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Departamento de Engenharia Mecânica e
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RELATÓRIO FINAL

**" Estudo do Coeficiente Global de Transferência em Permutadores
Carcaça-tubos"**

por

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Porto e FEUP, 30 de Setembro de 1993

PARECER

O aluno finalista do Curso de Engenharia Mecânica e Gestão Industrial **ADELINO LOPES**, realizou no INEGI, no âmbito do programa PRODEP, medida 4.3/7/7/92/93, um estágio cujo trabalho se encontra descrito no relatório apresentado com o título **"Estudo do Coeficiente Global de Transferência em Permutadores Carcaça-tubos"**.

Durante a execução do conjunto de tarefas que lhe foram atribuídas, o referido estagiário atingiu os objectivos que lhe foram propostos, mostrando ter conhecimentos adequados.

Face à qualidade do trabalho produzido cumpre-me informar que o estágio realizado se revestiu de grande interesse para esta instituição.

Porto, 27 de Dezembro de 1993

O Supervisor



PARECER

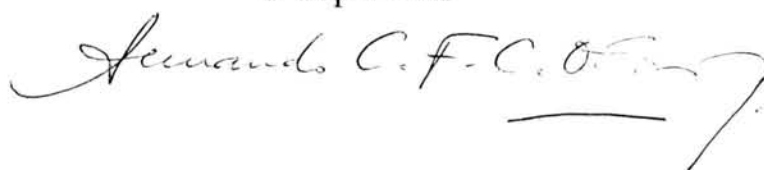
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INTRODUÇÃO

Em diversas situações praticas é necessário uma estimativa do tamanho de um permutador. Para um engenheiro de processo que tenta estimar o custo e espaço de uma instalação, são numa primeira análise, suficientes a área de transferência, diâmetro da carcaça e comprimento aproximados. O processo completo (exacto) de dimensionamento, exige também uma estimativa preliminar das dimensões, usadas como solução inicial num processo interactivo que termina com a obtenção da solução final.

O método simplificado frequentemente usado consiste na escolha de um coeficiente global de transferência de calor. Esta escolha baseia-se na experiência, ou no uso de valores tabelados na literatura, para os fluidos em causa. No entanto, este método tem um alto grau de incerteza: os valores tablados têm uma gama de variação muito grande. Para além desse facto, são tomados valores idênticos de K_{estimado} , para diferentes caudais e diâmetros da carcaça.

Para um calculo expedito e mais exacto, o objectivo deste trabalho é obter uma relação entre K , os caudais e diâmetro da carcaça, e com ela gerar valores de K , tabelar e representa-los na forma gráfica.

OBTENÇÃO DO COEFICIENTE GLOBAL DE TRANSFERÊNCIA

Neste trabalho foram obtidos valores do coeficiente global de transferência para permutadores monofásico com, cabeça flutuante, uma passagem na carcaça (tipo E) e nos tubos. A cabeça flutuante exige maior folga entre o feixe de tubos e a carcaça permitindo diferenças de temperaturas mais elevadas entre eles e consequentemente maiores dilatações. A escolha deste tipo de permutadores deve-se ao facto de ser o mais usado na pratica.

Foram considerados três situações distintas, água a circular na carcaça e nos tubos, água nos tubos e ar na carcaça e ar na carcaça e nos tubos. Para cada uma destas situações utilizaram-se vários caudais, tanto na carcaça como nos tubos. Assim para o caso da água a circular tanto na carcaça como nos tubos, os caudais considerados foram: 1, 2, 5, 10, 20, 50 e 100 quilogramas por segundo (Kg/s). Quando os fluidos são água e ar temos os mesmos caudais para a água, sendo os do ar: 0.1, 0.2, 0.5, 1e 2 (Kg/s). Para o ar na carcaça e nos tubos, os caudais na carcaça são: 0.1, 0.2, 0.5, 1e 2 (Kg/s) e nos tubos: 1, 2, 5, 10 e 20 (Kg/s). Em cada situação geraram-se valores de Ke para todas as combinações de caudais, considerando as geometrias de feixe quadrada (90°) e triangular (30°), assim como o diâmetro dos tubos três quartos de polegada ($3/4''$) e uma polegada ($1''$).

O coeficiente global de transferência (Ke) é referenciado a área exterior dos tubos e as suas unidades são o watt por metro quadrado e graus kelving (W/m^2K). Os diâmetros da carcaça tidos em conta foram os normalizados e as unidades consideradas foram o metro (m).

O calculo de Ke passa pela contabilização do efeito de diversas resistências, a resistência de convecção interior, de convecção exterior e de condução. Quando o fluido é a água considera-se uma resistência adicional- a resistência de depósitos- que tem em conta o efeito de deposição de partículas na superfície dos tubos. Para esta resistência foram considerados os valores aconselhados pela norma Tema para temperaturas inferiores a $100^\circ C$. Esta norma atribui dois valores á dita resistência, consoante a velocidade do escoamento é maior ou menor que 1 m/s sendo respectivamente, $1/9760$ e $1/4880$ (m^2K/W). No caso água-água, ou seja água a circular nos tubos e na carcaça, esta resistência é considerada tanto no exterior como no interior dos tubos. Para minorar as perdas para o exterior o fluido mais quente circula nos tubos.

É calculada a perda de carga tanto nos tubos como na carcaça. A finalidade deste calculo é saber quando a que ela ultrapassa o valor aconselhado na prática (0.7 atm). A sua avaliação é feita para $L/D_c=15$. Para a contabilização das resistências, calculo da perda de carga e coeficiente de convecção nos tubos utilizaram-se métodos já conhecidos da transferência de calor e mecânica dos

fluidos. No calculo da carga e coeficiente de transferência por convecção do lado da carcaça utilizou-se o método de Bell-Delaware. Quando a perda de carga é superior a 0.7 atm a distância entre separadores varia entre a mínima, vinte por cento do diâmetro da carcaça ($0.2 \cdot D_c$) ou 0.0508 m, o maior dos dois, e D_c com incremento de $0.1 \cdot D_c$. A perda de carga é analisada para cada distância considerada e caso seja inferior a 0.7 atm pára-se de incrementar.

No que diz respeito as propriedades dos fluidos utilizados, consideram-se viscosidades diferentes para a água, consoante ela circule dentro ou fora dos tubos. Para o ar elas são iguais independentemente deste circular na carcaça ou nos tubos. Para a água a circular nos tubos elas são: massa volumica 1000 Kg/m³, a viscosidade 0.0005 Kg/(m.s), calor especifico 4180 J/(Kg.°c) e condutibilidade térmica 0.63 W/m². Quando a água circula na carcaça apenas a viscosidade passa a ser 0.0008 Kg/(m.s). No caso do ar temos: massa volumica 1 Kg/m³, calor especifico 1010 J/(Kg°c) , a condutibilidade térmica igual a 0.03 W/m² e a viscosidade de $2.1 \cdot 10^{-5}$ Kg/(m.s).

MODOS DE OBTENÇÃO DO COEFICIENTE GLOBAL DE TRANSFERÊNCIA

Para obter os valores do coeficiente global de transferência foi elaborado um programa em Quikbasic em que:

- O utilizador define os fluidos, os caudais, o diâmetro da carcaça, o arranjo do feixe e o diâmetro do tubo.

- A distância mínima entre os separadores é a mínima (20% Dc) e caso esta seja inferior a 0.0508 m passa a ser considerado este valor.

- O permutador respeita as folgas de fabrico fixadas pelas normas (TEMA).

- Utilizou-se o método de Bell-Delaware para o calculo do coeficiente de convecção na carcaça.

- As perdas de carga nos tubos e carcaça foram avaliadas, na hipótese da relação L/D_c ser de 15 de acordo com o pretendido.

- Caso o regime do escoamento, na carcaça ou nos tubos seja laminar o utilizador recebe uma mensagem.

- O utilizador recebe uma mensagem quando a perda de carga na carcaça ou nos tubos for superior a 0.7 atm.

- Para perdas de carga superiores a 0.7 atm na carcaça a distância entre separadores vai sendo incrementada 10% Dc até que aquela seja inferior a 0.7 atm mas, sem nunca ultrapassar Dc.

Após a elaboração do programa geraram-se os valores do coeficiente global de transferência.

RESULTADOS

Na prática determinadas situações revelam-se demasiado dispendiosas ou pouco eficientes. É o que acontece quando temos perdas de carga elevadas, regimes de escoamento laminar ou coeficientes globais de transferência baixos. Para perdas de carga de carga elevadas os custos associados são também elevados não compensando o ganho em termos de coeficiente. Para regimes laminares dado o seu baixo coeficiente de convecção a tem uma eficiência de transferência baixa, o mesmo acontecendo para baixos valores de Ke . Por tal facto apenas foram retidos os valores do coeficiente global para os quais:

- O regime de escoamento na carcaça ou nos tubos era turbulento.
- A perda de carga na carcaça ou nos tubos fosse inferior a 0.7 atmosferas.
- O seu valor não fosse inferior a quarenta (W/m^2K)

Todos os valores que satisfazem as três condições encontram-se nas tabelas. Para os tabelar e representar graficamente utilizou-se o EXCEL.

CONCLUSÕES

- Da leitura das tabelas verifica-se que os valores mais altos do coeficiente global de transferência são obtidos para a situação água-água, seguindo-se a situação água-ar e em ultimo o caso ar-ar. Os máximos obtidos são respectivamente; 2758.2; 249.3; e 187.7 W/m²K. A grande diferença verificada entre o primeiro e o segundo e terceiro casos, deve-se aos maiores caudais permitidos sem que se ultrapasse o limite de perda de carga e também ao facto de a condutibilidade da água ser cerca de dez vezes a do ar.

- Dos gráficos em que temos o coeficiente global de transferência em função do diâmetro de carcaça para várias combinações de caudais observa-se que, á medida que o diâmetro da carcaça aumenta, o coeficiente global diminui a menos de algumas excepções. Era de esperar uma diminuição dado que, aumentando o diâmetro da carcaça aumenta também o numero de tubos, a distância entre separadores e o corte dos separadores. Como consequência diminui a velocidade do escoamento tanto no interior como no exterior dos tubos. Para as combinações de caudais mais baixos a variação de K_e é praticamente linear para as três situações consideradas. Quando temos combinações de caudais mais altos a queda de K_e é mais acentuada para os diâmetros de carcaça mais baixos. Este fenómeno aparece de forma mais notável no caso água-água. São também visíveis as tais excepções, mais frequentes e destacáveis no caso água-ar. Estas excepções devem-se a dois fenómenos distintos : para diâmetros de carcaça baixos deve-se ao facto de se conseguir satisfazer para diâmetros de carcaça superiores, o limite de perda de carga com área de escoamento cruzado inferiores sendo a velocidade na carcaça superior. Tal fenómeno destaca-se mais no caso água-ar, porque é aquele em que a diferença entre as resistências de convecção interior e exterior é maior, assim como o peso desta.

- O coeficiente global de transferência é menor para o maior diâmetro dos tubos em ambos os arranjos. Aumentando o diâmetro dos tubos diminui-se o coeficiente de convecção interior.

- Conclui-se também que para o mesmo diâmetro dos tubos Ke é ligeiramente inferior para o arranjo de 30°C . Com o arranjo de 30°C o número de tubos é superior diminuindo a velocidade do escoamento no interior dos tubos. No entanto o arranjo de 30°C ainda é preferível ao arranjo de 90°C porque o incremento de área devido ao maior número de tubos compensa a diminuição de Ke .

- Dos gráficos de Ke em função do caudal na carcaça conclui-se que o coeficiente global de transferência aumenta cada vez menos à medida que aumenta o caudal na carcaça. Segue uma evolução tipo exponencial. O coeficiente global evolui desta forma porque, é necessário aumentar a distância entre separadores à medida que aumenta o caudal, para satisfazer o limite de perda de carga, obtendo-se assim aumentos da velocidade cada vez menores. Além disso o desequilíbrio entre o peso dos coeficientes de transferência interior e exterior dos tubos é cada vez maior. Em algumas situações como se pode ver nos gráficos Ke , diminui ao aumentar o caudal na carcaça. Tal facto deve-se à maior área de escoamento, para conseguir satisfazer o limite da perda de carga.

TABELAS

TABELA-1 AR-AR ARRANJO-90 Dt=3/4"

CAUDAIS NOS TUBOS		CAUDAIS NA CARÇAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	103.7	0.205	134.8	0.205	155.7	0.255	131.2	0.337	92.8
		0.255	80.6	0.255	105.5	0.255	125.2	0.305	96.9	0.387	74.6
		0.305	63.5	0.305	81.9	0.305	99.2	0.337	90.8	0.438	65.9
		0.337	46.8	0.337	64.0	0.337	82.2	0.387	74.6	0.489	57.5
				0.387	51.2	0.387	67.7	0.438	63.3	0.533	51.5
				0.438	43.4	0.438	56.2	0.489	53.8	0.591	45.5
						0.489	47.9	0.533	48.5	0.635	40.8
						0.533	42.0	0.591	42.0		
2		0.205	117.1	0.205	158.2	0.205	187.7	0.255	166.5	0.337	122.7
		0.255	92.7	0.255	127.2	0.255	157.0	0.305	124.4	0.387	108.5
		0.305	74.3	0.305	100.7	0.305	128.3	0.387	101.2	0.438	94.0
		0.337	55.9	0.337	77.0	0.337	104.8	0.438	88.6	0.489	83.7
		0.387	45.9	0.387	62.5	0.387	88.9	0.489	76.0	0.533	75.5
		0.438	40.1	0.438	54.0	0.438	75.3	0.533	69.1	0.591	68.0
				0.489	46.7	0.489	64.7	0.591	60.5	0.635	61.4
				0.533	40.7	0.533	56.6	0.635	54.7	0.686	55.2
						0.591	50.1	0.686	49.5	0.737	49.0
						0.635	45.5	0.737	44.2	0.787	44.7
						0.686	41.4	0.787	40.5	0.838	40.1
5		0.387	51.8	0.387	74.0	0.387	114.0	0.387	135.0	0.387	148.4
		0.438	45.9	0.438	65.1	0.438	99.0	0.438	123.3	0.438	133.9
		0.489	40.2	0.489	56.8	0.489	85.9	0.489	106.9	0.489	122.7
				0.533	49.4	0.533	74.9	0.533	98.3	0.533	111.9
				0.591	44.8	0.591	67.2	0.591	87.6	0.591	104.2
				0.635	41.4	0.635	61.7	0.635	80.0	0.635	95.0
						0.686	56.8	0.686	73.2	0.686	86.4
						0.737	51.9	0.737	66.3	0.737	77.7
						0.787	48.2	0.787	61.3	0.787	71.4
						0.838	44.2	0.838	55.9	0.838	64.7
						0.889	41.5	0.889	52.2	0.889	60.3
								0.94	48.3	0.94	58.0
								0.991	45.4	0.991	54.3
								1.067	40.4	1.067	48.2
										1.118	44.7
10				0.533	54.0	0.533	85.7	0.533	118.0	0.533	138.1
				0.591	49.3	0.591	77.7	0.591	106.3	0.591	131.7
				0.635	45.7	0.635	71.8	0.635	97.7	0.635	121.2
				0.686	42.6	0.686	66.6	0.686	90.2	0.686	111.0
						0.737	61.3	0.737	82.5	0.737	100.9
						0.787	57.3	0.787	76.8	0.787	93.4
						0.838	53.0	0.838	70.6	0.838	85.4
						0.889	50.0	0.889	66.4	0.889	79.9
						0.94	46.6	0.94	61.6	0.94	78.4
						0.991	44.1	0.991	58.2	0.991	73.8
								1.068	51.9	1.067	65.6
								1.118	48.7	1.118	61.3
								1.219	43.2	1.219	54.1
										1.321	48.7
									1.422	43.2	
20						0.787	64.3	0.787	89.9	0.787	113.5
						0.838	59.9	0.838	83.3	0.838	104.6
						0.889	56.7	0.889	78.6	0.889	98.4
						0.94	52.9	0.94	73.3	0.94	98.2
						0.991	50.3	0.991	69.5	0.991	92.8
						1.067	45.0	1.067	62.1	1.067	82.8
						1.118	42.6	1.118	58.6	1.118	77.8
								1.219	52.3	1.219	69.1
								1.321	47.7	1.321	62.7
								1.422	42.5	1.422	55.8
										1.524	51.3

TABELA-2 AR-AR ARRANJO-90 Dt=1"

CAUDAIS NOS TUBOS		CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	93.5	0.205	120.6	0.205	140.5	0.255	119.4	0.387	64.5
		0.255	73.8	0.255	95.3	0.255	113.2	0.305	96.3	0.438	57.9
		0.305	58.5	0.305	74.5	0.305	90.1	0.337	85.2	0.489	48.8
		0.337	51.3	0.337	64.9	0.337	77.6	0.387	63.1	0.533	45.5
				0.387	43.8	0.387	57.1	0.438	55.4		
						0.438	49.3	0.489	45.6		
						0.489	40.8	0.533	43.0		
2		0.205	107.5	0.205	144.8	0.205	174.4	0.255	155.3	0.387	89.8
		0.255	86.1	0.255	116.9	0.255	145.1	0.305	129.9	0.438	83.3
		0.305	69.3	0.305	93.0	0.305	118.8	0.337	117.3	0.489	71.9
		0.337	61.4	0.337	81.9	0.337	103.2	0.387	54.1	76.0	68.4
				0.387	54.1	0.387	76.0	0.438	78.4	0.591	58.4
				0.438	48.1	0.438	66.7	0.489	65.3	0.635	52.0
				0.489	40.8	0.489	55.8	0.533	63.0	0.686	47.5
				0.533	41.2	0.533	54.8	0.591	52.2	0.737	41.6
						0.591	43.5	0.635	46.6		
								0.686	42.7		
5		0.305	79.7	0.305	112.8	0.305	152.9	0.305	171.8	0.387	123.6
		0.337	71.3	0.337	100.4	0.337	134.4	0.337	159.2	0.438	120.5
		0.387	45.5	0.387	64.7	0.387	98.9	0.387	118.3	0.489	107.7
		0.438	41.5	0.438	58.6	0.438	88.5	0.438	110.5	0.533	105.9
				0.489	50.2	0.489	75.2	0.489	93.6	0.591	91.0
				0.533	52.3	0.533	76.6	0.533	93.4	0.635	82.1
						0.591	59.4	0.591	76.7	0.686	75.6
						0.635	54.0	0.635	69.3	0.737	67.2
						0.686	50.3	0.686	64.2	0.787	61.4
						0.737	45.6	0.737	57.6	0.838	56.4
						0.787	42.2	0.787	53.0	0.889	52.3
								0.838	48.9	0.94	49.6
								0.889	45.6	0.991	46.6
								0.94	41.9	1.067	41.7
10		0.387	48.2	0.387	70.2	0.387	112.3	0.387	137.9	0.387	145.2
		0.438	44.2	0.438	64.1	0.438	101.6	0.438	131.7	0.438	146.2
		0.533	40.8	0.489	55.3	0.489	87.1	0.489	112.9	0.489	134.0
				0.533	58.5	0.533	90.7	0.533	115.4	0.533	134.9
				0.591	44.2	0.591	69.3	0.591	94.1	0.591	116.6
				0.635	40.7	0.635	63.5	0.635	85.7	0.635	106.3
						0.686	59.6	0.686	80.0	0.686	98.5
						0.737	54.6	0.737	72.7	0.737	88.8
						0.787	50.9	0.787	67.5	0.787	81.8
						0.838	47.6	0.838	62.8	0.838	75.7
						0.889	44.8	0.889	58.9	0.889	70.6
						0.94	41.5	0.94	54.3	0.94	68.2
								0.991	51.5	0.991	64.4
								1.067	46.1	1.067	57.6
								1.118	42.8	1.118	53.1
20				0.591	47.1	0.591	76.6	0.591	108.1	0.591	139.0
				0.635	43.5	0.635	70.6	0.635	99.3	0.635	127.9
				0.686	41.2	0.686	66.6	0.686	93.3	0.686	119.4
						0.737	61.5	0.737	85.7	0.737	108.8
						0.787	57.8	0.787	80.0	0.787	101.0
						0.838	54.3	0.838	75.0	0.838	94.1
						0.889	51.4	0.889	70.7	0.889	88.3
						0.94	47.8	0.94	65.6	0.94	86.9
						0.991	45.6	0.991	62.4	0.991	82.5
						1.067	40.9	1.067	56.0	1.067	73.9
								1.118	52.3	1.118	68.7
								1.219	46.7	1.219	61.0
								1.321	42.7	1.321	55.0
										1.422	49.2
										1.524	45.2

TABELA-3 AR-AR ARRANJO-30 Dt=3/4"

		CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	97.1	0.205	125.9	0.205	145.6	0.255	121.3	0.337	86.3
		0.255	74.9	0.255	97.3	0.255	115.3	0.305	87.8	0.337	92.9
		0.305	60.0	0.305	76.9	0.305	92.9	0.337	84.3	0.438	63.0
		0.337	46.0	0.337	59.9	0.337	76.4	0.387	67.8	0.489	52.5
				0.387	47.4	0.387	61.7	0.438	59.0	0.533	47.1
2				0.438	41.0	0.438	52.6	0.489	49.2	0.591	42.2
						0.489	44.0	0.533	44.3		
		0.205	110.3	0.205	150.0	0.205	177.4	0.255	156.1	0.337	115.8
		0.255	86.9	0.255	97.3	0.255	146.4	0.305	112.6	0.387	100.3
		0.305	70.6	0.305	76.9	0.305	121.2	0.337	112.1	0.438	91.7
5		0.337	53.3	0.337	59.9	0.337	98.5	0.387	93.4	0.489	77.2
		0.387	43.3	0.387	47.4	0.387	82.2	0.438	83.3	0.533	69.6
				0.438	41.0	0.438	71.2	0.489	70.2	0.591	63.6
						0.489	60.2	0.533	63.8	0.635	55.3
						0.533	52.7	0.591	56.8	0.686	49.1
10						0.591	47.3	0.635	49.6	0.737	45.2
						0.635	41.7	0.686	44.4	0.787	40.2
								0.737	40.9		
		0.337	59.8	0.337	85.7	0.337	123.7	0.337	145.9	0.337	152.2
		0.387	49.4	0.387	70.2	0.387	107.2	0.387	127.0	0.387	140.1
20		0.438	44.4	0.438	62.6	0.438	94.6	0.438	117.3	0.438	134.7
				0.489	54.1	0.489	81.0	0.489	100.3	0.489	115.2
				0.533	47.1	0.533	70.7	0.533	92.2	0.533	104.8
				0.591	43.1	0.591	64.2	0.591	83.1	0.591	98.5
								0.635	57.5	0.635	73.8
50								0.686	52.5	0.686	66.8
								0.737	49.0	0.737	62.2
								0.787	44.8	0.787	56.4
								0.838	41.4	0.838	51.8
										0.889	48.0
100										0.94	44.3
										0.991	41.6
										1.067	43.8
										1.118	40.9
200		0.489	41.1	0.489	59.5	0.489	93.8	0.489	120.6	0.489	142.8
				0.533	51.7	0.533	81.7	0.533	111.7	0.533	130.9
				0.591	47.6	0.591	74.7	0.591	101.7	0.591	125.7
				0.635	43.3	0.635	67.5	0.635	91.3	0.635	112.5
				0.686	40.1	0.686	62.2	0.686	83.5	0.686	102.2
500						0.737	58.4	0.737	78.1	0.737	95.1
						0.787	53.8	0.787	71.5	0.787	86.5
						0.838	50.1	0.838	66.2	0.838	79.7
						0.889	46.9	0.889	61.7	0.889	78.0
						0.94	43.6	0.94	57.2	0.94	72.1
1000						0.991	41.2	0.991	53.9	0.991	67.7
								1.067	48.2	1.067	60.4
								1.118	45.4	1.118	56.7
								1.219	40.8	1.219	50.7
								1.321		1.321	45.0
2000				0.737	40.7	0.737	65.6	0.737	91.6	0.737	115.9
						0.787	60.9	0.787	84.5	0.787	106.3
						0.838	57.0	0.838	78.8	0.838	98.7
						0.889	53.0	0.889	73.8	0.889	98.5
						0.94	50.0	0.94	68.8	0.94	91.4
5000						0.991	47.4	0.991	65.1	0.991	86.2
						1.067	42.5	1.067	58.3	1.067	77.1
						1.118	40.4	1.118	55.2	1.118	72.7
								1.219	49.7	1.219	65.4
								1.321	44.9	1.321	58.6
10000										1.422	52.1
										1.524	47.9

TABELA-4 AR-AR ARRANJO-30 Dt=1"

		CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
CAUDAIS NOS TUBOS	1	0.205	90.6	0.205	116.6	0.205	135.9	0.255	110.4	0.387	61.5
		0.255	68.7	0.255	88.2	0.255	104.8	0.305	87.4	0.438	52.8
		0.305	53.7	0.305	67.9	0.305	81.6	0.337	79.6	0.489	44.2
		0.337	48.5	0.337	60.9	0.337	72.6	0.387	60.0	0.533	40.9
				0.387	47.5	0.387	58.2	0.438	50.6		
	2					0.438	45.2	0.489	41.5		
		0.205	104.1	0.205	140.1	0.205	168.9	0.255	145.3	0.387	86.2
		0.255	80.8	0.255	109.1	0.255	135.8	0.305	119.9	0.438	77.0
		0.305	64.4	0.305	85.8	0.305	109.0	0.337	110.4	0.489	66.0
		0.337	58.4	0.337	77.5	0.337	97.4	0.387	83.3	0.533	62.1
	5	0.387	46.3	0.387	61.0	0.387	79.9	0.438	72.3	0.591	52.8
				0.438	45.2	0.438	61.9	0.489	60.1	0.635	47.0
						0.489	51.7	0.533	57.2	0.686	41.8
						0.533	50.1	0.591	47.5		
								0.635	42.3		
	10	0.255	92.2	0.255	130.9	0.255	171.2	0.255	186.6	0.387	120.0
		0.305	74.8	0.305	105.2	0.305	142.5	0.305	161.2	0.438	113.4
		0.337	68.1	0.337	95.6	0.337	128.0	0.337	151.5	0.489	100.6
		0.387	54.6	0.387	76.3	0.387	108.1	0.387	114.5	0.533	97.6
				0.438	55.8	0.438	83.5	0.438	103.6	0.591	83.7
				0.489	47.8	0.489	70.8	0.489	87.5	0.635	75.3
				0.533	48.9	0.533	70.9	0.533	86.2	0.686	67.8
						0.591	55.4	0.591	70.9	0.737	62.5
						0.635	50.4	0.635	64.0	0.787	56.1
						0.686	46.1	0.686	58.1	0.838	51.5
	20					0.737	43.0	0.737	53.9	0.887	47.6
								0.787	48.7	0.94	45.5
								0.838	45.0	0.991	42.0
								0.889	41.7		
		0.387	58.7	0.387	84.6	0.387	125.6	0.387	134.3	0.387	142.0
		0.438	42.5	0.438	61.4	0.438	96.7	0.438	124.8	0.438	139.3
				0.489	53.0	0.489	82.9	0.489	106.7	0.489	126.8
				0.533	55.1	0.533	89.4	0.533	107.5	0.533	126.0
				0.591	42.0	0.591	65.4	0.591	88.1	0.591	108.6
						0.635	59.9	0.635	80.2	0.635	98.8
						0.686	55.3	0.686	73.6	0.686	89.9
						0.737	51.9	0.737	68.7	0.737	83.4
						0.787	47.8	0.787	62.8	0.787	75.6
						0.838	44.7	0.838	58.5	0.838	70.0
						0.889	41.9	0.889	54.6	0.889	65.0
								0.94	50.8	0.94	63.2
								0.991	47.4	0.991	58.7
								1.067	42.4	1.067	52.4
										1.118	49.1
										1.219	43.3
				0.533	59.4	0.533	95.6	0.533	125.4	0.533	151.3
				0.591	45.0	0.591	72.9	0.591	102.3	0.591	131.0
				0.635	41.7	0.635	67.2	0.635	93.9	0.635	120.3
						0.686	62.5	0.686	86.9	0.686	110.5
						0.737	58.9	0.737	81.6	0.737	103.2
						0.787	54.7	0.787	75.3	0.787	94.6
						0.838	51.4	0.838	70.6	0.838	88.1
						0.889	48.5	0.889	66.3	0.889	82.4
						0.94	45.4	0.94	61.9	0.94	81.4
						0.991	42.8	0.991	58.2	0.991	76.2
								1.067	52.1	1.067	68.1
								1.118	49.3	1.118	64.2
								1.219	43.9	1.219	56.9
								1.321	40.1	1.321	51.6
										1.422	45.9
										1.524	42.2

TABELA-5 AGAU-AGUA ARRANJO-90 Dt=3/4"

		CAUDAIS NA CARCAÇA													
		1		2		5		10		20		50		100	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	553.7	0.205	606.4	0.205	697.3	0.205	711.4	0.205	721.5				
		0.255	359.8	0.255	381.6	0.255	418.8	0.255	428.1	0.255	431.5				
2		0.205	724.9	0.205	800.5	0.205	961.7	0.205	986.7	0.205	1006.3	0.305	623.8		
		0.255	582.8	0.255	642.3	0.255	755.2	0.255	785.8	0.255	797.3	0.337	476.7		
		0.305	468.4	0.305	514.6	0.305	559.9	0.305	616.1	0.305	613.2	0.387	280.6		
		0.337	350.0	0.337	385.8	0.337	421.0	0.337	460.4	0.337	472.0				
5		0.387	224.1	0.387	248.1	0.387	257.0	0.387	272.6	0.387	277.5				
		0.205	906.5	0.205	1027.0	0.205	1310.0	0.205	1360.6	0.205	1398.0	0.305	973.1	0.438	654.6
		0.255	764.4	0.255	870.1	0.255	1091.0	0.255	1150.1	0.255	1180.1	0.337	914.5	0.489	481.6
		0.305	641.2	0.305	731.0	0.305	825.9	0.305	954.4	0.305	947.6	0.387	762.1	0.533	398.9
		0.337	539.7	0.337	629.7	0.337	729.4	0.337	856.3	0.337	897.5	0.438	647.1	0.591	287.0
		0.387	452.3	0.387	527.3	0.387	610.2	0.387	705.8	0.387	739.9	0.489	477.5		
10				0.438	456.1	0.438	524.3	0.438	563.4	0.438	630.9	0.533	394.6		
				0.489	353.5	0.489	399.1	0.489	424.5	0.489	464.3	0.591	284.5		
				0.533	296.1	0.533	332.8	0.533	353.1	0.533	382.4				
						0.591	249.1	0.591	261.3	0.591	270.0				
		0.205	1156.5	0.205	1361.9	0.205	1905.2	0.205	2014.3	0.205	2097.2	0.305	1248.2	0.438	926.8
		0.255	982.3	0.255	1163.9	0.255	1596.3	0.255	1739.6	0.255	1796.9	0.337	1199.5	0.489	831.7
		0.305	750.2	0.305	876.1	0.305	1015.9	0.305	1217.6	0.305	1206.5	0.387	1039.6	0.533	770.6
		0.337	627.8	0.337	752.9	0.337	900.0	0.337	1101.5	0.337	1170.4	0.438	911.8	0.591	685.0
		0.387	537.5	0.387	646.7	0.387	776.0	0.387	937.7	0.387	998.8	0.489	819.6	0.635	632.6
				0.438	573.4	0.438	685.5	0.438	754.0	0.438	879.9	0.533	754.6	0.686	486.8
20				0.489	511.5	0.489	612.9	0.489	675.0	0.489	781.3	0.591	671.4	0.737	393.6
				0.533	461.1	0.533	556.6	0.533	616.2	0.533	711.1	0.635	615.3	0.787	323.6
						0.591	502.6	0.591	554.8	0.591	595.7	0.686	475.9		
						0.635	464.1	0.635	511.7	0.635	548.9	0.737	385.9		
						0.686	376.4	0.686	409.2	0.686	434.1	0.787	308.1		
						0.737	314.8	0.737	339.1	0.737	357.3				
						0.787	266.3	0.787	284.5	0.787	297.9				
		0.205	1246.6	0.205	1488.6	0.205	2162.7	0.205	2304.4	0.205	2413.5	0.305	1847.2	0.438	1217.5
		0.255	1080.0	0.255	1303.7	0.255	1871.7	0.255	2071.7	0.255	2153.6	0.337	1802.7	0.489	1119.5
		0.305	931.7	0.305	1134.2	0.305	1380.2	0.305	1780.8	0.305	1757.1	0.387	1314.5	0.533	1055.6
		0.337	761.0	0.337	953.0	0.337	1201.6	0.337	1589.9	0.337	1737.8	0.438	1191.8	0.591	957.1
		0.387	602.7	0.387	743.5	0.387	919.6	0.387	1155.7	0.387	1249.9	0.489	1097.6	0.635	899.2
				0.438	672.9	0.438	832.6	0.438	935.7	0.438	1137.8	0.533	1025.7	0.686	829.6
				0.489	607.6	0.489	756.1	0.489	853.0	0.489	1030.0	0.591	930.7	0.737	756.4
50				0.533	550.0	0.533	691.8	0.533	785.8	0.533	947.1	0.635	811.6	0.787	702.7
						0.591	635.0	0.591	720.7	0.591	791.2	0.686	748.9	0.838	648.4
						0.635	593.0	0.635	673.1	0.635	739.0	0.737	696.2	0.889	608.4
						0.686	553.1	0.686	627.0	0.686	687.6	0.787	627.9	0.94	480.7
						0.737	510.9	0.737	577.9	0.737	632.8	0.838	589.5	0.991	429.1
						0.787	479.0	0.787	541.2	0.787	591.9	0.889	468.1	1.067	346.4
						0.838	443.2	0.838	499.7	0.838	545.5	0.94	401.4	1.118	279.1
						0.889	418.9	0.889	471.7	0.889	514.5	0.991	327.3		
						0.94	349.0	0.94	387.5	0.94	417.9	1.067	273.8		
								0.991	351.1	0.991	377.1				
								1.067	289.6	1.067	309.2				
								1.118	245.8	1.118	260.4				
		0.205	1318.7	0.205	1592.5	0.205	2389.0	0.205	2563.2	0.205	2698.9	0.305	2221.3	0.438	1956.8
		0.255	1161.0	0.255	1423.6	0.255	2129.1	0.255	2391.9	0.255	2501.6	0.337	2221.8	0.489	1828.6
		0.305	1018.2	0.305	1265.0	0.305	1578.9	0.305	2126.1	0.305	2092.4	0.387	2040.9	0.533	1748.2
		0.337	826.9	0.337	1058.6	0.337	1374.4	0.337	1907.2	0.337	2124.0	0.438	1891.3	0.591	1326.3
		0.387	720.2	0.387	930.8	0.387	1224.5	0.387	1681.9	0.387	1889.3	0.489	1770.8	0.635	1276.1
	100				0.438	850.4	0.438	1122.7	0.438	1318.7	0.438	1758.9	0.533	1667.5	0.686
				0.489	769.6	0.489	1024.5	0.489	1210.6	0.489	1601.2	0.591	1276.2	0.737	1119.5
				0.533	693.0	0.533	934.3	0.533	1114.5	0.533	1469.2	0.635	1027.6	0.787	1057.1
						0.591	778.8	0.591	911.9	0.591	1027.8	0.686	1136.8	0.838	999.6
						0.635	736.5	0.635	864.2	0.635	975.9	0.737	1059.9	0.889	949.8
						0.686	696.8	0.686	818.2	0.686	924.6	0.787	907.9	0.94	896.1
						0.737	654.2	0.737	768.4	0.737	868.4	0.838	951.5	0.991	853.0
						0.787	620.9	0.787	729.6	0.787	824.8	0.889	904.5	1.067	783.6
						0.838	583.3	0.838	685.2	0.838	774.4	0.94	853.5	1.118	685.1
						0.889	556.6	0.889	654.0	0.889	739.2	0.991	750.3	1.219	621.9
						0.94	526.1	0.94	618.8	0.94	700.2	1.067	691.9	1.321	568.3
								0.991	591.7	0.991	669.5	1.118	654.2	1.422	459.2
								1.067	542.6	1.067	615.6	1.219	543.4	1.524	394.0
								1.118	514.1	1.118	582.7	1.321	435.9		
								1.219	466.3	1.219	528.8	1.422	375.7		
								1.321	427.9	1.321	484.5				
										1.422	393.0				
										1.524	341.5				
		0.305	1056.9	0.305	1325.2	0.305	1673.8	0.305	2301.7	0.305	2262.3	0.387	2413.8	0.438	2273.1
		0.337	856.0	0.337	1106.9	0.337	1456.9	0.337	2069.8	0.337	2327.6	0.438	2445.6	0.489	2166.5
		0.387	750.2	0.387	981.6	0.387	1313.9	0.387	1855.2	0.387	2110.7	0.489	2301.7	0.533	2103.7
				0.438	905.2	0.438	1220.1	0.438	1455.1	0.438	2010.3	0.533	2185.2	0.591	1961.5
				0.489	823.6	0.489	1122.5	0.489	1350.0	0.489	1854.4	0.591	2085.8	0.635	1906.0
				0.533	742.8	0.533	1027.1	0.533	1249.1	0.533	1712.4	0.635	1986.0	0.686	1798.0
						0.591	961.7	0.591	1173.1	0.591	1372.1	0.686	1853.9	0.737	1681.4
						0.635	961.7	0.635	1113.4	0.635	1305.9	0.737	1757.2	0.787	1318.9
						0.686	863.0	0.686	1057.4	0.686	1242.0	0.787	1657.6	0.838	1270.4
						0.737	812.9	0.737	997.1	0.737	1172.3	0.838	1550.4	0.889	1219.0

TABELA-6 AGUA-AGUA ARRANJO-90 Dt=1°

		CAUDAIS NA CARCAÇA									
		1		2		5		10		20	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	494.9	0.205	531.0	0.205	599.5	0.205	612.0	0.205	617.6
		0.255	337.5	0.255	357.6	0.255	391.0	0.255	398.0	0.255	403.0
		0.305	198.4	0.305	206.6	0.305	218.6	0.305	221.7	0.305	223.4
2		0.205	656.6	0.205	721.7	0.205	854.3	0.205	879.9	0.205	891.4
		0.255	532.8	0.255	584.6	0.255	679.4	0.255	700.8	0.255	716.7
		0.305	428.3	0.305	468.3	0.305	534.9	0.305	554.3	0.305	565.1
5		0.337	338.7	0.337	366.1	0.337	392.0	0.337	420.6	0.337	429.5
		0.387	205.8	0.387	222.0	0.387	237.2	0.387	251.4	0.387	256.2
		0.205	851.6	0.205	964.4	0.205	1216.8	0.205	1269.5	0.205	1293.5
10		0.255	720.3	0.255	818.2	0.255	1016.9	0.255	1065.7	0.255	1102.6
		0.305	602.7	0.305	685.0	0.305	837.7	0.305	886.1	0.305	914.0
		0.337	542.5	0.337	616.2	0.337	693.5	0.337	788.3	0.337	820.2
20		0.387	399.9	0.387	465.6	0.387	538.2	0.387	616.9	0.387	647.1
		0.638	357.0	0.638	413.4	0.638	474.8	0.638	536.2	0.638	567.5
		0.489	305.7	0.489	352.8	0.489	403.9	0.489	433.1	0.489	476.9
50		0.591	217.5	0.591	240.8	0.591	253.4	0.591	269.7	0.591	277.0
		0.635	168.0	0.635	182.6	0.635	190.3	0.635	199.8	0.635	204.1
		0.205	1092.5	0.205	1285.3	0.205	1776.3	0.205	1890.9	0.205	1944.6
100		0.255	836.1	0.255	917.0	0.255	1264.1	0.255	1340.3	0.255	1399.3
		0.305	717.7	0.305	837.6	0.305	1077.8	0.305	1159.3	0.305	1207.5
		0.337	655.5	0.337	766.4	0.337	889.7	0.337	1052.0	0.337	1109.5
200		0.387	483.3	0.387	562.8	0.387	701.2	0.387	840.9	0.387	898.1
		0.438	439.2	0.438	527.6	0.438	632.1	0.438	749.4	0.438	807.5
		0.489	382.1	0.489	458.8	0.489	549.2	0.489	604.5	0.489	693.5
500		0.591	374.7	0.591	445.7	0.591	495.7	0.591	495.7	0.591	562.3
		0.635	342.3	0.635	409.2	0.635	450.1	0.635	450.1	0.635	506.8
		0.686	319.3	0.686	380.3	0.686	417.3	0.686	417.3	0.686	445.9
1000		0.737	250.1	0.737	288.7	0.737	311.0	0.737	311.0	0.737	327.7
		0.787	244.6	0.787	261.3	0.787	261.3	0.787	273.6	0.787	273.6
		0.838	202.8	0.838	214.8	0.838	214.8	0.838	223.5	0.838	223.5
2000		0.889	166.1	0.889	166.1	0.889	174.5	0.889	174.5	0.889	180.5
		0.205	1195.4	0.205	1430.2	0.205	2065.6	0.205	2222.2	0.205	2296.7
		0.255	1037.3	0.255	1253.4	0.255	1788.7	0.255	1945.3	0.255	2072.1
5000		0.305	893.6	0.305	1087.5	0.305	1530.4	0.305	1700.0	0.305	1805.6
		0.337	744.7	0.337	891.0	0.337	1062.3	0.337	1302.1	0.337	1391.4
		0.387	549.2	0.387	681.3	0.387	848.8	0.387	1062.5	0.387	1155.5
10000		0.438	506.0	0.438	627.2	0.438	780.5	0.438	967.6	0.438	1066.6
		0.489	446.2	0.489	554.4	0.489	692.1	0.489	782.2	0.489	938.0
		0.591	460.6	0.591	557.5	0.591	579.3	0.591	606.1	0.591	780.6
20000		0.635	425.6	0.635	543.2	0.635	543.2	0.635	606.1	0.635	713.7
		0.686	400.8	0.686	501.8	0.686	501.8	0.686	568.3	0.686	622.8
		0.737	367.9	0.737	458.0	0.737	458.0	0.737	516.8	0.737	564.6
50000		0.787	426.3	0.787	479.8	0.787	479.8	0.787	523.2	0.787	523.2
		0.838	397.8	0.838	446.7	0.838	446.7	0.838	486.1	0.838	486.1
		0.889	373.8	0.889	418.9	0.889	418.9	0.889	455.2	0.889	455.2
100000		0.94	347.0	0.94	388.5	0.94	388.5	0.94	421.7	0.94	421.7
		0.991	291.0	0.991	320.8	0.991	320.8	0.991	344.2	0.991	344.2
		1.067	248.1	1.067	272.2	1.067	272.2	1.067	290.8	1.067	290.8
200000		1.118	210.5	1.118	228.4	1.118	228.4	1.118	242.1	1.118	242.1
		1.219	157.9	1.219	168.9	1.219	168.9	1.219	177.1	1.219	177.1
		0.205	1280.0	0.205	1553.0	0.205	2331.8	0.205	2533.4	0.205	2630.7
500000		0.255	1127.9	0.255	1388.1	0.255	2076.2	0.255	2290.2	0.255	2468.0
		0.305	988.2	0.305	1230.9	0.305	1830.3	0.305	2078.3	0.305	2236.5
		0.337	914.7	0.337	1145.9	0.337	1445.6	0.337	1929.1	0.337	2131.7
1000000		0.387	655.5	0.387	853.1	0.387	1133.0	0.387	1548.8	0.387	1754.8
		0.438	608.4	0.438	792.5	0.438	1054.0	0.438	1426.6	0.438	1652.7
		0.489	505.7	0.489	649.3	0.489	846.5	0.489	985.4	0.489	1246.1
2000000		0.591	548.7	0.591	667.1	0.591	854.8	0.591	983.4	0.591	1229.1
		0.635	513.2	0.635	629.9	0.635	725.9	0.635	853.9	0.635	1072.5
		0.686	488.2	0.686	646.8	0.686	646.8	0.686	761.6	0.686	862.6
5000000		0.737	455.3	0.737	602.0	0.737	602.0	0.737	707.8	0.737	800.7
		0.787	568.4	0.787	667.7	0.787	667.7	0.787	754.7	0.787	848.9
		0.838	537.4	0.838	630.6	0.838	630.6	0.838	712.2	0.838	781.2
10000000		0.889	510.6	0.889	598.8	0.889	598.8	0.889	675.7	0.889	728.2
		0.94	479.2	0.94	562.0	0.94	562.0	0.94	634.3	0.94	674.7
		0.991	458.7	0.991	537.6	0.991	537.6	0.991	606.5	0.991	652.6
20000000		1.067	419.7	1.067	493.4	1.067	493.4	1.067	558.1	1.067	595.1
		1.118	393.9	1.118	461.8	1.118	461.8	1.118	521.2	1.118	558.1
		1.219	355.5	1.219	416.8	1.219	416.8	1.219	470.2	1.219	505.4
50000000		1.321	381.6	1.321	448.8	1.321	448.8	1.321	499.4	1.321	534.9
		1.422	344.8	1.422	388.7	1.422	388.7	1.422	429.4	1.422	464.9
		1.524	280.4	1.524	310.7	1.524	310.7	1.524	340.9	1.524	360.9
100000000		0.205	1316.7	0.205	1607.3	0.205	2456.4	0.205	2681.2	0.205	2790.4
		0.255	1168.0	0.255	1449.4	0.255	2216.5	0.255	2462.0	0.255	2668.8
		0.305	1031.1	0.305	1298.2	0.305	1983.3	0.305	2277.8	0.305	2471.6
200000000		0.337	958.9	0.337	1216.1	0.337	1559.2	0.337	2136.9	0.337	2388.3
		0.387	686.3	0.387	906.0	0.387	1228.3	0.387	1732.5	0.387	1994.3
		0.438	640.8	0.438	848.3	0.438	1155.1	0.438	1618.3	0.438	1915.6
500000000		0.489	570.7	0.489	760.6	0.489	1046.0	0.489	1266.7	0.489	1732.7
		0.591	639.6	0.591	792.6	0.591	1072.6	0.591	1283.0	0.591	1735.9
		0.635	599.1	0.635	839.3	0.635	1031.3	0.635	1031.3	0.635	1387.3
1000000000		0.686	534.0	0.686	729.7	0.686	879.3	0.686	879.3	0.686	1016.8
		0.737	502.4	0.737	667.0	0.737	828.4	0.737	828.4	0.737	958.5
		0.787	654.2	0.787	789.3	0.787	789.3	0.787	913.8	0.787	913.8
2000000000		0.838	623.5	0.838	752.6	0.838	752.6	0.838	871.8	0.838	871.8
		0.889	596.6	0.889	720.5	0.889	720.5	0.889	834.9	0.889	834.9
		0.94	563.7	0.94	681.9	0.94	681.9	0.94	791.4	0.94	791.4
5000000000		0.991	542.6	0.991	656.5	0.991	656.5	0.991	762.2	0.991	762.2
		1.067	498.8	1.067	606.6	1.067	606.6	1.067	707.3	1.067	707.3
		1.118	472.5	1.118	573.8	1.118	573.8	1.118	668.3	1.118	668.3
10000000000		1.219	430.4	1.219	523.6	1.219	523.6	1.219	610.8	1.219	610.8
		1.321	485.1	1.321	485.1	1.321	485.1	1.321	565.2	1.321	565.2
		1.422	441.1	1.422	441.1	1.422	441.1	1.422	515.7	1.422	515.7
20000000000		1.524	411.6	1.524	411.6	1.524	411.6	1.524	480.4	1.524	480.4

TABELA-7 AGUA-AGUA ARRANJO-30 Dt=3/4"

		CAUDAIS NA CARCAÇA											
		1		2		5		10		20		50	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1	0.205	524.6		0.205	565.1	0.205	643.0	0.205	656.2	0.205	665.2	0.305	501.8
	0.255	296.9		0.255	312.4	0.255	337.6	0.255	343.9	0.255	346.4	0.337	399.3
	0.205	583.3		0.205	753.7	0.205	899.0	0.205	925.1	0.205	942.9		
	0.255	541.8		0.255	595.6	0.255	694.5	0.255	721.8	0.255	732.7		
	0.305	392.9		0.305	426.2	0.305	458.0	0.305	495.6	0.305	504.1		
2	0.337	304.2		0.337	331.8	0.337	358.4	0.337	387.1	0.337	395.6		
	0.205	867.3		0.205	983.9	0.205	1247.1	0.205	1297.8	0.205	1333.3	0.305	924.9
	0.255	723.3		0.255	822.5	0.255	1023.9	0.255	1084.4	0.255	1109.1	0.337	853.9
	0.305	612.1		0.305	697.0	0.305	786.4	0.305	904.3	0.305	932.8	0.387	703.8
	0.337	511.8		0.337	595.1	0.337	686.6	0.337	800.0	0.337	837.4	0.438	606.3
5	0.387	423.4		0.387	491.2	0.387	565.3	0.387	648.3	0.387	678.2	0.489	401.0
				0.438	432.5	0.438	495.2	0.438	530.9	0.438	591.2	0.533	321.0
				0.489	307.7	0.489	342.9	0.489	362.2	0.489	391.2		
				0.533	251.1	0.533	277.9	0.533	292.4	0.533	312.6		
	0.205	1109.8		0.205	1308.1	0.205	1618.4	0.205	1928.2	0.205	2007.5	0.305	1201.4
10	0.255	833.2		0.255	967.6	0.255	1258.9	0.255	1315.6	0.255	1390.2	0.337	1137.8
	0.305	722.1		0.305	843.3	0.305	977.8	0.305	1166.8	0.305	1214.8	0.387	979.7
	0.337	601.9		0.337	720.3	0.337	858.9	0.337	1044.1	0.337	1108.7	0.438	864.0
	0.387	509.9		0.387	611.4	0.387	730.6	0.387	875.5	0.387	930.9	0.489	761.4
				0.438	549.4	0.438	654.7	0.438	718.6	0.438	833.6	0.533	700.2
20				0.489	483.2	0.489	576.2	0.489	632.7	0.489	726.8	0.591	631.6
				0.533	435.5	0.533	523.2	0.533	577.2	0.533	661.3	0.635	471.5
						0.591	477.4	0.591	525.6	0.591	563.2	0.686	382.2
						0.635	374.9	0.635	406.6	0.635	430.7	0.737	321.1
						0.686	313.2	0.686	336.7	0.686	354.2		
50						0.737	269.2	0.737	287.3	0.737	300.6		
	0.205	1203.6		0.205	1440.4	0.205	2084.4	0.205	2230.0	0.205	2336.8	0.305	1786.5
	0.255	1035.4		0.255	1251.4	0.255	1785.8	0.255	1978.3	0.255	2062.2	0.337	1720.1
	0.305	899.2		0.305	1095.0	0.305	1333.2	0.305	1711.2	0.305	1816.3	0.387	1264.4
	0.337	733.1		0.337	916.8	0.337	1153.7	0.337	1514.5	0.337	1654.4	0.438	1143.0
100	0.387	577.5		0.387	711.3	0.387	878.1	0.387	1096.0	0.387	1184.4	0.489	1035.1
				0.438	650.4	0.438	803.3	0.438	901.7	0.438	1090.6	0.533	965.4
				0.489	580.7	0.489	720.3	0.489	810.8	0.489	972.1	0.591	884.9
				0.533	525.2	0.533	658.3	0.533	746.1	0.533	893.0	0.635	797.5
						0.591	609.2	0.591	690.1	0.591	756.4	0.686	728.1
						0.635	555.3	0.635	628.0	0.635	687.4	0.737	681.6
						0.686	512.9	0.686	579.0	0.686	632.8	0.787	628.0
						0.737	483.6	0.737	545.4	0.737	595.6	0.838	511.6
						0.787	445.6	0.787	501.4	0.787	546.5	0.889	448.1
						0.838	379.0	0.838	421.2	0.838	454.5	0.94	388.9
						0.889	339.4	0.889	374.8	0.889	402.5	0.991	327.1
						0.94	300.6	0.94	330.1	0.94	352.9	1.067	254.1
								0.991	291.6	0.991	310.1		
								1.067	230.0	1.067	242.6		
	0.205	1279.3		0.205	1550.3	0.205	2322.7	0.205	2504.9	0.205	2640.5	0.305	2176.0
50	0.255	1120.6		0.255	1378.0	0.255	2055.3	0.255	2314.4	0.255	2430.0	0.337	1827.9
	0.305	986.2		0.305	1230.0	0.305	1538.8	0.305	2065.3	0.305	2220.5	0.387	1999.9
	0.337	802.3		0.337	1027.6	0.337	1334.9	0.337	1842.8	0.337	2054.3	0.438	1827.9
	0.387	694.1		0.387	896.8	0.387	1179.3	0.387	1608.9	0.387	1806.7	0.489	1686.6
				0.438	826.6	0.438	1090.4	0.438	1280.0	0.438	1697.3	0.533	1314.4
100				0.489	741.3	0.489	985.1	0.489	1162.5	0.489	1525.5	0.591	1231.3
				0.533	613.9	0.533	803.9	0.533	938.8	0.533	1183.7	0.635	1140.0
						0.591	755.6	0.591	884.0	0.591	995.7	0.686	1062.1
						0.635	701.8	0.635	822.0	0.635	927.0	0.737	1008.3
						0.686	658.9	0.686	772.1	0.686	870.8	0.787	953.5
						0.737	627.9	0.737	736.3	0.737	830.8	0.838	894.1
						0.787	588.0	0.787	689.2	0.787	777.4	0.889	841.7
						0.838	554.9	0.838	650.2	0.838	733.2	0.94	792.2
						0.889	525.5	0.889	615.5	0.889	693.9	0.991	698.2
						0.94	495.7	0.94	581.1	0.94	655.7	1.067	642.9
								0.991	554.0	0.991	624.9	1.118	610.2
								1.067	507.8	1.067	574.1	1.219	559.7
								1.118	482.9	1.118	545.4	1.321	445.9
								1.219	442.1	1.219	499.8	1.422	376.9
								1.321	362.6	1.321	404.1	1.524	315.8
										1.422	343.4		
										1.524	290.5		
	0.255	1158.1		0.255	1435.1	0.255	2185.0	0.255	2480.3	0.255	2613.5	0.305	2380.2
	0.305	1026.3		0.305	1292.7	0.305	1638.2	0.305	2248.4	0.305	2433.6	0.337	2395.7
	0.337	833.3		0.337	1078.9	0.337	1422.9	0.337	2014.8	0.337	2270.2	0.387	2290.5
100	0.387	726.1		0.387	950.9	0.387	1274.6	0.387	1791.7	0.387	2040.5	0.438	2131.8
				0.438	883.6	0.438	1191.7	0.438	1421.9	0.438	1956.2	0.489	2011.7
				0.489	798.0	0.489	1087.7	0.489	1308.2	0.489	1786.7	0.533	1912.6
				0.533	719.0	0.533	994.1	0.533	1208.9	0.533	1647.8	0.591	1794.2
						0.591	935.7	0.591	1141.0	0.591	1334.2	0.635	1665.9
						0.635	871.7	0.635	1065.3	0.635	1248.3	0.686	1558.0
						0.686	821.1	0.686	1004.6	0.686	1178.3	0.737	1242.7
						0.737	711.5	0.737	853.9	0.737	983.8	0.787	1197.9
						0.787	672.6	0.787	808.4	0.787	932.5	0.838	1137.1
						0.838	639.8	0.838	769.8	0.838	889.1	0.889	1082.4
						0.889	610.2	0.889	735.0	0.889	849.7	0.94	1028.6
						0.94	578.9	0.94	696.9	0.94	806.7	0.991	894.6
								0.991	671.0	0.991	777.8	1.067	833.8
								1.067	620.0	1.067	721.7	1.118	798.8
								1.118	593.8	1.118	691.3	1.219	741.7
								1.219	548.3	1.219	640.0	1.321	680.1
								1.321	503.6	1.321	587.4	1.422	625.0
										1.422	537.9	1.524	582.0
										1.524	501.4		

TABELA-8 AGUA-AGUA ARRANJO-30 Dt=3/4"

		CAUDAIS NA CARCAÇA															
		1		2		5		10		20		50		100			
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	481.4	0.205	516.6	0.205	582.4	0.205	594.5	0.205	600.0						
		0.255	288.2	0.255	303.5	0.255	327.9	0.255	333.2	0.255	336.9						
2		0.205	640.7	0.205	704.6	0.205	832.8	0.205	857.9	0.205	869.3	0.337	381.6				
		0.255	496.0	0.255	542.9	0.255	626.3	0.255	646.0	0.255	660.1	0.387	222.6				
		0.305	391.0	0.305	426.0	0.305	482.4	0.305	499.1	0.305	508.5						
		0.337	304.6	0.337	327.4	0.337	348.9	0.337	371.8	0.337	379.0						
		0.387	189.3	0.387	199.9	0.387	209.6	0.387	219.3	0.387	219.5						
5		0.205	834.1	0.205	945.8	0.205	1192.2	0.205	1244.2	0.205	1268.4	0.337	784.7	0.438	533.4		
		0.255	681.4	0.255	773.2	0.255	954.2	0.255	1000.7	0.255	1034.9	0.387	635.4	0.489	366.6		
		0.305	561.0	0.305	636.0	0.305	770.6	0.305	813.9	0.305	839.5	0.438	533.5	0.533	304.3		
		0.337	516.2	0.337	585.4	0.337	657.8	0.337	744.1	0.337	773.7	0.489	365.0	0.591	210.8		
		0.387	422.8	0.387	480.1	0.387	540.0	0.387	609.1	0.387	610.6	0.533	302.3				
		0.438	334.2	0.438	384.9	0.438	439.5	0.438	494.4	0.438	519.8	0.591	209.3				
		0.489	248.8	0.489	280.2	0.489	312.6	0.489	330.3	0.489	355.6						
				0.533	244.7	0.533	267.2	0.533	279.2	0.533	296.4						
				0.591	172.4	0.591	187.3	0.591	195.2	0.591	204.9						
10		0.205	1069.8	0.205	1260.6	0.205	1740.0	0.205	1853.0	0.205	1907.2	0.337	1078.7	0.438	778.3		
		0.255	798.9	0.255	928.1	0.255	1201.8	0.255	1276.5	0.255	1332.8	0.387	900.3	0.489	676.9		
		0.305	676.9	0.305	789.1	0.305	1007.6	0.305	1082.9	0.305	1128.6	0.438	778.6	0.533	631.9		
		0.337	628.9	0.337	734.8	0.337	852.5	0.337	1003.4	0.337	1058.0	0.489	671.4	0.591	551.7		
		0.387	525.7	0.387	617.3	0.387	720.1	0.387	848.3	0.387	851.2	0.533	623.5	0.635	498.2		
		0.438	416.3	0.438	498.0	0.438	593.4	0.438	698.0	0.438	749.7	0.591	540.9	0.686	359.5		
		0.489	361.1	0.489	431.3	0.489	513.1	0.489	562.7	0.489	640.4	0.635	485.7	0.737	302.5		
				0.533	419.6	0.533	490.6	0.533	532.4	0.533	598.8	0.686	352.6	0.787	228.7		
				0.591	348.6	0.591	415.3	0.591	455.8	0.591	512.8	0.737	297.3				
				0.635	317.7	0.635	377.0	0.635	412.7	0.635	461.0	0.787	226.5				
20		0.205	1172.4	0.205	1405.6	0.205	2028.9	0.205	2184.2	0.205	2259.9	0.337	1374.3	0.438	1057.2		
		0.255	994.0	0.255	1202.3	0.255	1705.3	0.255	1859.6	0.255	1981.6	0.387	1183.8	0.489	949.5		
		0.305	768.0	0.305	915.8	0.305	1223.6	0.305	1336.5	0.305	1406.9	0.438	1057.8	0.533	904.2		
		0.337	719.1	0.337	861.0	0.337	1027.1	0.337	1254.4	0.337	1340.9	0.489	938.7	0.591	802.3		
		0.387	611.1	0.387	738.5	0.387	890.7	0.387	1095.5	0.387	1100.3	0.533	887.1	0.635	737.5		
		0.438	484.7	0.438	596.1	0.438	742.8	0.438	914.3	0.438	1005.2	0.591	779.8	0.686	669.4		
		0.489	426.4	0.489	527.8	0.489	655.8	0.489	739.0	0.489	879.2	0.635	710.3	0.737	620.6		
				0.533	524.4	0.533	640.3	0.533	713.4	0.533	837.9	0.686	645.6	0.787	559.6		
				0.591	434.3	0.591	543.0	0.591	614.5	0.591	722.7	0.737	599.2	0.838	520.0		
				0.635	400.6	0.635	499.6	0.635	564.4	0.635	658.8	0.787	546.7	0.889	417.5		
50		0.205	1256.9	0.205	1528.9	0.205	2296.1	0.205	2497.1	0.205	2596.5	0.337	1415.0	0.438	1170.6		
		0.255	1088.1	0.255	1342.6	0.255	2002.2	0.255	2218.3	0.255	2394.0	0.387	1263.2	0.489	1022.8		
		0.305	945.6	0.305	1179.9	0.305	1745.9	0.305	1985.2	0.305	2144.4	0.438	1170.6	0.533	1295.4		
		0.337	885.7	0.337	1111.1	0.337	1404.2	0.337	1666.6	0.337	2064.7	0.489	1302.0	0.591	1177.5		
		0.387	752.9	0.387	956.0	0.387	1227.5	0.387	1653.5	0.387	1864.5	0.533	1260.6	0.635	1111.6		
		0.438	586.9	0.438	763.4	0.438	1013.2	0.438	1361.4	0.438	1573.3	0.591	1129.6	0.686	1030.6		
		0.489	488.3	0.489	626.1	0.489	814.7	0.489	947.1	0.489	1190.3	0.635	1051.0	0.737	970.0		
				0.533	635.8	0.533	814.5	0.533	936.7	0.533	1163.5	0.686	975.3	0.787	892.6		
				0.591	524.8	0.591	692.3	0.591	812.8	0.591	1013.5	0.737	916.7	0.838	845.5		
				0.635	490.3	0.635	647.2	0.635	760.2	0.635	942.0	0.787	860.1	0.889	793.0		
100		0.205	1293.6	0.205	1583.6	0.205	2421.7	0.205	2646.3	0.205	2758.2	0.337	1432.1	0.438	1202.9		
		0.255	1130.1	0.255	1407.3	0.255	2149.4	0.255	2400.6	0.255	2607.7	0.387	1258.3	0.489	1033.0		
		0.305	990.9	0.305	1251.4	0.305	1906.9	0.305	2196.0	0.305	2392.6	0.438	1209.9	0.533	1027.3		
		0.337	931.0	0.337	1183.4	0.337	1521.8	0.337	2080.3	0.337	2329.4	0.489	1188.8	0.591	1027.3		
		0.387	796.9	0.387	1028.1	0.387	1349.0	0.387	1881.8	0.387	1896.2	0.533	1185.2	0.635	1038.1		
		0.438	621.0	0.438	822.1	0.438	1119.3	0.438	1560.0	0.438	1844.7	0.591	1164.5	0.686	1038.5		
		0.489	552.7	0.489	736.1	0.489	1011.2	0.489	1223.6	0.489	1662.4	0.635	1295.7	0.737	1246.2		
				0.533	757.8	0.533	1026.0	0.533	1227.7	0.533	1649.1	0.686	1220.7	0.787	1165.7		
				0.591	614.4	0.591	857.2	0.591	1040.9	0.591	1410.8	0.737	1162.8	0.838	1121.8		
				0.635	537.6	0.635	732.4	0.635	880.4	0.635	1134.0	0.787	1100.8	0.889	1064.2		

TABELA-9 AGUA-AR ARRANJO-30 Dt=3/4"

		CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	114.9	0.205	157.5	0.205	189.6	0.255	151.5		
		0.255	85.5	0.255	115.9	0.255	142.4				
2		0.205	121.1	0.205	169.3	0.205	207.0	0.255	197.0	0.337	144.1
		0.255	98.2	0.255	140.7	0.255	181.7	0.305	138.0		
		0.305	79.8	0.305	112.8	0.305	151.0	0.337	138.4		
		0.337	58.6	0.337	83.0	0.337	118.3				
5		0.205	125.8	0.205	176.7	0.205	221.3	0.255	216.7	0.337	176.3
		0.255	102.9	0.255	150.5	0.255	198.4	0.305	157.8	0.387	157.8
		0.305	86.1	0.305	125.7	0.305	175.2	0.337	169.8	0.438	177.9
		0.337	63.5	0.337	93.4	0.337	126.3	0.387	154.8	0.489	143.1
		0.387	53.1	0.387	77.9	0.387	114.0	0.438	148.8	0.533	125.9
		0.438	48.2	0.438	70.6	0.438	93.9	0.489	120.8		
		0.489	41.1	0.489	59.5	0.489	79.7	0.533	108.1		
				0.533	50.9	0.533					
10		0.205	129.9	0.205	187.1	0.205	234.3	0.255	225.7	0.337	188.1
		0.255	104.9	0.255	154.7	0.255	205.9	0.305	164.3	0.387	167.9
		0.305	87.9	0.305	129.8	0.305	183.1	0.337	178.7	0.438	194.9
		0.337	64.7	0.337	96.0	0.337	146.4	0.387	165.1	0.489	172.2
		0.387	54.2	0.387	80.4	0.387	133.1	0.438	160.5	0.533	159.9
		0.438	49.4	0.438	73.1	0.438	120.7	0.489	140.9	0.591	158.2
		0.489	43.3	0.489	64.0	0.489	105.6	0.533	132.1	0.635	138.2
				0.533	55.7	0.533	92.1	0.591	122.0	0.686	123.6
				0.591	51.6	0.591	85.2	0.635	107.5	0.737	112.3
				0.635	46.7	0.635	76.1	0.686	97.2		
				0.686	43.1	0.686	69.5	0.737	89.3		
				0.737	40.3	0.737	64.5				
20		0.205	131.1	0.205	189.6	0.205	238.2	0.255	238.3	0.337	199.3
		0.255	107.5	0.255	160.6	0.255	216.3	0.305	172.0	0.387	196.3
		0.305	90.1	0.305	134.6	0.305	192.8	0.337	188.7	0.438	206.3
		0.337	66.0	0.337	98.6	0.337	153.1	0.387	171.6	0.489	183.2
		0.387	54.9	0.387	81.9	0.387	137.3	0.438	168.1	0.533	170.6
		0.438	50.1	0.438	74.7	0.438	125.0	0.489	148.2	0.591	170.5
		0.489	43.9	0.489	65.5	0.489	109.6	0.533	139.4	0.635	157.2
				0.533	56.9	0.533	95.5	0.591	129.1	0.686	146.0
				0.591	52.8	0.591	88.6	0.635	118.5	0.737	137.8
				0.635	48.6	0.635	81.4	0.686	110.6	0.787	128.2
				0.686	45.5	0.686	76.1	0.737	104.7	0.838	117.1
				0.737	43.2	0.737	72.1	0.787	97.8	0.889	117.8
				0.787	40.4	0.787	67.4	0.838	90.1	0.94	108.2
						0.838	62.6	0.889	84.2	0.991	100.6
						0.889	58.8	0.94	77.8	1.067	86.2
						0.94	54.6	0.991	72.9		
						0.991	51.5	1.067	63.3		
						1.067	45.2				
50		0.205	132.0	0.205	197.7	0.205	241.1	0.255	242.5	0.337	204.1
		0.255	108.4	0.255	162.5	0.255	219.8	0.305	175.0	0.387	208.2
		0.305	90.9	0.305	136.4	0.305	196.6	0.337	193.0	0.438	221.3
		0.337	66.5	0.337	100.0	0.337	155.9	0.387	180.6	0.489	196.6
		0.387	55.8	0.387	83.9	0.387	143.0	0.438	177.9	0.533	179.0
		0.438	50.9	0.438	76.5	0.438	130.3	0.489	156.8	0.591	180.2
		0.489	44.6	0.489	67.1	0.489	114.3	0.533	144.9	0.635	167.0
				0.533	57.8	0.533	98.1	0.591	134.6	0.686	155.9
				0.591	53.7	0.591	91.1	0.635	124.1	0.737	147.5
				0.635	49.5	0.635	84.0	0.686	116.1	0.787	137.8
				0.686	46.4	0.686	78.7	0.737	110.2	0.838	129.8
				0.737	44.1	0.737	74.7	0.787	103.3	0.889	134.4
				0.787	41.3	0.787	70.0	0.838	97.5	0.94	126.1
						0.838	66.1	0.889	92.4	0.991	120.3
						0.889	62.7	0.94	86.7	1.067	108.5
						0.94	58.8	0.991	82.7	1.118	103.6
						0.991	56.2	1.067	74.6	1.219	94.1
						1.067	50.6	1.118	71.3	1.321	84.5
100						1.118	48.4	1.219	64.8	1.422	74.6
						1.219	44.0	1.321	58.6	1.524	68.4
						1.321	40.1	1.422	52.0		
								1.524	48.0		
		0.255	108.7	0.255	163.2	0.255	221.2	0.255	244.2	0.337	204.1
		0.305	91.3	0.305	137.1	0.305	198.1	0.305	176.2	0.387	208.2
		0.337	66.7	0.337	100.4	0.337	157.0	0.337	194.7	0.438	221.3
		0.387	56.0	0.387	84.4	0.387	144.3	0.387	182.7	0.489	196.6
		0.438	51.1	0.438	77.0	0.438	131.7	0.438	180.4	0.533	179.0
		0.489	44.8	0.489	67.5	0.489	115.6	0.489	159.2	0.591	180.2
				0.533	58.6	0.533	100.4	0.533	150.1	0.635	167.0
				0.591	54.5	0.591	93.3	0.591	139.4	0.686	155.9
				0.635	50.2	0.635	86.0	0.635	128.5	0.737	147.5
				0.686	47.1	0.686	80.6	0.686	120.3	0.787	137.8
				0.737	44.4	0.737	75.7	0.737	112.5	0.838	129.8
				0.787	41.7	0.787	71.1	0.787	105.6	0.889	139.3
						0.838	67.2	0.838	99.8	0.94	130.8
						0.889	63.7	0.889	94.7	0.991	125.0
						0.94	59.8	0.94	88.9	1.067	112.8
						0.991	57.2	0.991	84.9	1.118	107.9
						1.067	51.5	1.067	76.6	1.219	98.2
						1.118	49.3	1.118	73.3	1.321	90.4
						1.219	44.8	1.219	66.7	1.422	81.0
						1.321	41.3	1.321	61.4	1.524	75.9
								1.422	55.0		
								1.524	51.6		

TABELA-10 AGUA-AR ARRANJO-30 Dt=1*

CAUDIS	TUBOS	CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	109.6	0.205	150.3	0.205	183.8	0.255	149.3	0.387	104.7
		0.255	82.0	0.255	111.4	0.255	139.3				
2		0.205	116.2	0.205	162.9	0.205	203.1	0.255	190.6	0.387	104.7
		0.255	93.1	0.255	132.9	0.255	174.6	0.305	168.2		
		0.305	76.3	0.305	108.2	0.305	148.0	0.337	148.5		
		0.337	67.5	0.337	94.4	0.337	125.8	0.387	100.4		
		0.387	51.2	0.387	69.8	0.387	95.5				
5		0.205	121.3	0.205	173.1	0.205	219.2	0.255	212.9	0.387	150.7
		0.255	98.1	0.255	143.3	0.255	193.1	0.305	193.5	0.438	151.7
		0.305	81.0	0.305	118.1	0.305	167.2	0.337	185.6	0.489	131.5
		0.337	74.3	0.337	108.2	0.337	151.4	0.387	142.1	0.533	126.8
		0.387	60.2	0.387	87.6	0.387	132.4	0.438	134.7	0.591	99.9
		0.438	43.5	0.438	63.7	0.438	102.5	0.489	110.0		
				0.489	53.8	0.489	84.8	0.533	108.1		
				0.533	55.2	0.533	85.2	0.591	82.3		
				0.591	40.7	0.591	62.1				
10		0.205	125.3	0.205	181.4	0.205	232.7	0.255	223.2	0.387	162.0
		0.255	100.3	0.255	147.9	0.255	201.5	0.305	205.6	0.438	166.7
		0.305	83.1	0.305	122.5	0.305	176.2	0.337	198.3	0.489	157.3
		0.337	76.2	0.337	112.4	0.337	159.8	0.387	152.1	0.533	161.7
		0.387	61.9	0.387	91.3	0.387	141.0	0.438	146.3	0.591	141.3
		0.438	44.7	0.438	66.2	0.438	109.2	0.489	127.6	0.635	130.9
		0.533	41.4	0.489	57.6	0.489	94.9	0.533	132.5	0.686	113.9
				0.533	61.0	0.533	99.6	0.591	108.4	0.737	103.8
				0.591	46.2	0.591	75.9	0.635	100.2	0.787	89.9
				0.635	42.9	0.635	70.4	0.686	89.0		
						0.686	63.6	0.737	82.0		
						0.737	59.1	0.787	72.4		
						0.787	53.1				
20		0.205	126.6	0.205	184.2	0.205	237.2	0.255	236.1	0.387	169.3
		0.255	102.8	0.255	153.5	0.255	212.0	0.305	213.3	0.438	176.6
		0.305	84.3	0.305	125.2	0.305	181.8	0.337	206.5	0.489	168.6
		0.337	77.4	0.337	115.0	0.337	165.1	0.387	158.5	0.533	175.3
		0.387	62.9	0.387	93.6	0.387	146.5	0.438	153.9	0.591	153.5
		0.438	45.4	0.438	67.7	0.438	113.4	0.489	134.9	0.635	143.1
		0.489		0.489	59.1	0.489	98.9	0.533	141.4	0.686	133.4
		0.533	42.2	0.533	62.8	0.533	104.6	0.591	115.5	0.737	125.9
				0.591	47.4	0.591	79.4	0.635	107.2	0.787	117.2
				0.635	44.1	0.635	73.7	0.686	100.5	0.838	110.4
				0.686	41.5	0.686	69.3	0.737	95.2	0.889	101.0
						0.737	65.7	0.787	89.0	0.94	100.5
						0.787	61.6	0.838	84.2	0.991	92.9
						0.838	58.3	0.889	77.9	1.067	80.4
						0.889	54.4	0.94	72.4	1.118	73.3
						0.94	50.8	0.991	67.5		
						0.991	47.7	1.067	59.0		
						1.067	42.0	1.118	54.5		
50		0.205	127.5	0.205	186.1	0.205	240.5	0.255	241.0	0.387	178.6
		0.255	103.7	0.255	155.5	0.255	216.0	0.305	225.0	0.438	188.6
		0.305	86.1	0.305	129.2	0.305	190.3	0.337	218.3	0.489	177.5
		0.337	79.0	0.337	118.5	0.337	172.5	0.387	166.6	0.533	186.2
		0.387	64.2	0.387	96.4	0.387	153.4	0.438	162.9	0.591	163.5
		0.438	46.1	0.438	69.4	0.438	118.2	0.489	140.5	0.635	153.1
		0.489	40.1	0.489	60.1	0.489	101.9	0.533	148.5	0.686	143.5
		0.533	42.8	0.533	64.2	0.533	108.4	0.591	121.1	0.737	135.9
				0.591	48.3	0.591	81.9	0.635	112.7	0.787	127.1
				0.635	45.0	0.635	76.3	0.686	106.1	0.838	120.3
				0.686	42.4	0.686	71.9	0.737	100.8	0.889	114.1
				0.737	40.3	0.737	68.3	0.787	94.6	0.94	116.6
						0.787	64.2	0.838	89.8	0.991	110.8
						0.838	61.0	0.889	85.4	1.067	99.8
						0.889	58.0	0.94	80.3	1.118	95.4
						0.94	54.6	0.991	76.4	1.219	86.0
						0.991	52.0	1.067	68.8	1.321	79.8
						1.067	46.8	1.118	65.9	1.422	69.2
						1.118	44.8	1.219	59.4	1.524	63.7
						1.219	40.5	1.321	55.2		
								1.422	48.3		
								1.524	44.8		
100		0.205	127.9	0.205	186.9	0.205	241.8	0.255	243.1	0.387	181.0
		0.255	104.1	0.255	156.4	0.255	217.6	0.305	227.5	0.438	192.0
		0.305	86.5	0.305	130.0	0.305	192.0	0.337	220.9	0.489	185.3
		0.337	79.3	0.337	119.3	0.337	174.2	0.387	168.7	0.533	195.4
		0.387	64.5	0.387	97.0	0.387	155.2	0.438	165.4	0.591	171.3
		0.438	46.3	0.438	69.8	0.438	119.5	0.489	145.4	0.635	157.5
		0.489	40.5	0.489	61.0	0.489	104.4	0.533	154.3	0.686	147.8
		0.533	43.3	0.533	65.2	0.533	111.4	0.591	125.3	0.737	131.5
				0.591	49.0	0.591	83.8	0.635	115.1	0.838	124.7
				0.635	45.4	0.635	77.4	0.686	108.4	0.889	118.4
				0.686	42.8	0.686	72.9	0.737	103.1	0.94	121.6
				0.737	40.7	0.737	69.4	0.787	97.1	0.991	115.8
						0.787	65.3	0.838	92.2	1.067	104.4
						0.838	62.1	0.889	87.8	1.118	100.0
						0.889	59.1	0.94	82.7	1.219	90.3
						0.94	55.7	0.991	78.8	1.321	84.0
						0.991	53.1	1.067	70.9	1.422	75.0
						1.067	47.8	1.118	45.8	1.524	70.5
						1.118	45.8	1.219	61.4		
						1.219	41.4	1.321	57.1		
								1.422	51.1		
								1.524	48.0		

TABELA-11 AGUA-AR ARRANJO-90 Dt=3/4"

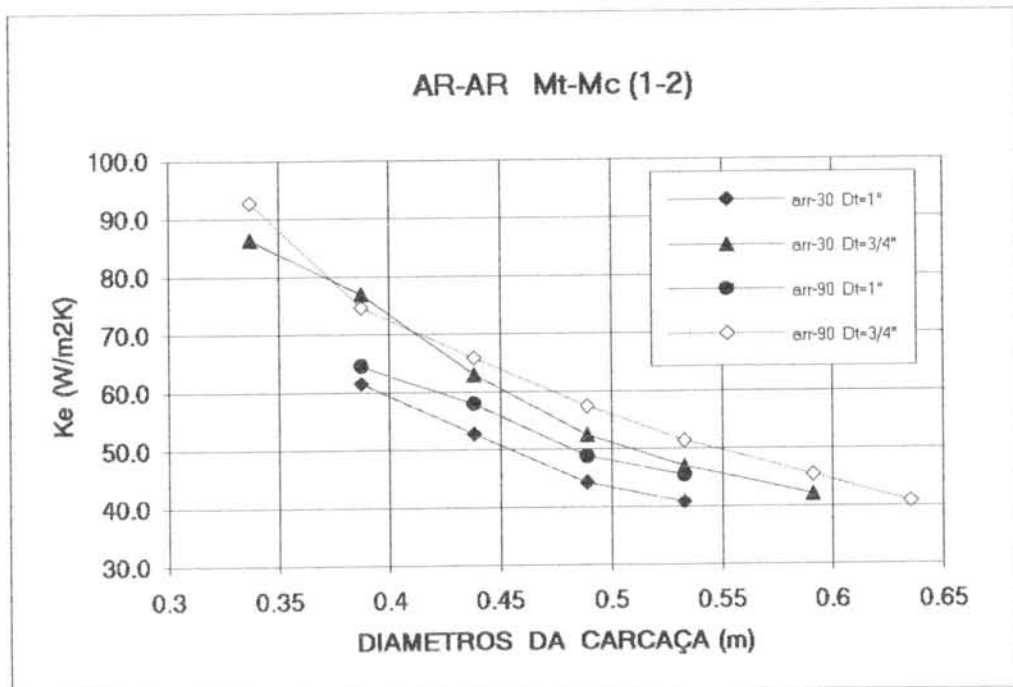
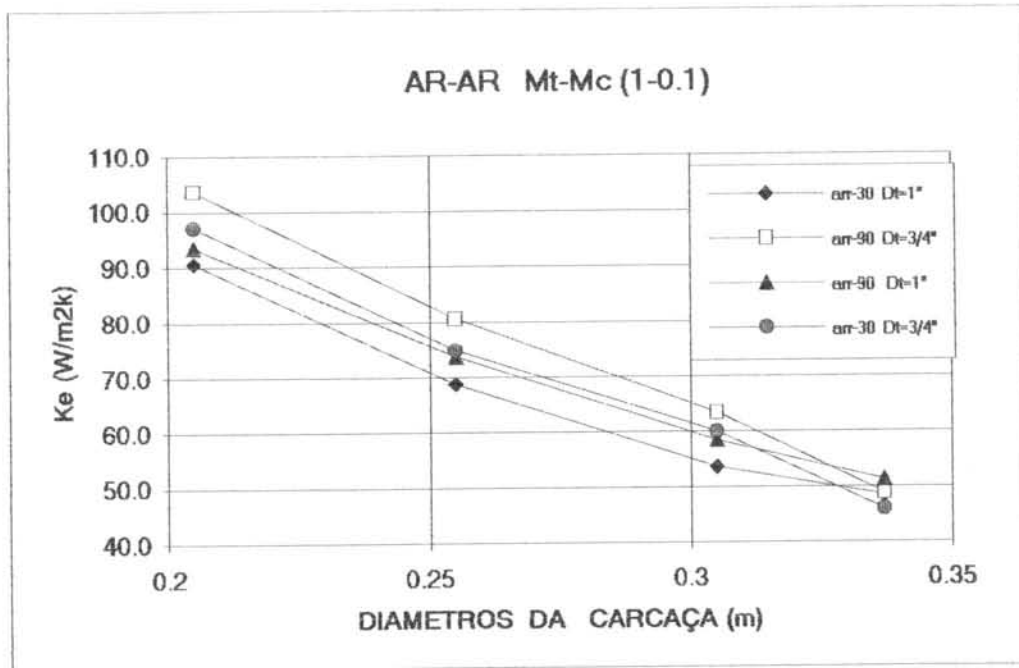
		CAUDAIS NA CARCAÇA									
		0.1		0.2		0.5		1		2	
		Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1		0.205	121.2	0.205	166.0	0.205	198.7	0.255	168.7		
		0.255	93.3	0.255	128.5	0.255	158.9				
2		0.205	127.3	0.205	177.6	0.205	215.6	0.255	205.5	0.337	154.1
		0.255	103.6	0.255	148.8	0.255	191.2	0.305	158.1	0.387	128.5
		0.305	85.1	0.305	121.7	0.305	164.5	0.337	148.6		
		0.337	61.7	0.337	88.2	0.337	126.0	0.387	118.4		
		0.387	49.1	0.387	68.7	0.387	101.9				
5		0.205	132.0	0.205	186.8	0.205	229.3	0.255	224.3	0.337	182.3
		0.255	108.2	0.255	158.4	0.255	207.3	0.305	173.9	0.387	180.8
		0.305	89.5	0.305	130.9	0.305	181.7	0.337	174.7	0.438	170.9
		0.337	65.8	0.337	96.8	0.337	145.4	0.387	161.3	0.489	154.1
		0.387	55.2	0.387	81.2	0.387	132.2	0.438	154.0	0.533	138.1
		0.438	49.6	0.438	72.8	0.438	117.9	0.489	129.9	0.591	122.9
		0.489	43.1	0.489	62.7	0.489	100.1	0.533	118.0		
				0.533	54.0	0.533	85.7	0.591	100.4		
				0.591	48.0	0.591	74.6				
10		0.205	136.3	0.205	195.5	0.205	242.5	0.255	240.0	0.337	191.4
		0.255	111.7	0.255	166.0	0.255	220.6	0.305	181.0	0.387	193.0
		0.305	91.4	0.305	134.9	0.305	189.5	0.337	183.0	0.438	185.1
		0.337	66.9	0.337	99.3	0.337	151.1	0.387	171.0	0.489	178.1
		0.387	56.3	0.387	83.6	0.387	138.7	0.438	165.4	0.533	165.7
		0.438	50.8	0.438	75.2	0.438	124.4	0.489	146.5	0.591	163.6
		0.489	44.8	0.489	66.3	0.489	109.7	0.533	137.6	0.635	152.7
				0.533	57.7	0.533	95.6	0.591	126.1	0.686	136.0
				0.591	53.1	0.591	87.8	0.635	117.2	0.737	121.7
				0.635	49.5	0.635	81.8	0.686	105.9	0.787	109.9
				0.686	45.8	0.686	74.8	0.737	95.9		
				0.737	42.3	0.737	68.4	0.787	87.6		
						0.787	63.1				
20		0.205	137.4	0.205	197.9	0.205	246.3	0.255	245.4	0.337	202.1
		0.255	112.9	0.255	168.6	0.255	225.2	0.305	190.0	0.387	200.8
		0.305	93.6	0.305	139.8	0.305	199.3	0.337	192.9	0.438	194.3
		0.337	68.2	0.337	102.1	0.337	157.7	0.387	177.1	0.489	188.4
		0.387	57.0	0.387	85.0	0.387	142.6	0.438	172.8	0.533	176.0
		0.438	51.4	0.438	76.7	0.438	128.6	0.489	153.5	0.591	175.5
		0.489	45.4	0.489	67.7	0.489	113.5	0.533	144.6	0.635	164.5
				0.533	58.9	0.533	99.0	0.591	133.0	0.686	153.7
				0.591	54.3	0.591	91.2	0.635	124.0	0.737	142.9
				0.635	50.7	0.635	85.0	0.686	116.4	0.787	134.5
				0.686	47.7	0.686	79.9	0.737	108.6	0.838	125.6
				0.737	44.6	0.737	74.7	0.787	102.6	0.889	119.1
				0.787	42.2	0.787	70.6	0.838	96.1	0.94	117.1
						0.838	66.2	0.889	91.3	0.991	110.1
						0.889	63.0	0.94	83.3	1.067	96.0
						0.94	58.0	0.991	78.7	1.118	88.0
						0.991	55.0	1.067	69.2		
						1.067	48.7	1.118	64.2		
						1.118	45.5				
50		0.205	138.3	0.205	207.0	0.205	248.9	0.255	249.3	0.337	206.5
		0.255	113.7	0.255	170.4	0.255	228.5	0.305	193.3	0.387	212.3
		0.305	94.4	0.305	141.6	0.305	203.0	0.337	196.8	0.438	206.8
		0.337	68.7	0.337	103.2	0.337	160.4	0.387	186.0	0.489	201.6
		0.387	57.9	0.387	87.0	0.387	148.4	0.438	182.6	0.533	188.4
		0.438	52.3	0.438	78.6	0.438	133.9	0.489	162.1	0.591	184.9
		0.489	46.0	0.489	69.4	0.489	118.2	0.533	152.9	0.635	173.9
		0.533	40.0	0.533	60.2	0.533	102.8	0.591	138.4	0.686	163.0
				0.591	55.2	0.591	93.6	0.635	129.3	0.737	152.3
				0.635	51.6	0.635	87.5	0.686	121.7	0.787	143.7
				0.686	48.5	0.686	82.3	0.737	113.9	0.838	134.8
				0.737	45.5	0.737	77.1	0.787	107.8	0.889	128.1
				0.787	43.1	0.787	73.0	0.838	101.3	0.94	132.1
				0.838	40.5	0.838	68.7	0.889	96.5	0.991	126.2
						0.889	65.4	0.94	90.6	1.067	113.6
						0.94	61.4	0.991	86.6	1.118	108.2
						0.991	58.7	1.067	77.9	1.219	97.6
						1.067	52.8	1.118	74.3	1.321	90.3
100		0.305	94.7	0.305	142.3	0.305	204.5	0.305	194.7	0.337	208.3
		0.337	68.9	0.337	103.7	0.337	161.5	0.337	198.4	0.387	214.9
		0.387	58.1	0.387	87.5	0.387	149.6	0.387	188.0	0.438	209.9
		0.438	52.5	0.438	79.0	0.438	135.2	0.438	185.0	0.489	205.1
		0.489	46.3	0.489	69.8	0.489	119.4	0.489	164.3	0.533	191.9
		0.533	40.2	0.533	60.6	0.533	103.8	0.533	155.2	0.591	193.7
				0.591	55.9	0.591	95.8	0.591	143.2	0.635	182.1
				0.635	52.3	0.635	89.5	0.635	133.8	0.686	170.7
				0.686	49.2	0.686	84.3	0.686	125.9	0.737	159.5
				0.737	46.1	0.737	79.0	0.737	118.0	0.787	147.7
				0.787	43.4	0.787	74.0	0.787	110.1	0.838	138.8
				0.838	40.9	0.838	69.7	0.838	103.6	0.889	132.0
						0.889	66.4	0.889	98.7	0.94	136.7
						0.94	62.4	0.94	92.8	0.991	130.8
						0.991	59.7	0.991	88.8	1.067	117.8
						1.067	53.7	1.067	79.9	1.118	112.3
						1.118	51.3	1.118	76.2	1.219	101.5
						1.219	46.3	1.219	68.9	1.321	94.2
						1.321	43.0	1.321	63.9	1.422	84.3
								1.422	57.2	1.524	79.0
								1.524	53.6		

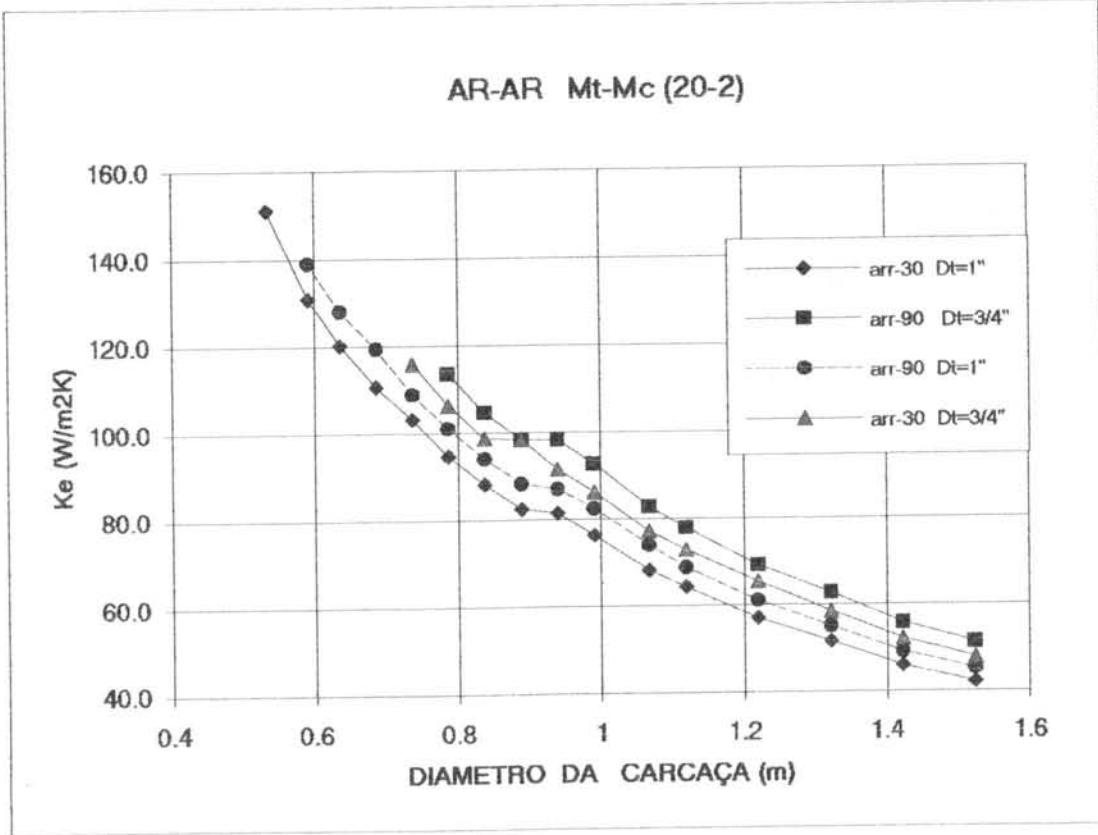
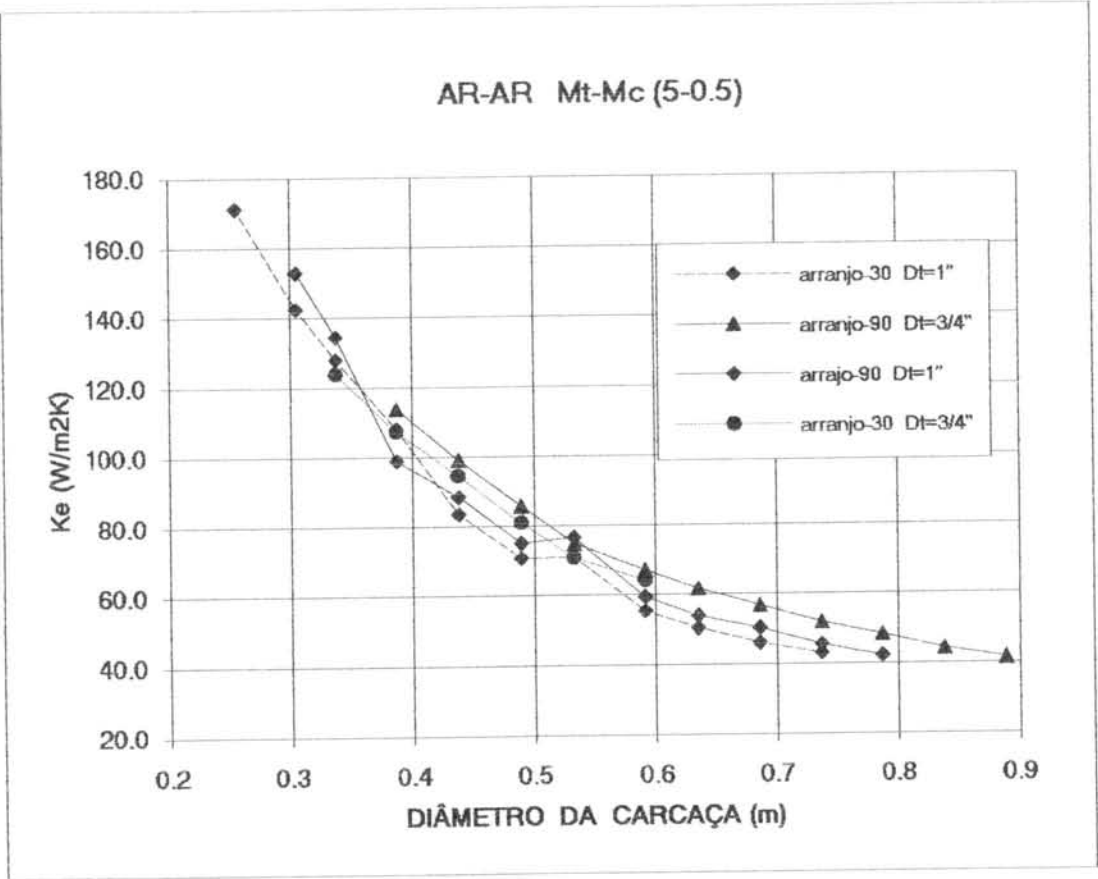
TABELA-12 AGUA-AR ARRANJO-90 Dt=1"

	CAUDAIS NA CARCAÇA									
	01		02		03		04		05	
	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke	Dc	Ke
1	0.205	113.0	0.205	155.0	0.205	189.9	0.255	164.2		
	0.255	86.7	0.255	121.8	0.255	152.8	0.305	120.0		
	0.305	66.4	0.305	87.9	0.305	110.5				
2	0.205	115.7	0.205	167.9	0.205	208.2	0.255	199.8	0.387	112.6
	0.255	98.2	0.255	140.4	0.255	183.1	0.305	177.7		
	0.305	81.0	0.305	115.3	0.305	157.6	0.337	158.7		
	0.337	71.2	0.337	100.2	0.337	134.0	0.387	108.2		
	0.387	44.0	0.387	61.6	0.387	91.7				
5	0.205	124.9	0.205	176.4	0.205	225.6	0.255	221.4	0.387	153.3
	0.255	103.1	0.255	150.7	0.255	201.1	0.305	202.0	0.438	157.5
	0.305	85.6	0.305	125.0	0.305	176.4	0.337	192.6	0.489	147.4
	0.337	77.3	0.337	112.7	0.337	157.4	0.387	145.2	0.533	140.5
	0.387	49.0	0.387	72.0	0.387	117.1	0.438	140.8	0.591	115.4
	0.438	45.1	0.438	66.1	0.438	107.0	0.489	122.2	0.635	97.2
	0.533	41.3	0.489	57.4	0.489	92.6	0.533	119.4		
			0.533	59.5	0.533	93.2	0.591	93.3		
			0.591	44.0	0.591	68.8	0.635	79.7		
					0.635	60.1				
10	0.205	129.1	0.205	167.0	0.205	239.6	0.255	231.2	0.387	164.2
	0.255	105.2	0.255	155.2	0.255	209.2	0.305	213.5	0.438	171.7
	0.305	87.6	0.305	129.3	0.305	185.1	0.337	205.1	0.489	163.1
	0.337	79.2	0.337	116.9	0.337	165.7	0.387	154.9	0.533	169.6
	0.387	50.1	0.387	74.4	0.387	123.3	0.438	152.0	0.591	148.4
	0.438	46.2	0.438	68.5	0.438	113.3	0.489	132.9	0.635	137.6
	0.489	40.3	0.489	59.7	0.489	98.5	0.533	139.8	0.686	129.4
	0.533	43.5	0.533	64.2	0.533	105.1	0.591	113.7	0.737	112.1
			0.591	48.1	0.591	79.4	0.635	105.1	0.787	101.3
			0.635	44.6	0.635	73.5	0.686	99.3	0.838	90.5
			0.686	42.3	0.686	69.6	0.737	87.7	0.889	80.3
					0.737	62.6	0.787	80.2		
					0.787	57.8	0.838	72.7		
					0.838	53.1	0.889	65.5		
					0.889	48.6				
20	0.205	131.4	0.205	169.8	0.205	244.2	0.255	244.3	0.387	171.1
	0.255	108.7	0.255	161.0	0.255	219.9	0.305	226.7	0.438	181.0
	0.305	90.7	0.305	134.1	0.305	195.0	0.337	213.1	0.489	173.7
	0.337	82.0	0.337	119.4	0.337	170.9	0.387	161.1	0.533	182.6
	0.387	51.5	0.387	75.8	0.387	127.2	0.438	159.3	0.591	160.2
	0.438	47.6	0.438	70.0	0.438	117.3	0.489	139.9	0.635	149.5
	0.489	41.4	0.489	61.0	0.489	102.3	0.533	148.6	0.686	141.1
	0.533	44.9	0.533	66.0	0.533	110.0	0.591	120.6	0.737	130.8
			0.591	49.3	0.591	82.6	0.635	111.8	0.787	123.0
			0.635	45.8	0.635	76.7	0.686	106.0	0.838	115.9
			0.686	43.5	0.686	72.8	0.737	98.8	0.889	109.8
			0.737	40.7	0.737	68.0	0.787	93.2	0.94	110.8
					0.787	64.3	0.838	88.2	0.991	101.7
					0.838	60.9	0.889	83.9	1.067	89.5
					0.889	58.0	0.94	78.4	1.118	81.6
					0.94	54.3	0.991	72.9	1.219	68.2
					0.991	51.0	1.067	64.5		
					1.067	45.3	1.118	59.5		
					1.118	42.2	1.219	50.8		
50	0.205	131.4	0.205	191.8	0.205	247.6	0.255	249.1	0.387	180.2
	0.255	108.7	0.255	163.1	0.255	223.7	0.305	223.4	0.438	192.6
	0.305	90.7	0.305	136.0	0.305	199.32	0.337	225.1	0.489	182.1
	0.337	82.0	0.337	123.1	0.337	178.5	0.387	169.2	0.533	193.0
	0.387	51.5	0.387	77.5	0.387	132.2	0.438	168.2	0.591	169.7
	0.438	47.6	0.438	71.6	0.438	122.1	0.489	145.2	0.635	159.1
	0.489	41.4	0.489	62.0	0.489	105.2	0.533	155.4	0.686	150.5
	0.533	44.9	0.533	67.3	0.533	113.7	0.591	125.9	0.737	140.4
			0.591	50.1	0.591	85.1	0.635	117.1	0.787	132.5
			0.635	46.6	0.635	79.2	0.686	111.3	0.838	125.4
			0.686	44.4	0.686	75.3	0.737	104.1	0.889	119.2
			0.737	41.6	0.737	70.5	0.787	98.6	0.94	121.5
					0.787	66.8	0.838	93.6	0.991	116.6
					0.838	63.5	0.889	89.2	1.067	105.0
					0.889	60.5	0.94	83.6	1.118	99.5
					0.94	56.7	0.991	80.2	1.219	89.8
					0.991	54.4	1.067	72.2	1.321	83.4
					1.067	49.0	1.118	68.5	1.422	74.3
					1.118	46.6	1.219	61.9	1.524	67.7
					1.219	42.1	1.321	57.5		
100	0.205	131.8	0.205	192.6	0.205	225.2	0.255	251.0	0.387	182.5
	0.255	109.1	0.255	163.9	0.255	200.9	0.305	234.7	0.438	195.0
	0.305	91.0	0.305	136.8	0.305	180.1	0.337	227.7	0.489	189.9
	0.337	82.4	0.337	123.9	0.337	163.4	0.387	171.2	0.533	202.3
	0.387	51.7	0.387	77.9	0.387	133.4	0.438	170.6	0.591	177.5
	0.438	47.8	0.438	72.1	0.438	123.3	0.489	150.1	0.635	166.5
	0.489	41.7	0.489	62.9	0.489	107.7	0.533	161.3	0.686	154.6
	0.533	45.4	0.533	68.4	0.533	116.8	0.591	130.1	0.737	144.6
			0.591	50.8	0.591	87.0	0.635	121.0	0.787	136.7
			0.635	47.3	0.635	81.0	0.686	113.5	0.838	129.6
			0.686	44.7	0.686	76.3	0.737	106.4	0.889	123.3
			0.737	42.0	0.737	71.6	0.787	100.9	0.94	126.3
					0.787	67.9	0.838	95.9	0.991	121.3
					0.838	64.5	0.889	91.5	1.067	109.3
					0.889	61.6	0.94	85.8	1.118	103.9
					0.94	57.7	0.991	82.4	1.219	93.9
					0.991	55.5	1.067	74.2	1.321	87.5
					1.067	49.9	1.118	70.6	1.422	78.0
					1.118	47.5	1.219	63.8	1.524	73.3
					1.219	42.9	1.321	59.5		
					1.321	40.0	1.422	53.0		
							1.524	49.9		

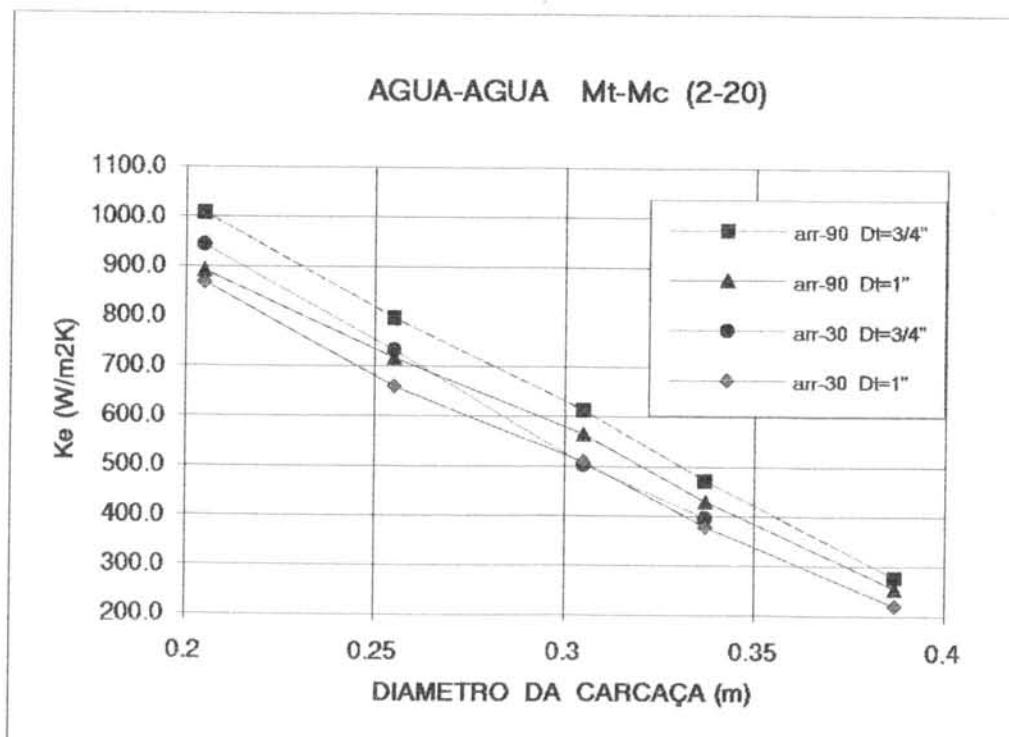
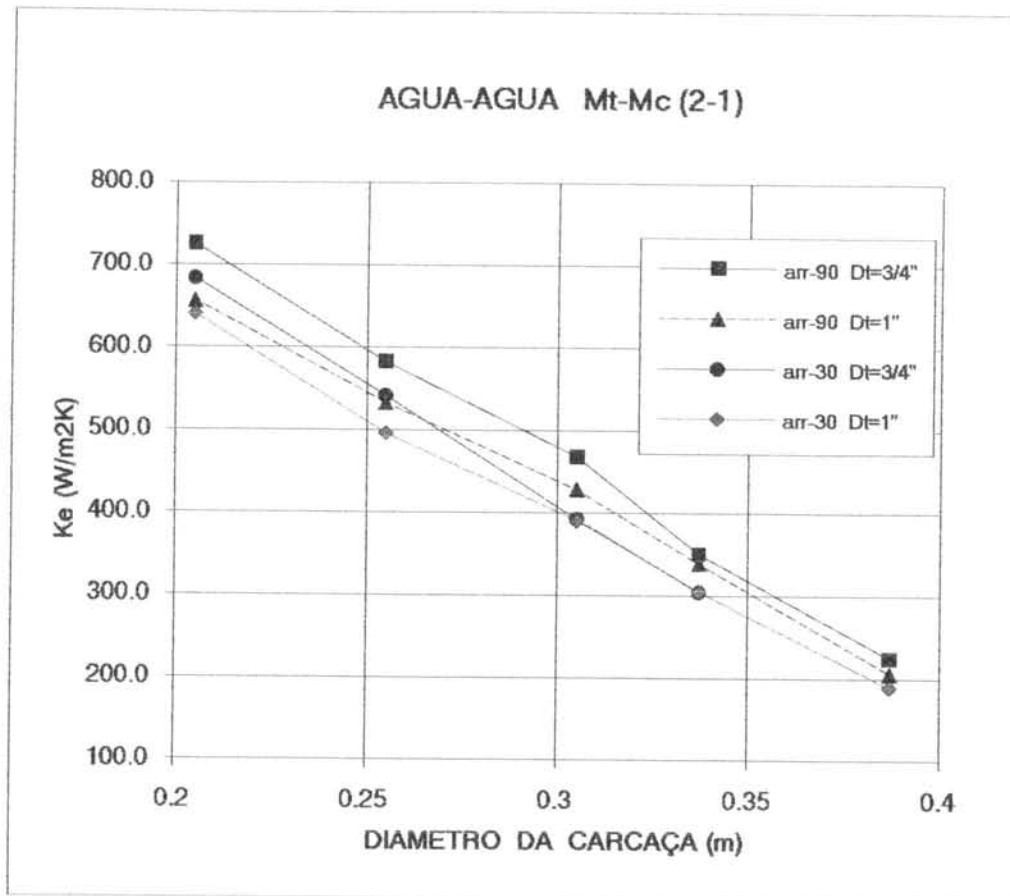
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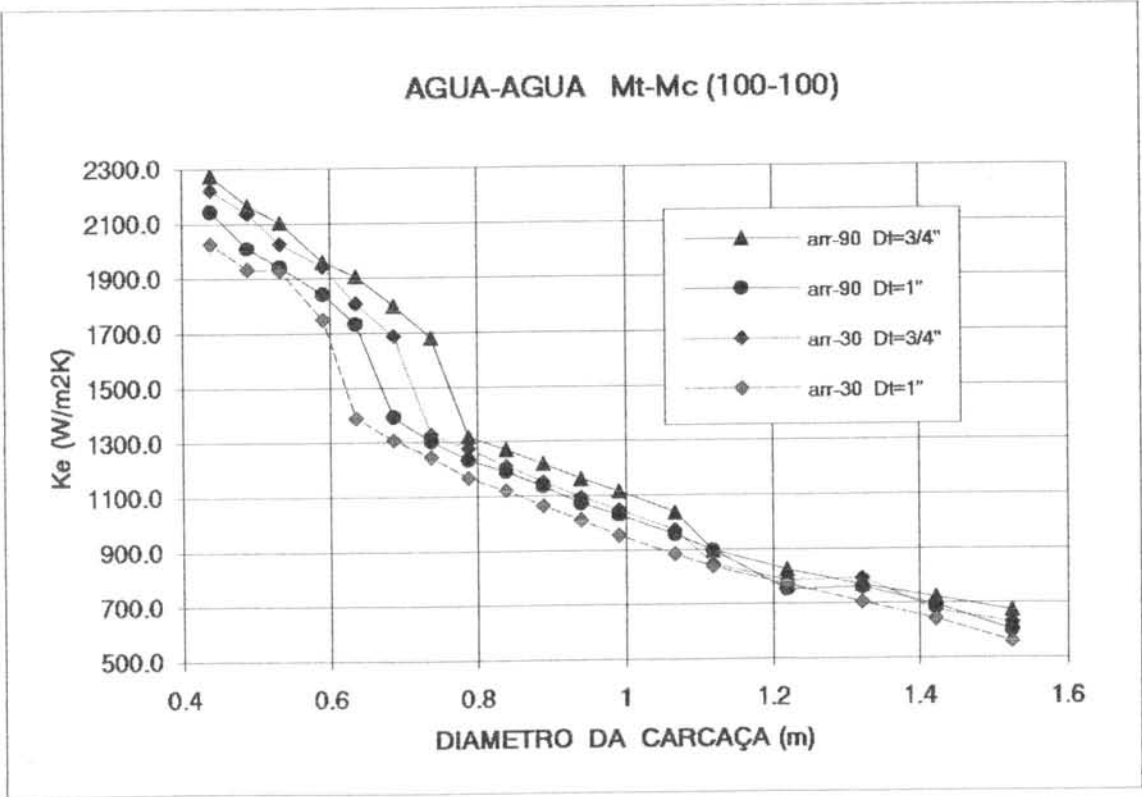
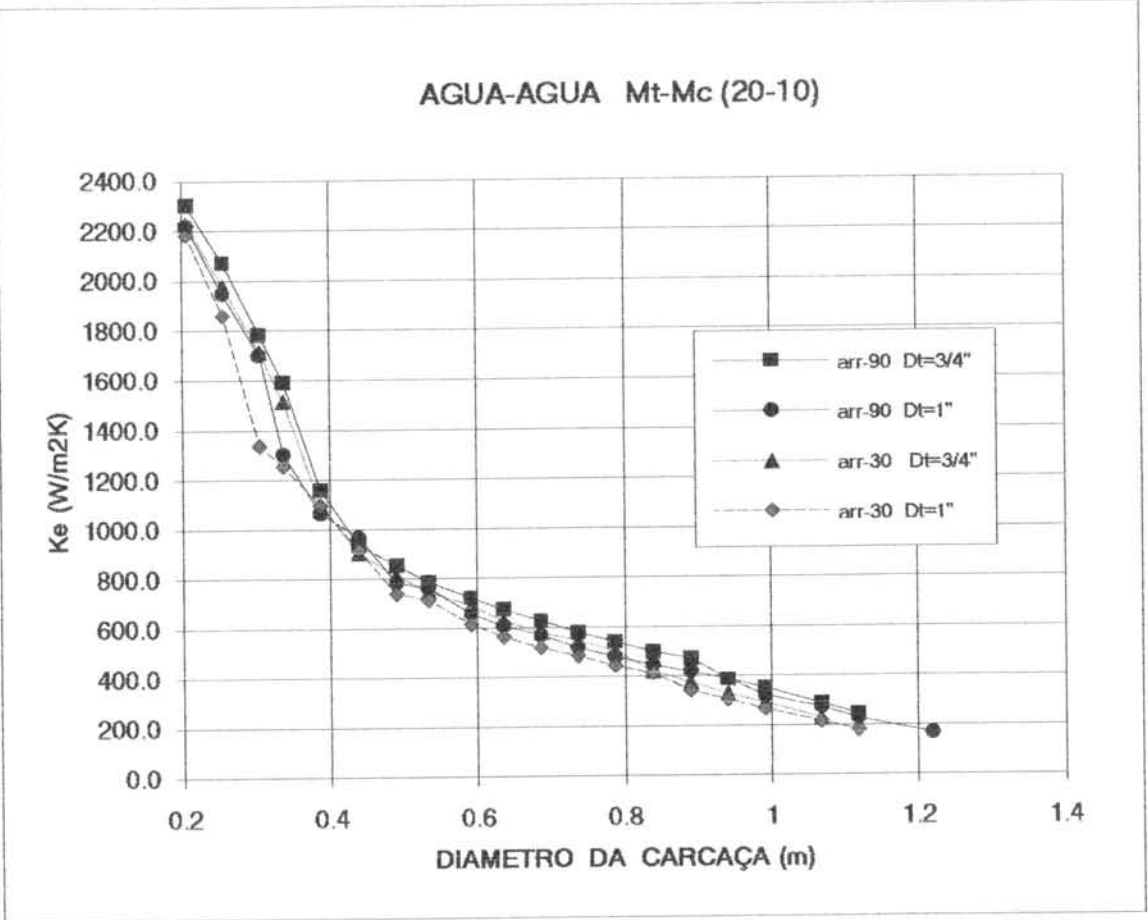
Ke EM FUNÇÃO DO DIÂMETRO DA CARÇAÇA



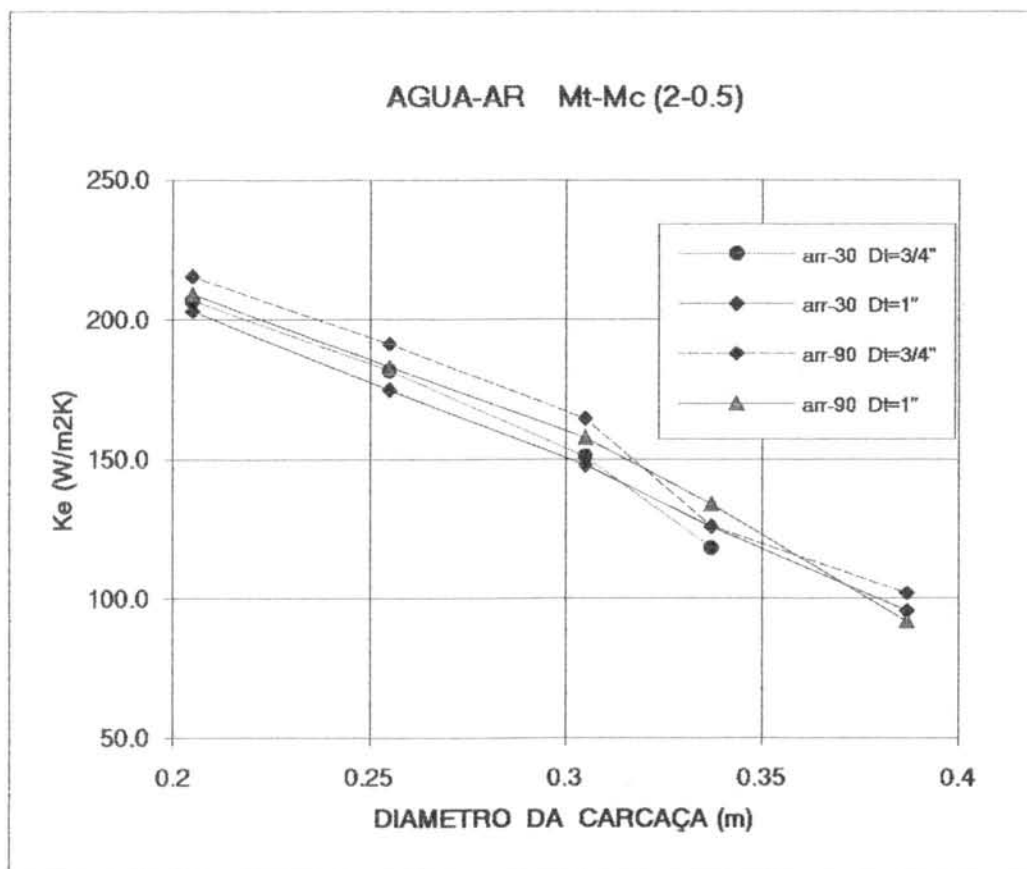
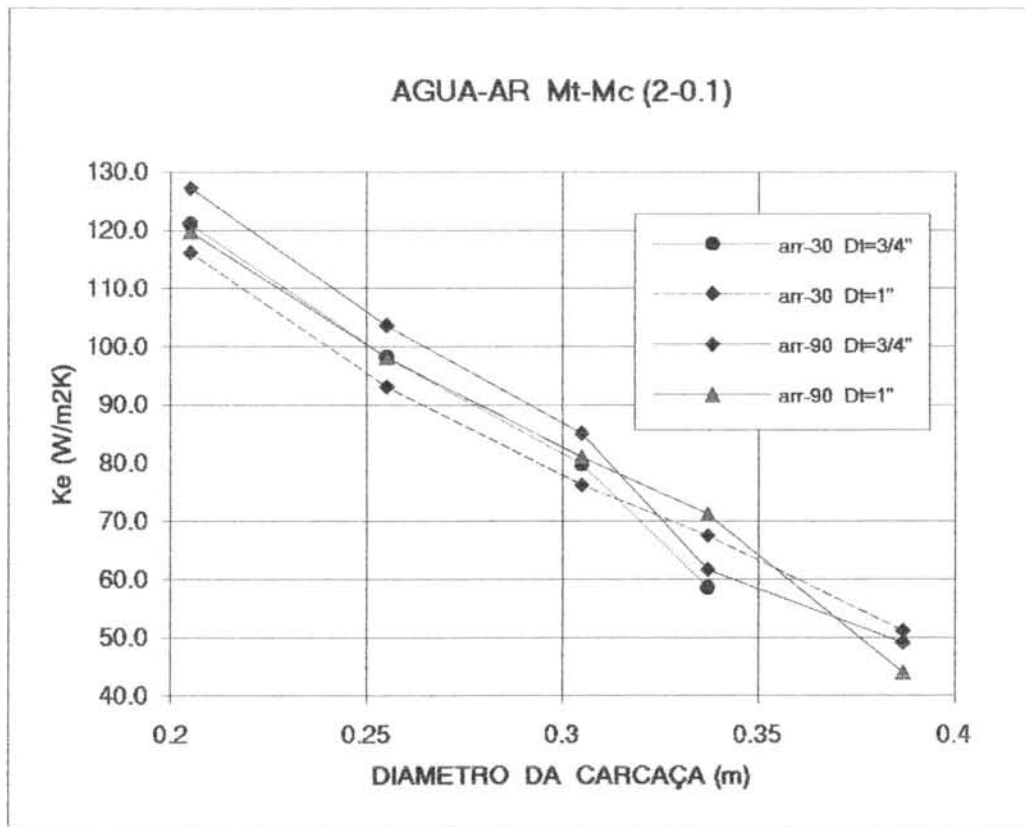


Ke EM FUNÇÃO DO DIÂMETRO DA CARCAÇA

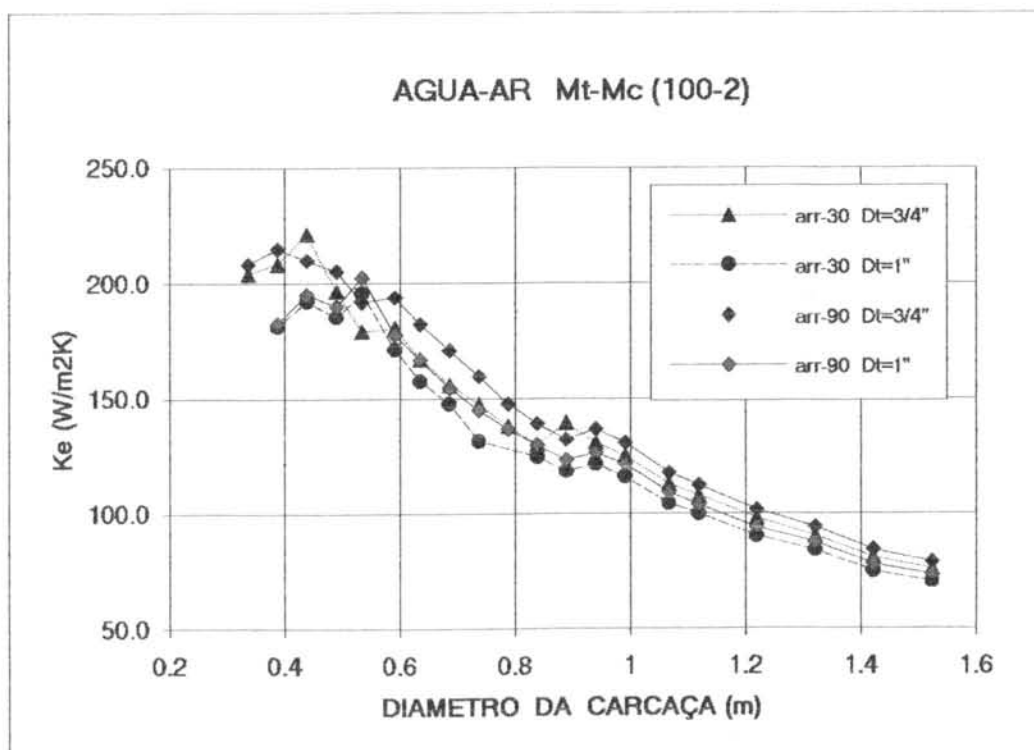
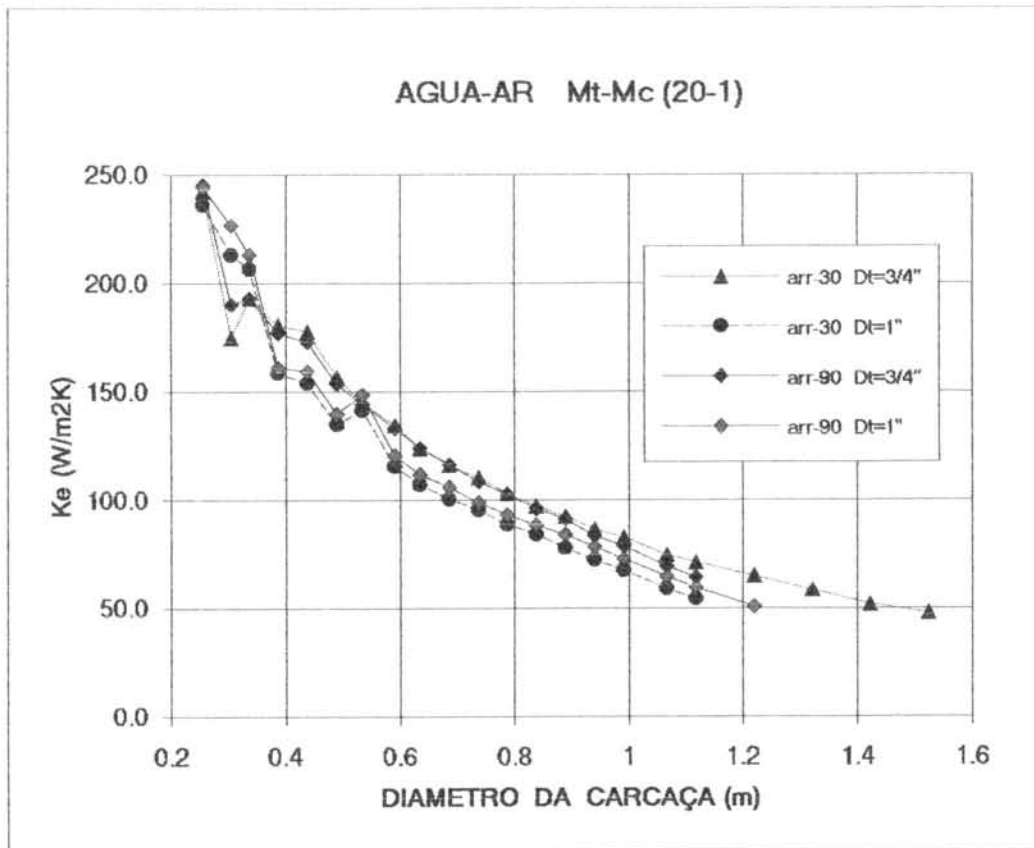




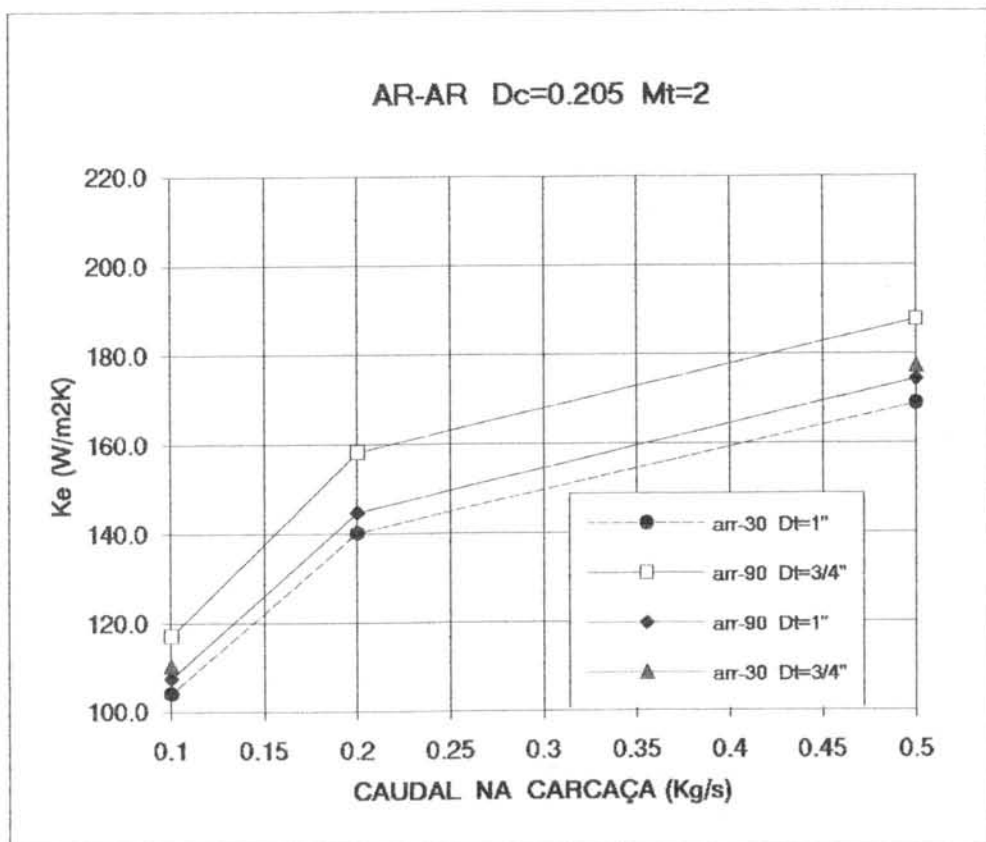
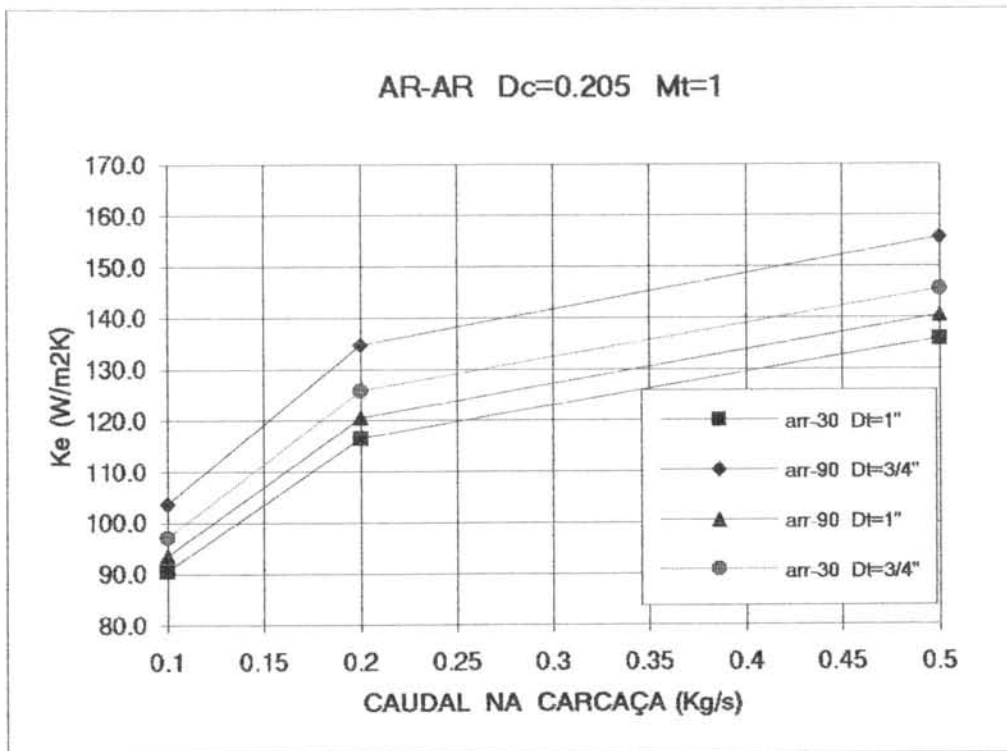
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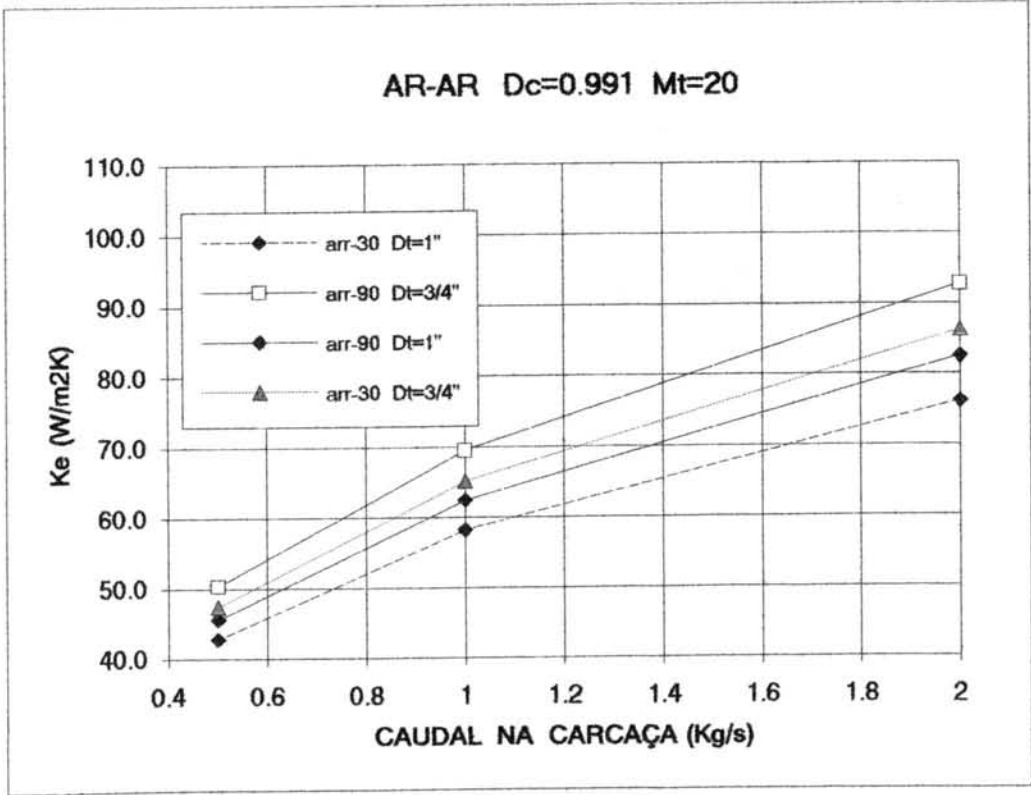
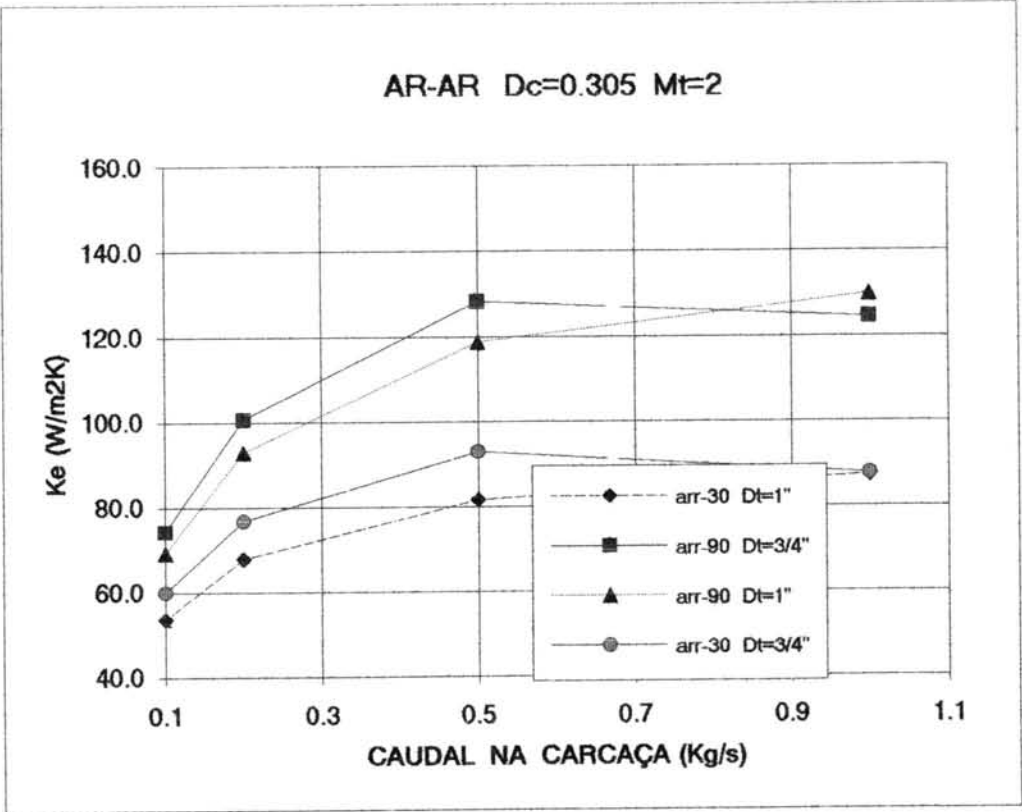
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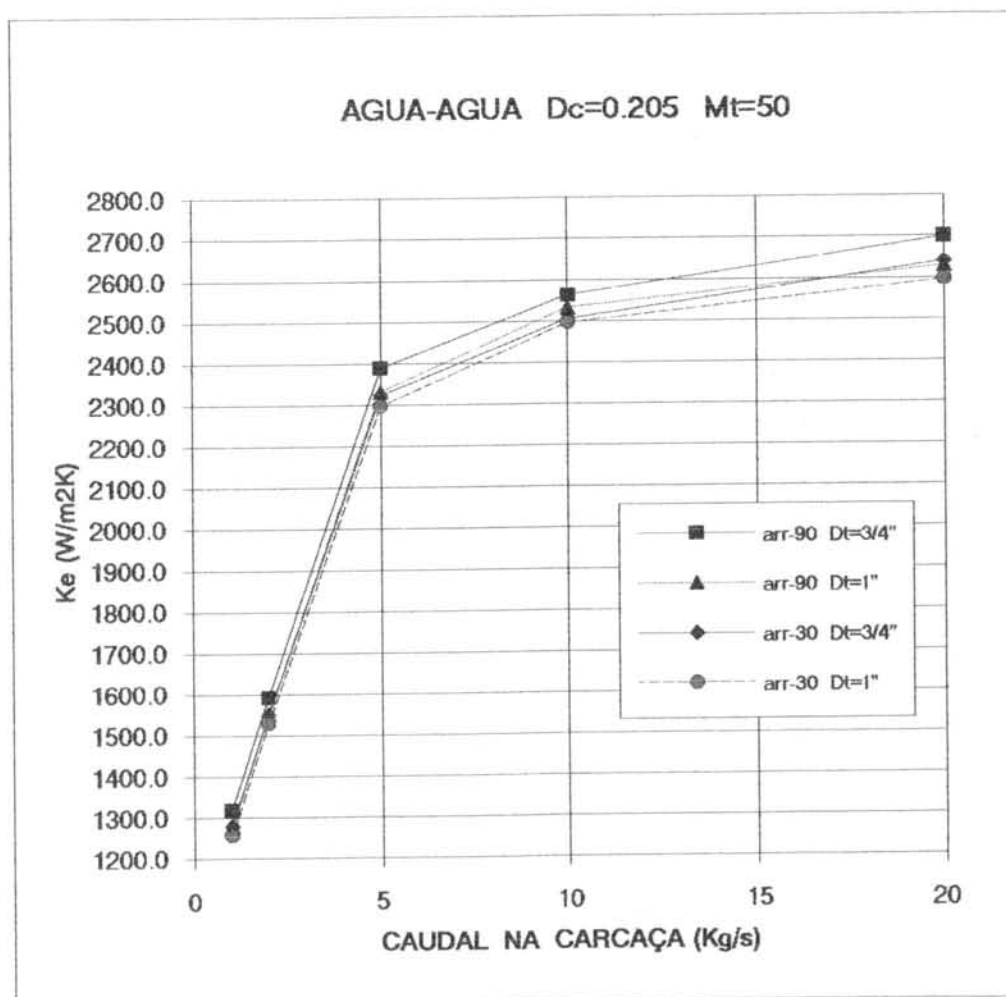
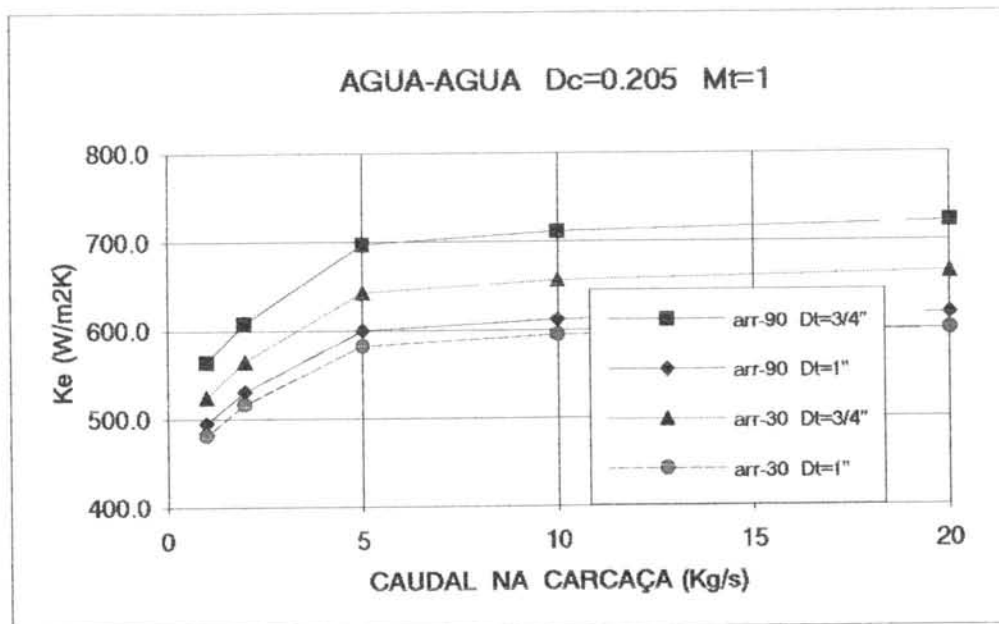
Ke EM FUNÇÃO DO CAUDAL NA CARÇAÇA



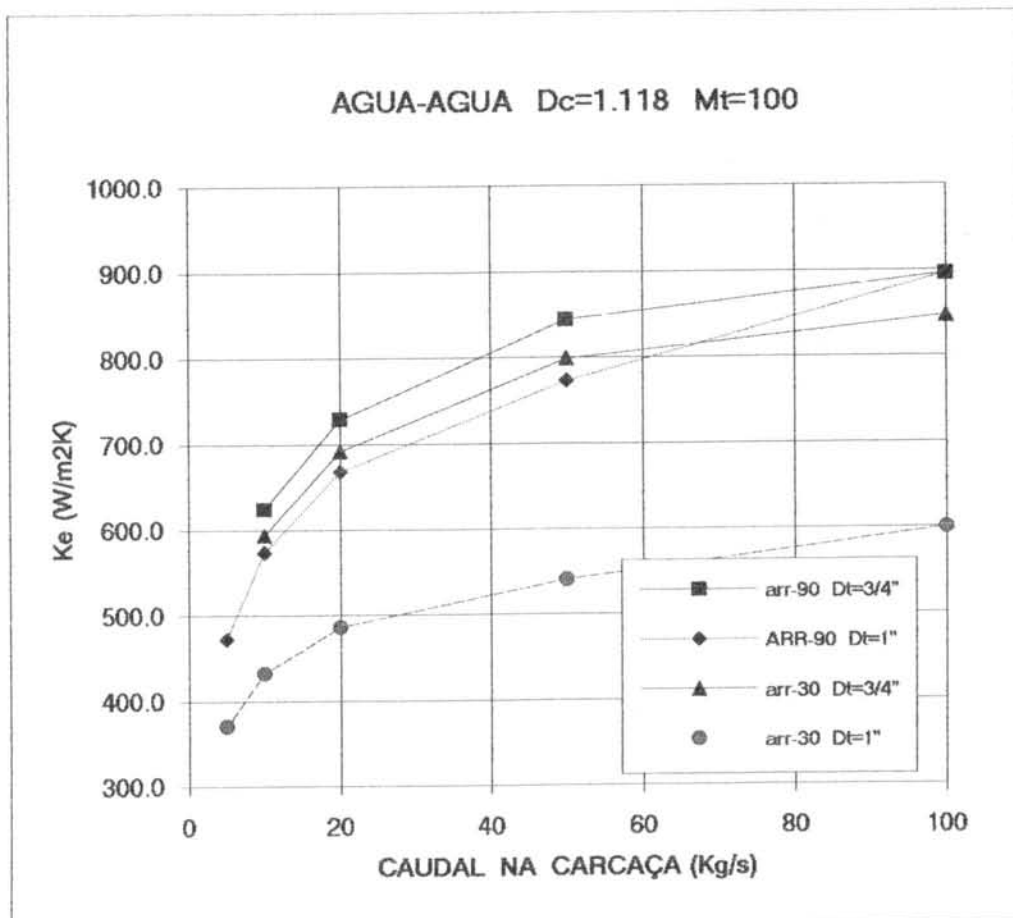
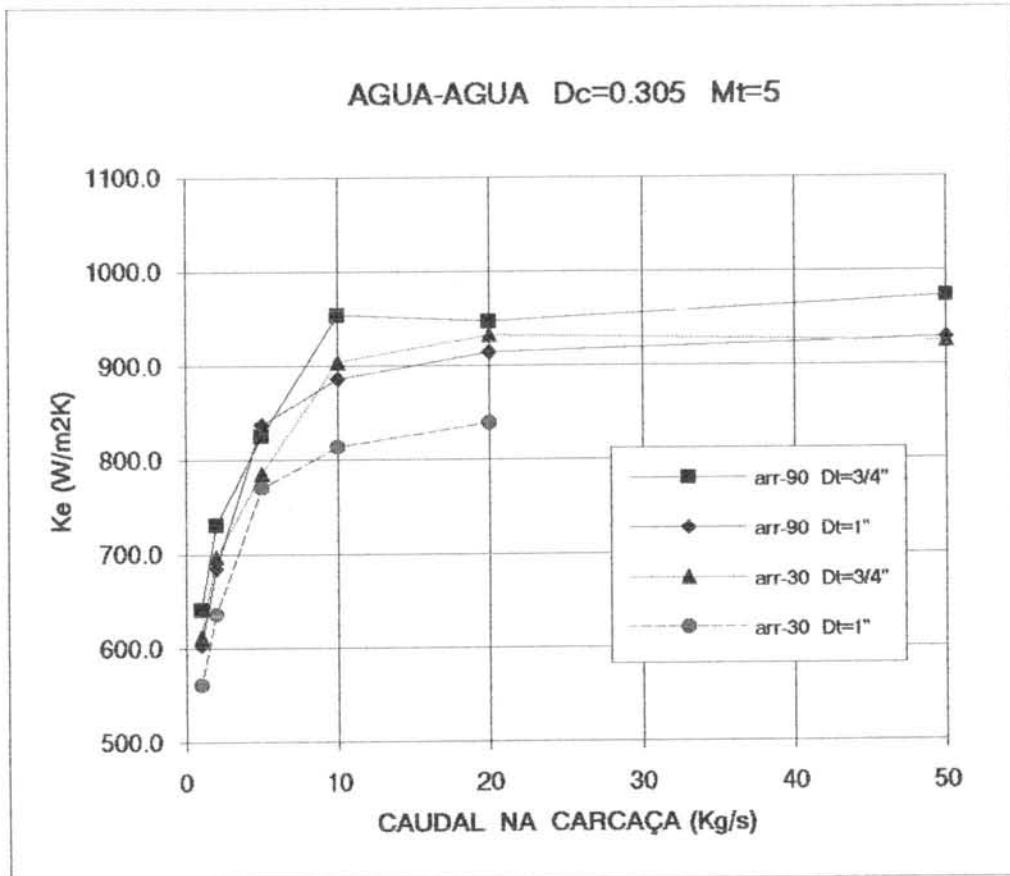
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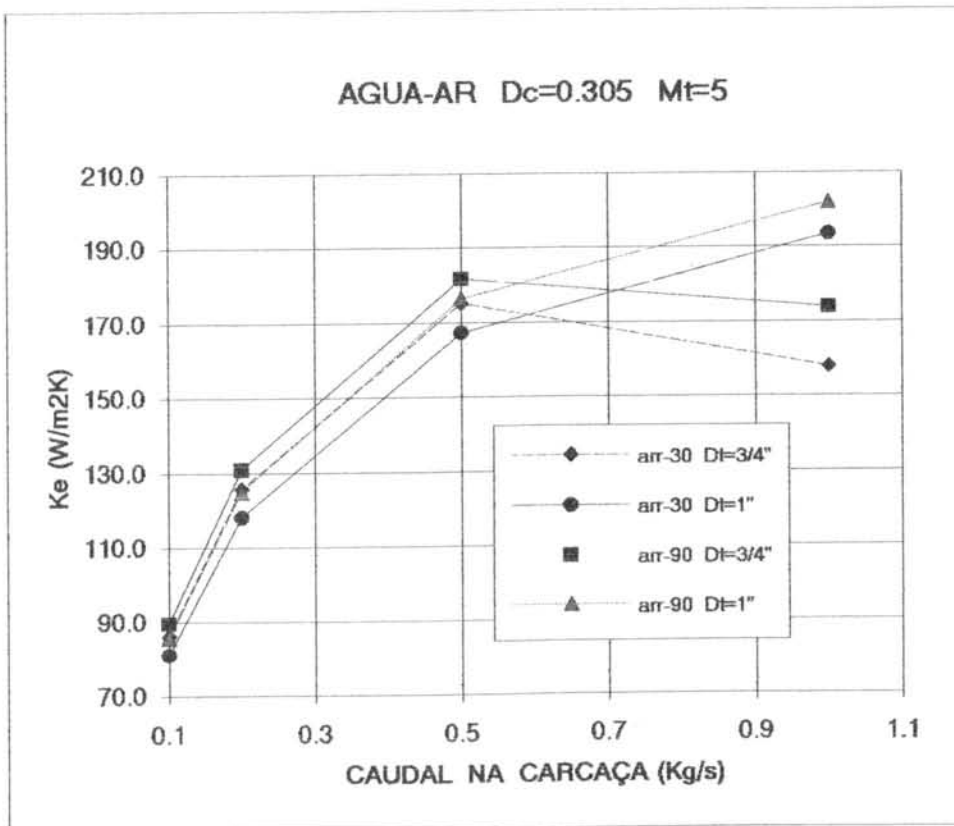
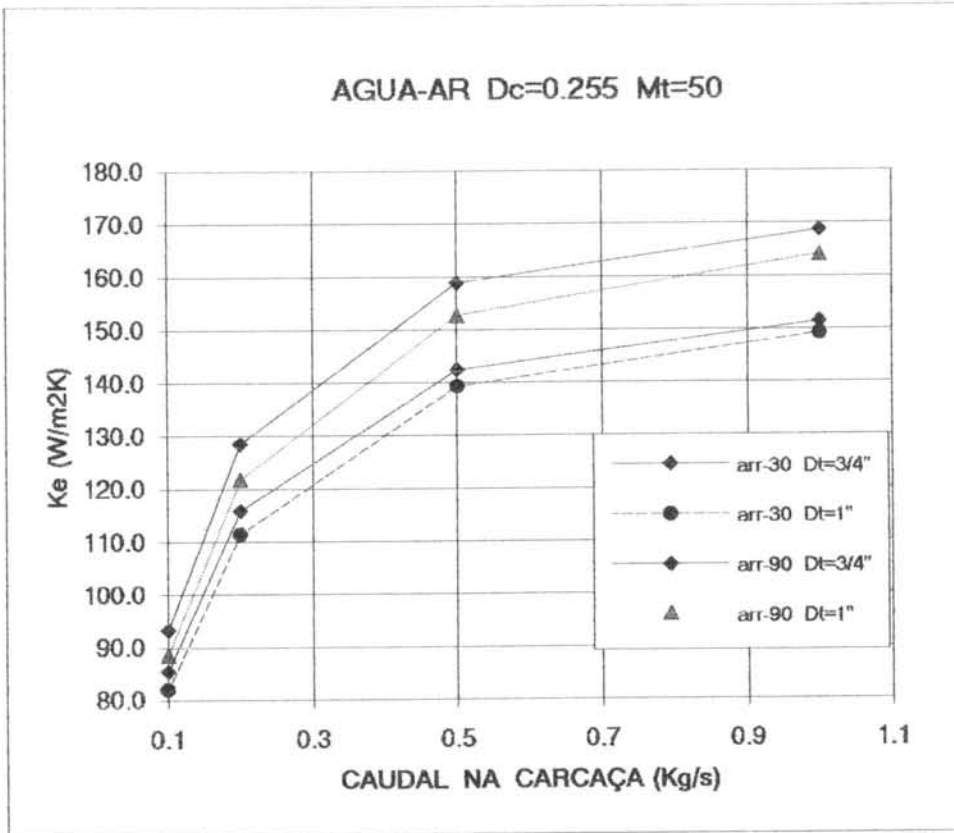
Ke EM FUNÇÃO DO CAUDAL NA CARÇAÇA



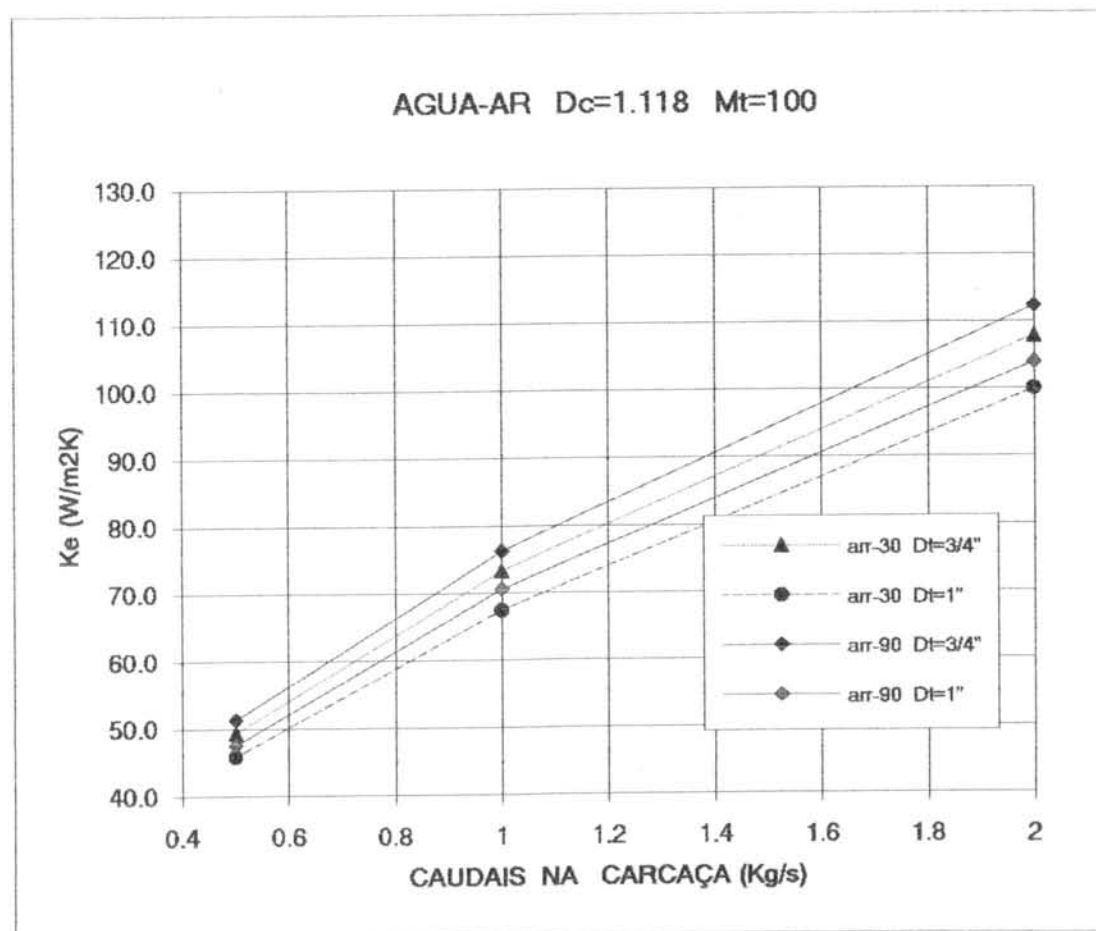
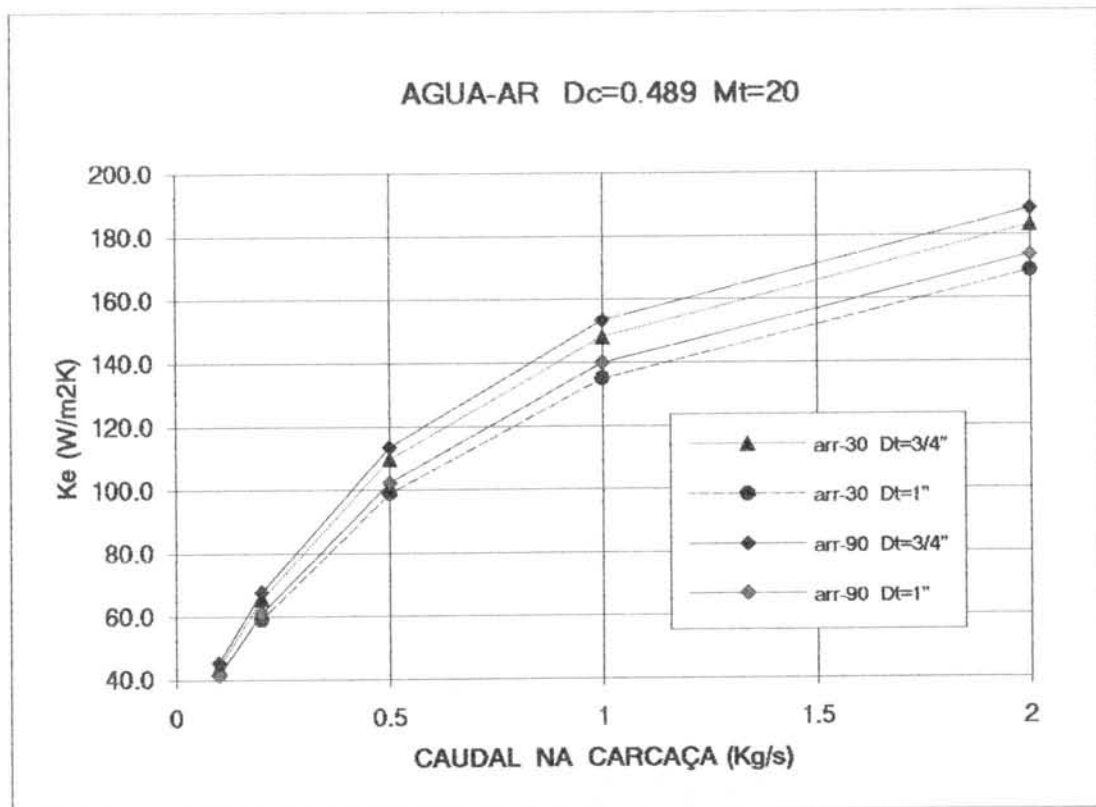
Ke EM FUNÇÃO DO CAUDAL NA CARÇAÇA



Ke EM FUNÇÃO DO CAUDAL NA CARÇAÇA



K_e EM FUNÇÃO DO CAUDAL NA CARÇAÇA



ANEXO

Programa

```
DECLARE SUB RRf (Acs!, Ats!, Sm!, Rf!)
DECLARE SUB Fatrc (Rec!, arranjo!, fic!)
DECLARE SUB RRb (RAfcAc!, NFS!, Ntc!, Rec!, Rb!)
DECLARE SUB Fatri (Rein!, d0!, espessura!, epslon!, Fati!)
```

```
*****
'      PROPRIEDADES DOS FLUIDOS
*****

roc = 1
cpc = 1010
kc = .03
viscc = 2.1 * 10 ^ -5
rot = 1000
cpt = 4180
Kt = .63
Visct = .0005
*****
'      ARRANJO TUBOS E LEITURA CAUDAIS
*****

MODIFIC2 = 1
10 CLS
PRINT "Difm.tubos ( 1 -3/4"; 2 -1") ?"
DO
    A$ = INKEY$
LOOP WHILE (A$ <> "1" AND A$ <> "2")
d0 = VAL(A$)
PRINT "Arranjo tubos ( 1 -90$, 2 -30$) ?"
DO
    A$ = INKEY$
LOOP WHILE (A$ <> "1" AND A$ <> "2")
arranjo = VAL(A$)
IF d0 = 1 THEN
    d0 = .01905
    p = .0254
ELSE
    d0 = .0254
    p = .03175
END IF

IF arranjo = 1 THEN
    pp = p
    pn = p
ELSE
    pp = .866 * p
    pn = .5 * p
END IF
```

```

IF MODIFIC2 = 0 THEN
GOTO 30
END IF

20 CLS
INPUT "Caudal carcaça (kg/s)="; mc
INPUT "Caudal tubos (kg/s)="; mt

'*****
'      LEITURA E CALCULO DO NOS TUBOS
'*****

30 CLS
PRINT " -----DIAMETROS DE CARCAÇAS-----"
PRINT ""
PRINT " 1 ----.205 m      13 ----.787 m"
PRINT " 2 ----.255 m      14 ----.838 m"
PRINT " 3 ----.305 m      15 ----.889 m"
PRINT " 4 ----.337 m      16 ----.940 m"
PRINT " 5 ----.387 m      17 ----.991 m"
PRINT " 6 ----.438 m      18 ----1.067 m"
PRINT " 7 ----.489 m      19 ----1.118 m"
PRINT " 8 ----.533 m      20 ----1.219 m"
PRINT " 9 ----.591 m      21 ----1.321 m"
PRINT "10 ----.635 m      22 ----1.422 m"
PRINT "11 ----.686 m      23 ----1.524 m"
PRINT "12 ----.737 m      "

999 LOCATE 25, 10
INPUT "Qual o nº ordem da carcaça "; i
IF i < 1 OR i > 23 THEN GOTO 999

RESTORE 100
FOR j = 1 TO i
READ DC, df, nt1, nt2, nt3, nt4
NEXT j

IF arranjo = 1 THEN
IF d0 = .0254 THEN
nt = nt3
ELSE
nt = nt1
END IF

ELSE
IF d0 = .0254 THEN
nt = nt4
ELSE
nt = nt2
END IF

END IF

```

```

*****
'      CALCULO ALFA CARCAÇA
*****

pi = 3.14159

RLsD = .2
40  Ls = RLsD * DC
    IF Ls < .0508 THEN Ls = .0508
    Lc = (.2 + (RLsD - .2) * .1667) * DC

deq = d0
Ntc = DC * (1 - 2 * Lc / DC) / pp
tctl1 = (DC - 2 * Lc) / (df - d0)
tctl1 = SQR(1 / (tctl1 ^ 2) - 1)
tctl = 2 * ATN(tctl1)
fj = tctl / 2 / pi - SIN(tctl) / 2 / pi
fc = 1 - 2 * fj
Ntcj = .8 * (Lc - (df - d0) / 2) / pp

Sm = Ls * (DC - df + (df - d0) / p * (p - deq))

RAfcAc = Ls * (DC - df) / Sm
IF (2 * Ls < .9144) THEN
    deltats = 7.9375E-04
ELSE
    deltats = 3.96875E-04
END IF

teta1 = (1 - 2 * Lc / DC)
teta1 = SQR(1 / (teta1 ^ 2) - 1)
teta = 2 * ATN(teta1)
Ats = pi / 4 * ((deq + deltats) ^ 2 - deq ^ 2) * nt * (1 - fj)

IF DC <= .3366 THEN deltacs = .00254
IF DC > .3366 AND DC <= .4382 THEN deltacs = .003175
IF DC > .4382 AND DC <= .591 THEN deltacs = .00381
IF DC > .591 AND DC <= .9906 THEN deltacs = .004445
IF DC > .9906 AND DC < 1.4 THEN deltacs = .005715
IF DC >= 1.4 THEN deltacs = .00762

Acs = pi * DC * deltacs * (1 - teta / (2 * pi)) / 2
Ajb = DC ^ 2 / 8 * (teta - SIN(teta))
Ajt = pi * deq ^ 2 / 4 * fj * nt
Aj = Ajb - Ajt
dj = 4 * Aj / (pi * nt * fj * deq + DC * teta / 2)

Rec = deq * mc / (viscc * Sm)
PRINT "o numero de reynols e"; Rec
vc = mc / Sm / roc

```

```

*****
'          CALCULO DE jideal
*****
SELECT CASE Rec
CASE 0 TO 100
    IF arranjo = 1 THEN

        ji = .96835 * Rec ^ (-.6172)
    ELSE
        ji = 1.6159 * Rec ^ (-.6739)
    END IF
CASE 100 TO 1000
    IF arranjo = 1 THEN
        ji = .5367 * Rec ^ (-.5002)
    ELSE
        ji = .7542 * Rec ^ (-.5105)
    END IF
CASE ELSE
    ji = .376 * Rec ^ (-.4)
END SELECT

hideal = ji * mc * cpc / Sm * (viscc * cpc / kc) ^ (-2 / 3)

*****
'          CALCULO DE jc
*****
jc = .55 + .72 * fc

*****
'          CALCULO DE jf
*****
x = (Acs + Ats) / Sm
Y = Acs / (Acs + Ats)
SELECT CASE Y
CASE 0 TO .25
    jf0 = 1.001 - 1.2052 * x + 1.1282 * x ^ 2 - .42677 * x ^ 3
    jf025 = .99943 - 1.3955 * x + 1.2354 * x ^ 2 - .43603 * x ^ 3
    jf = jf0 + Y / .25 * (jf025 - jf0)
CASE .25 TO .5
    jf025 = .99943 - 1.3955 * x + 1.2354 * x ^ 2 - .43603 * x ^ 3
    jf05 = .99824 - 1.6076 * x + 1.3988 * x ^ 2 - .48485 * x ^ 3
    jf = jf025 + (Y - .25) / .25 * (jf05 - jf025)
CASE .5 TO .75
    jf05 = .99824 - 1.6076 * x + 1.3988 * x ^ 2 - .48485 * x ^ 3
    jf075 = 1.0001 - 1.8539 * x + 1.5824 * x ^ 2 - .50926 * x ^ 3
    jf = jf05 + (Y - .5) / .25 * (jf075 - jf05)
CASE ELSE
    jf075 = 1.0001 - 1.8539 * x + 1.5824 * x ^ 2 - .50926 * x ^ 3
    jf1 = .99848 - 2.1682 * x + 2.1228 * x ^ 2 - .84596 * x ^ 3
    jf = jf075 + (Y - .75) / .25 * (jf1 - jf075)
END SELECT

```

```

*****
*
*   CALCULO DE jb
*
*****
IF Rec > 100 THEN
    jb = 1.004 * EXP(-1.227 * RAfcAc)
ELSE
    jb = .994 * EXP(-1.3105 * RAfcAc)
END IF
jlim = .578 + .437 * RAfcAc
IF jb >= jlim THEN
    NFS = 0
ELSE
    IF Rec > 100 THEN
        SELECT CASE jlim
            CASE .7 TO .756
                NFS = (Ntc * 1.0417 * (jlim - .708))
            CASE .756 TO .895
                NFS = (Ntc * (.05 + 2.0833 * (jlim - .756)))
            CASE ELSE
                NFS = (Ntc * (.333 + 1.59 * (jlim - .895)))
        END SELECT
    ELSE
        SELECT CASE jlim
            CASE .6 TO .748
                NFS = (Ntc * .8929 * (jlim - .692))
            CASE .748 TO .777
                NFS = (Ntc * (.05 + 1.724 * (jlim - .748)))
            CASE .777 TO .822
                NFS = (Ntc * (.1 + 2.222 * (jlim - .777)))
            CASE .822 TO .89
                NFS = (Ntc * (.2 + 1.956 * (jlim - .822)))
            CASE ELSE
                NFS = (Ntc * (.333 + 1.518 * (jlim - .89)))
        END SELECT
    END IF
    IF NFS - INT(NFS) >= .1 THEN
        NFS = INT(NFS + 1)
    ELSE
        NFS = INT(NFS)
    END IF
    x = RAfcAc
    Y = NFS / Ntc
    IF Rec > 100 THEN
        SELECT CASE Y
            CASE 0 TO .05
                jb0 = 1.004 * EXP(-1.227 * x)
                jb05 = 1.00096 * EXP(-.6654 * x)
                jb = jb0 + Y / .05 * (jb05 - jb0)
            CASE .05 TO .1
                jb05 = 1.00096 * EXP(-.6654 * x)
                jb1 = 1.0014 * EXP(-.51332 * x)
                jb = jb05 + (Y - .05) / .05 * (jb1 - jb05)
        END SELECT
    END IF
END IF

```

```

CASE .1 TO .2
    jb1 = 1.0014 * EXP(-.51332 * x)
    jb2 = 1 - .29143 * x
    jb = jb1 + (Y - .1) / .1 * (jb2 - jb1)
CASE .2 TO .333
    jb2 = 1 - .29143 * x
    jb3 = 1 - .14286 * x
    jb = jb2 + (Y - .2) / .133 * (jb3 - jb2)
CASE .333 TO .5
    jb3 = 1 - .14286 * x
    jb5 = 1
    jb = jb3 + (Y - .333) / .167 * (jb5 - jb3)
CASE ELSE
    jb = 1
END SELECT
ELSE
SELECT CASE Y
CASE 0 TO .05
    jb0 = .994 * EXP(-1.3105 * x)
    jb05 = .9986 * EXP(-.716416 * x)
    jb = jb0 + Y / .05 * (jb05 - jb0)
CASE .05 TO .1
    jb05 = .9986 * EXP(-.716416 * x)
    jb1 = 1.00092 * EXP(-.56255 * x)
    jb = jb05 + (Y - .05) / .05 * (jb1 - jb05)
CASE .1 TO .2
    jb1 = 1.00092 * EXP(-.56255 * x)
    jb2 = 1 - .31214 * x
    jb = jb1 + (Y - .1) / .1 * (jb2 - jb1)
CASE .2 TO .333
    jb2 = 1 - .31214 * x
    jb3 = 1 - .15343 * x
    jb = jb2 + (Y - .2) / .133 * (jb3 - jb2)
CASE .333 TO .5
    jb3 = 1 - .15343 * x
    jb5 = 1
    jb = jb3 + (Y - .333) / .167 * (jb5 - jb3)
CASE ELSE
    jb = 1
END SELECT
END IF

```

END IF

```

*****
'      CALCULO DE jl
*****

```

```

SELECT CASE Rec
CASE 0 TO 20
    jl = (10 / (Ntc + Ntcj)) ^ .18

```

```

CASE 20 TO 100
    JI20 = (10 / (Ntc + Ntcj)) ^ .18
    JI100 = 1
    jl = JI20 + (JI100 - JI20) * (Rec - 20) / 80
CASE ELSE
    jl = 1
END SELECT
*****

hc = (hideal * jc * jb * jf * jl)
'-----
'calculo alfa dos tubos
'-----

di = d0 - 4 * 10 ^ -3
ct = mt / nt
vt = 4 * ct / (pi * di ^ 2 * rot)
ret = 4 * ct / (pi * di * Visct)
PRINT "o numero de reynols e"; ret
pr = Visct * cpt / Kt
SELECT CASE ret
CASE 0 TO 2300
    Nu = 4
CASE 2300 TO 4000
    Nu = .116 * (ret ^ (2 / 3) - 125) * pr ^ (1 / 3)
CASE ELSE
    Nu = .023 * ret ^ .8 * pr ^ .333
END SELECT
PRINT ret ^ (2 / 3)
xi = Nu * Kt / di
SELECT CASE vc
CASE 0 TO 1
    xde = 4880
CASE ELSE
    xde = 9760
END SELECT
SELECT CASE vt
CASE 0 TO 1
    xdi = 4880
CASE ELSE
    xdi = 9760
END SELECT
'-----
'calculo do coeficiente global de transferencia
'-----
Ke = 1 / (1 / xi * d0 / di + 1 / hc + ln(d0 / di) * d0 / (2 * 15) + 1 / xdi * d0 / di)
PRINT "o coeficiente global de transferencia e ="; Ke
*****
'    CALCULO PERDA DE CARGA NA CARCAÇA
*****
CALL Fatrc(Rec, arranjo, fic)
CALL RRb(RAfcAc, NFS, Ntc, Rec, Rb)
CALL RRf(Acs, Ats, Sm, Rf)

```

```

Ns = 15 * DC / Ls - 1

dpif = 2 * fic * Ntc * roc * vc ^ 2
vj = mc / roc / SQR(Sm * Aj)
IF Rec > 100 THEN
    dpif = (2 + .6 * Ntcj) * roc * vj ^ 2 / 2
ELSE
    dpif = 26 * vj * viscc * (Ntcj / (p - d0) + Ls / dj ^ 2)
    dpif = dpif + .002 * roc * vj ^ 2 / 2
END IF

dpc = dpif * (Ns - 1) * Rf * Rb + dpif * Ns * Rf
dpc = dpc + dpif * (Ntc + Ntcj) / Ntc * Rs * Rb

'-----
'calculo da perda de carga nos tubos
'-----

e = .046 * 10 ^ -3
IF ret < 2300 THEN
    F = 64 / ret
ELSE
    F = .02
50   fi = F
    F = 1 / (4 * (LOG(e / di / 3.7 + 2.51 / (ret * SQR(fi)))) ^ 2)

    IF ABS(F - fi) > .000001 THEN
        GOTO 50
    END IF
END IF
l = 15 * DC
hf = 8 * F * l * ct ^ 2 / (di ^ 5 * pi ^ 2 * 9.8 * rot ^ 2)
dp = hf * rot * 9.8
dp = dp / 10 ^ 5
dpc = dpc / 10 ^ 5
PRINT "tctl1="; tctl1
IF INT(RLsD) = 1 THEN
    GOTO 70
END IF
IF dpc > .7 THEN
    RLsD = RLsD + .1
    GOTO 40
END IF
70 PRINT "a perda de carga na carcaça e="; dpc
IF (ret < 2300) OR (Rec < 2300) THEN
    PRINT "o regime nos tubos ou na carcaça e laminar "
END IF
PRINT " o coeficiente de fricção de Darcy e="; F
F = .02
PRINT " a perda de carga nos tubos e="; dp
PRINT " "
PRINT "NFS=", NFS
MODIFIC1 = 0

```

```

MODIFIC2 = 0
INPUT "quer alterar o diâmetro dos tubos (s-1,n-0)?", op
  IF (op = 1) THEN
    MODIFIC1 = 1
  END IF
INPUT " quer alterar os caudais (s-1,n-0)?", op1
  IF (op1 = 1) THEN
    MODIFIC2 = 1
  END IF
IF (MODIFIC1 = 0) AND (MODIFIC2 = 0) THEN
INPUT " quer alterar o diâmetro da carcaça ou sair do programa (1-alterar/0-sair)?", op2
  IF op2 = 1 THEN
    GOTO 30
  ELSE
    GOTO 80
  END IF
  ELSE
    IF (MODIFIC1 = 1) THEN
      GOTO 10
    END IF
  IF (MODIFIC1 = 0) AND (MODIFIC2 = 1) THEN
    GOTO 20
  END IF
END IF
80  END

```

' DADOS : DIMENSÕES DE CARCAÇAS E NUMERO DE TUBOS

```

100 DATA .205,.1733,32,37,21,22
DATA .2545,.2228,52,61,32,37
DATA .3048,.273,80,90,48,57
DATA .3366,.3048,95,110,60,67
DATA .3874,.3556,138,163,88,96
DATA .4382,.4064,188,211,112,130
DATA .489,.4572,236,273,148,172
DATA .5334,.489,276,318,170,199
DATA .591,.5461,341,381,210,247
DATA .635,.5937,397,470,250,294
DATA .6858,.6445,465,559,286,349
DATA .7366,.6953,554,630,348,397
DATA .7874,.7461,633,745,402,472
DATA .8382,.7969,742,856,460,538
DATA .889,.8477,827,970,517,608
DATA .9398,.8954,929,1090,588,678
DATA .9906,.9462,1025,1206,645,766
DATA 1.0668,1.0224,1201,1409,745,890
DATA 1.1176,1.0732,1349,1562,856,990
DATA 1.2192,1.1684,1620,1827,1029,1188
DATA 1.3208,1.27,1918,2212,1216,1405
DATA 1.4224,1.3716,2241,2588,1420,1638
DATA 1.524,1.4732,2587,2987,1639,1889

```

SUB Fatrc (Rec, arranjo, fic)

```

!*****
!
!   CALCULO DO PARÂMETRO fideal COMO
!   FUNÇÃO DO N§ DE REYNOLDS
!   E DO ARRANJO DOS TUBOS
!
!*****

SELECT CASE arranjo
CASE 1   !***** QUADRADOS DIREITOS *****
    SELECT CASE Rec
    CASE 0 TO 100
         $f_{ic} = 10^{(1.678 - .966 * \text{LOG}(\text{Rec}) / \text{LOG}(10))}$ 
    CASE 100 TO 500
         $f_{ic} = 10^{(-.2676 - .7404 * \text{LOG}(\text{Rec} / 100) / \text{LOG}(10))}$ 
    CASE 500 TO 1000
         $f_{ic} = 10^{(-.785 - .3463 * \text{LOG}(\text{Rec} / 500) / \text{LOG}(10))}$ 
    CASE 1000 TO 5000
         $f_{ic} = 10^{(-.8894 + .106 * \text{LOG}(\text{Rec} / 1000) / \text{LOG}(10))}$ 
    CASE 5000 TO 10000
         $f_{ic} = 10^{(-.8153 - .05772 * \text{LOG}(\text{Rec} / 5000) / \text{LOG}(10))}$ 
    CASE 10000 TO 50000
         $f_{ic} = 10^{(-.8327 - .2394 * \text{LOG}(\text{Rec} / 10000) / \text{LOG}(10))}$ 
    CASE ELSE
         $f_{ic} = 2.675 * \text{Rec}^{(-.3035)}$ 
    END SELECT

CASE 2   !***** TRIÂNGULOS *****
    SELECT CASE Rec
    CASE 0 TO 100
         $f_{ic} = 10^{(1.933 - 1.042 * \text{LOG}(\text{Rec}) / \text{LOG}(10))}$ 
    CASE 100 TO 500
         $f_{ic} = 10^{(-.13668 - .602 * \text{LOG}(\text{Rec} / 100) / \text{LOG}(10))}$ 
    CASE 500 TO 1000
         $f_{ic} = 10^{(-.5575 - .4484 * \text{LOG}(\text{Rec} / 500) / \text{LOG}(10))}$ 
    CASE 1000 TO 50000
         $f_{ic} = .7021 * \text{Rec}^{(-.1828)}$ 
    CASE ELSE
         $f_{ic} = .2963 * \text{Rec}^{(-.1024)}$ 
    END SELECT
END SELECT
END SUB

SUB RRb (RAfcAc, NFS, Ntc, Rec, Rb)
!*****
!
!   CALCULO DE Rb
!
!*****

x = RAfcAc
Y = NFS / Ntc
IF Rec > 100 THEN
    SELECT CASE Y

```

```

CASE 0 TO .05
  Rb0 = 1.0145 * 10 ^ (-1.6329 * x)
  Rb05 = 1.0075 * 10 ^ (-.87263 * x)
  Rb = Rb0 + Y / .05 * (Rb05 - Rb0)
CASE .05 TO .1
  Rb05 = 1.0075 * 10 ^ (-.87263 * x)
  Rb1 = 1.0014 * 10 ^ (-.66583 * x)
  Rb = Rb05 + (Y - .05) / .05 * (Rb1 - Rb05)
CASE .1 TO .2
  Rb1 = 1.0014 * 10 ^ (-.66583 * x)
  Rb2 = 1.0031 * 10 ^ (-.42262 * x)
  Rb = Rb1 + (Y - .1) / .1 * (Rb2 - Rb1)
CASE .2 TO .333
  Rb2 = 1.0031 * 10 ^ (-.42262 * x)
  Rb3 = 1.0007 * 10 ^ (-.20143 * x)
  Rb = Rb2 + (Y - .2) / .133 * (Rb3 - Rb2)
CASE .333 TO .5
  Rb3 = 1.0007 * 10 ^ (-.20143 * x)
  Rb5 = 1
  Rb = Rb3 + (Y - .333) / .167 * (Rb5 - Rb3)
CASE ELSE
  Rb = 1
END SELECT
ELSE
  SELECT CASE Y
    CASE 0 TO .05
      Rb0 = 1.0038 * 10 ^ (-1.9923 * x)
      Rb05 = 1.0048 * 10 ^ (-1.0562 * x)
      Rb = Rb0 + Y / .05 * (Rb05 - Rb0)
    CASE .05 TO .1
      Rb05 = 1.0048 * 10 ^ (-1.0562 * x)
      Rb1 = 1.0028 * 10 ^ (-.81525 * x)
      Rb = Rb05 + (Y - .05) / .05 * (Rb1 - Rb05)
    CASE .1 TO .2
      Rb1 = 1.0028 * 10 ^ (-.81525 * x)
      Rb2 = .99998 * 10 ^ (-.51335 * x)
      Rb = Rb1 + (Y - .1) / .1 * (Rb2 - Rb1)
    CASE .2 TO .333
      Rb2 = .99998 * 10 ^ (-.51335 * x)
      Rb3 = .99992 * 10 ^ (-.24623 * x)
      Rb = Rb2 + (Y - .2) / .133 * (Rb3 - Rb2)
    CASE .333 TO .5
      Rb3 = .99992 * 10 ^ (-.24623 * x)
      Rb5 = 1
      Rb = Rb3 + (Y - .333) / .167 * (Rb5 - Rb3)
    CASE ELSE
      Rb = 1
  END SELECT
END IF
END SUB

SUB RRf (Acs, Ats, Sm, Rf)

```

```

*****
!
!
!          CALCULO DE Rf
!
!
*****

```

```

x = (Acs + Ats) / Sm
IF x > .8 THEN x = .8
Y = Acs / (Acs + Ats)
SELECT CASE Y
  CASE 0 TO .25
    Rf0 = .99677 - 3.5578 * x + 13.044 * x ^ 2 - 28.713 * x ^ 3 + 31.127 * x ^ 4 - 12.892 * x ^ 5
    Rf025 = .99457 - 4.8641 * x + 20.637 * x ^ 2 - 49.109 * x ^ 3 + 56.198 * x ^ 4 - 24.25 * x ^ 5
    Rf = Rf0 + Y / .25 * (Rf025 - Rf0)
  CASE .25 TO .5
    Rf025 = .99457 - 4.8641 * x + 20.637 * x ^ 2 - 49.109 * x ^ 3 + 56.198 * x ^ 4 - 24.25 * x ^ 5
    Rf05 = .99208 - 6.4058 * x + 29.593 * x ^ 2 - 71.501 * x ^ 3 + 81.731 * x ^ 4 - 35.093 * x ^ 5
    Rf = Rf025 + (Y - .25) / .25 * (Rf05 - Rf025)
  CASE .5 TO .75
    Rf05 = .99208 - 6.4058 * x + 29.593 * x ^ 2 - 71.501 * x ^ 3 + 81.731 * x ^ 4 - 35.093 * x ^ 5
    Rf075 = .98996 - 7.8167 * x + 38.1 * x ^ 2 - 93.139 * x ^ 3 + 106.76 * x ^ 4 - 45.879 * x ^ 5
    Rf = Rf05 + (Y - .5) / .25 * (Rf075 - Rf05)
  CASE ELSE
    Rf075 = .98996 - 7.8167 * x + 38.1 * x ^ 2 - 93.139 * x ^ 3 + 106.76 * x ^ 4 - 45.879 * x ^ 5
    IF x < .5 THEN
      Rf1 = .99453 - 11.223 * x + 72.603 * x ^ 2 - 209.52 * x ^ 3 + 213.8 * x ^ 4
    ELSE
      Rf1 = .472 - 1.1983 * x + 1.45 * x ^ 2 - .6667 * x ^ 3
    END IF
    Rf = Rf075 + (Y - .75) / .25 * (Rf1 - Rf075)
END SELECT
END SUB

```



BIBLIOGRAFIA

-Sebenta de Permutadores de calor.

-Sebenta de Transferência de calor.

-Manual Quick Basic.



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