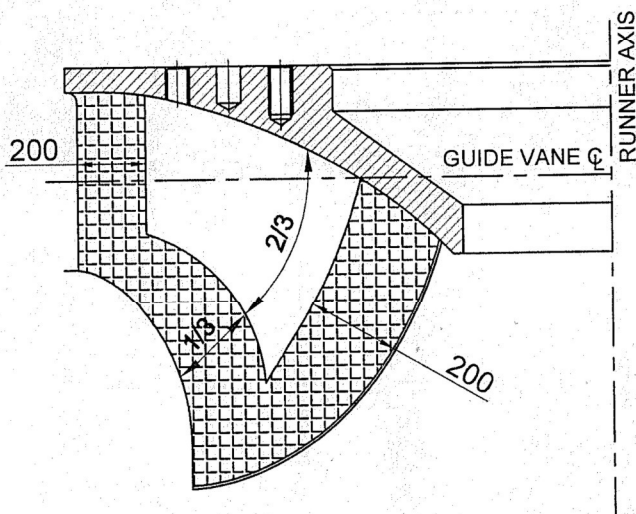
UNLESS OTHERWISE STATED.



RECORD OF INSPECTION

PROJECT NAME : COE-HM/837

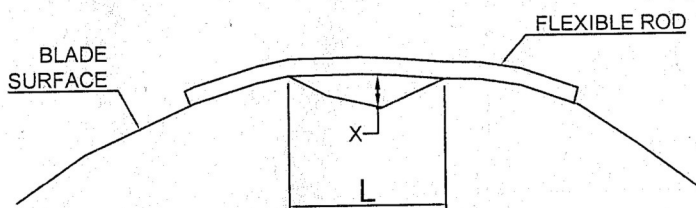
BLADE WAVINESS



ALLOWABLE DEVIATION ON

(MARKED ZONES-BOTH SIDES)

AT INLET & OUTLET EDGES	± 0.01
ELSEWHERE	± 0.02



	WAVINESS = X/L																													
	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc	Pr	Suc
WAVINESS																														
ZONE																														
WAVINESS																														
ZONE																														
WAVINESS																														
ZONE																														
WAVINESS																														
ZONE																														
WAVINESS																														
ZONE																														

NOTE :

THE FLEXIBLE ROD CAN BE APPLIED OVER ANY SURFACE OF THE RUNNER BLADE.

THE POINT OF MAXIMUM DEPARTURE X - SHALL LIE IN THE MIDDLE THIRD OF L. L SHOULD NOT BE LESS THAN 50mm.

MEASUREMENT FOR CHECKING WAVINESS TO BE CARRIED OUT SUITABLY AT LOCATIONS WHERE VISUAL INSPECTION WARRANTS SUCH A REQUIREMENT.

WAVINESS IS ALLOWED ONLY AS AN ISOLATED DEFECT OCCURING OCCASSIONALLY ON SURFACE.

NAME	SIGNATURE ²¹	DATE	ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
------	-------------------------	------	---