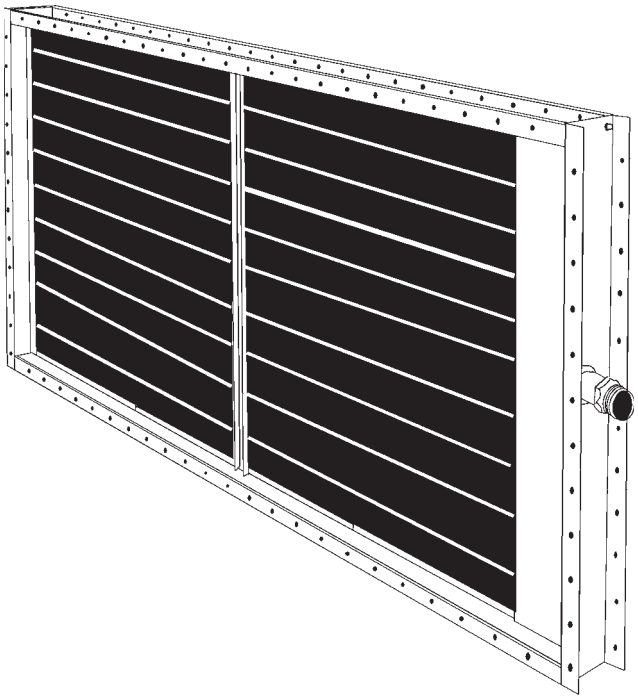
Steam Coils

Type KSH

Bulletin K70-KSH-PDI-11

1064628

We are on the Internet
www.keepriterefrigeration.com



Features

RIPPLED FINS produce a rippled air flow pattern for maximum heat transfer. These ripples also assure permanent "fin-tube bond" through greater flexibility under expansion and contraction.

STAGGERED TUBES create air turbulence to give maximum air side heat transfer.

MECHANICAL EXPANSION BOND ensures permanent metal to metal contact. (No low conductivity materials used as a bonding agent).

FIN COLLARS are drawn wide and smooth to provide maximum contact area.

STEAM BAFFLE disperses entering steam thereby preventing blow through or short circuiting and ensuring equal steam pressure throughout the supply header.

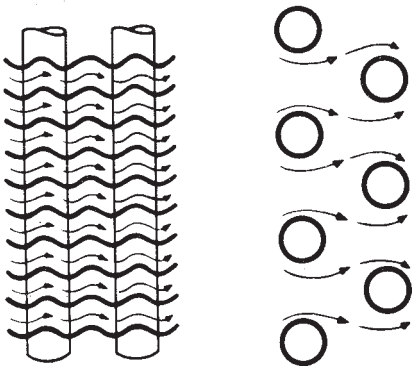
NOMENCLATURE

K SH 8 2 24 x 48

- KEEPRITE REFRIGERATION
- COIL TYPE STEAM HEAT
- FINS PER INCH (STD. 8 FINS/INCH)
- ROWS DEEP
- "W" DIMENSION (SEE P 4)
- NOMINAL TUBE LENGTH

THE IMPORTANT DIFFERENCE

KEEPRITE REFRIGERATION SURFACE



RIPPLED FINS STAGGERED TUBES
Highly Efficient result

Rippled Air Flow assure intimate and prolonger contact between air and the cooling surface.

COIL SELECTION

KSH Coils are a general purpose coil for reheat applications or when outdoor air temperature is ***above 35°F.*** For applications where modulating control is required and entering air is below freezing "Type DT" coils should be used.

KSH Coils are not recommended for use with steam pressures above 25 PSIG.

The following example outlines the procedure for determining the coil size, fin spacing, rows deep, etc.

SPECIFIED:

(a) Air Volume (Std. Air).....8,000 CFM
(b) Design Face Velocity (Max,).....700 FPM
(c) Steam Pressure.....10 PSIG
(d) Entering Air Temperature.....40°F.
(e) Leaving Air Temperature.....125°F.
(f) Heating Load.....741,000 BTU/Hr.

REQUIRED:

(a) Coil Size and Model
(b) Coil Nomenclature
(c) Leaving Air Temperature
(d) BTU/Hr. Capacity.
(e) Lbs. of Condensate/Hr.
(f) Air Side Friction Loss

PROCEDURE:

A. Determine Coil Face Dimensions

1. Coil Face Area Req'd = $\frac{\text{SpecifiedCFM*}}{\text{Design Face Vel.}} = \frac{8000}{700} = 11.4$ sq. ft.
   *(Specified CFM at Std. Air)
2. From Table 3, select a "24 x 72" coil with 12 sq. ft. face area as having face dimensions most suitable for this job.

B. Determine Coil Model Number

1. Temperature Rise Required = 125° - 40° = 85° F.
2. From Table 2, the Conversion Factor for 10 psig steam and 40° F. entering air is .878.
3. Then, $\frac{\text{Req'd Temp. Rise}}{\text{Conv. Factor}} = \frac{850}{.878} = 96.8°$ F. (Req'd Base Rise)
4. Actual Coil Face Vel. = $\frac{\text{Specified CFM}}{\text{Coil Face Area}} = \frac{8000}{12} = 667$ FPM
5. From Figure 1 (or Table 1 by interpolation), find "Model 82" coil has Base Temp. Rise of 100° F. at 667 FPM. Hence, select a "Model 82" coil.

C. Determine Coil Nomenclature ‡
From Coil Designation Chart, below, determine coil nomenclature as follows: KSH82 - 24x72.

D. Determine Leaving Air Temperature
1. Actual Temp. Rise = Base Rise x Conv. Factor
2. Actual Temp. Rise @ 10 psig and 40°F. EA = 100 x .878 = 87.8°F
3. Leaving Air Temperature = 40° + 87.8° = 127.8°F.

E. Determine BTU/Hr. Capacity
1. BTU/Hr. Capacity = 1.09 x Temp. Rise x CFM
   = 1.09 x 87.8 x 8000 = 766,000

F. Determine Lbs. of Condensate/Hr.

1 .Lbs. of Cond./Hr. = $\frac{\text{Total BTU/Hr. Capacity}}{\text{Latent heat @ 10 PSIG}} = \frac{766.000}{953} = 804$

G. Determine Air Side Friction
1. Air Friction = .210 inches of water from Fig. 1
   (or from Table 1 by interpolation).

COILS IN SERIES

Occasionally, it may be necessary to use two or more coils in series in order to heat the air to the required final temperature. Likewise, if row control is required, it would be necessary to furnish individual coils. Suppose, in the preceding example, that it had been desired to have a final air temperature considerably higher than 125°F. It would then be necessary to select an additional coil or coils to place after the first coil. In calculating the temperature rise through these additional coils, the leaving air temperature of the first coil is used as the entering air temperature to the second coil, etc. The method of computation is identical to that previously shown.

DETERMINATION OF MIXTURE AIR TEMPERATURE

Air entering the coil is usually a mixture of both return air and fresh air. Determine mixture air temperature per following example:

SPECIFIED:

Return Air Temperature.....70°F.
Fresh Air Temperature.....-200 F.
CFM (Return Air).....2000
CFM (Fresh Air).....1000

REQUIRED:

Mixture Air Temperature (° F.)

SOLUTION:

$$\text{MixtureAirTemp.} = \frac{(2000) \times (70) + (1000) \times (-20)}{3000}$$

$$= \frac{140{,}000 + (-20{,}000)}{3000} = \frac{120{,}000}{3000} = 40°\text{F.}$$

TABLE 1 **BASE TEMPERATURE RISE AND STATIC PRESSURE**

Temp. Rise based on 5 psig. steam and 0° F Ent. Air Temp. --- Static Pressure based on Std. Air (70°F, and 29.92" Hg.)

ROWS DEEP	MODEL	FACE VELOCITY - FEET PER MINUTE - STANDARD AIR															
		300		400		500		600		700		800		1000		1200	
		T.R.	S.P.	T.R.	S.P.	T.R.	S.P.	T.R.	S.P.	T.R.	S.P.	T.R.	S.P.	T.R.	S.P.	T.R.	S.P.
1 ROW	41	51.5	.020	45.4	.034	41.2	.049	37.9	.067	35.3	.087	33.1	.110	30.0	.162	27.4	.221
	71	72.8	.027	64.4	.044	58.5	.065	53.9	.088	50.3	.115	47.1	.145	42.6	.213	38.8	.291
	81	83.8	.031	74.4	.051	67.6	.074	62.2	.101	57.9	.132	54.7	.166	49.1	.243	44.9	.333
2 ROW	72	116.4	.047	106.8	.076	98.8	.112	92.0	.153	86.3	.199	81.5	.251	73.8	.368	67.6	.503
	82	130.7	.053	120.3	.087	112.0	.128	104.4	.175	98.0	.228	93.0	.287	84.2	.421	77.4	.576

TABLE 2 **STEAM CONVERSION FACTORS**

ENT. AIR TEMP. °F.	STEAM PRESSURE PSIG - STEAM TEMPERATURE ° F - LATENT HEAT BTU PER LB.					
	0 212° 970	2 218° 966	5 227° 961	10 239° 953	15 250° 946	25 267° 934
-30	1.065	1.094	1.132	1.186	1.232	1.307
-20	1.021	1.050	1.088	1.142	1.188	1.263
-10	.977	1.006	1.004	1.098	1.144	1.219
0	.933	.962	1.000	1.054	1.099	1.175
10	.889	.918	.956	1.010	1.056	1.131
20	.845	.874	.912	.966	1.011	1.087
30	.801	.830	.868	.922	.967	1.042
40	.757	.786	.824	.878	.923	.998
50	.713	.742	.780	.834	.879	.954
60	.669	.698	.736	.790	.835	.910
70	.625	.654	.692	.746	.791	.866
80	.581	.610	.648	.702	.747	.822
90	.537	.566	.604	.658	.703	.772
100	.493	.522	.560	.614	.659	.734
125	.383	.412	.450	.504	.549	.624
150	.273	.302	.340	.394	.439	.514

To Calculate Conversion Factors not given in above table, use following formula:
Conversion factor = $\frac{\text{Steam Temp. - Ent. Air Temp.}}{227}$

COIL SELECTION

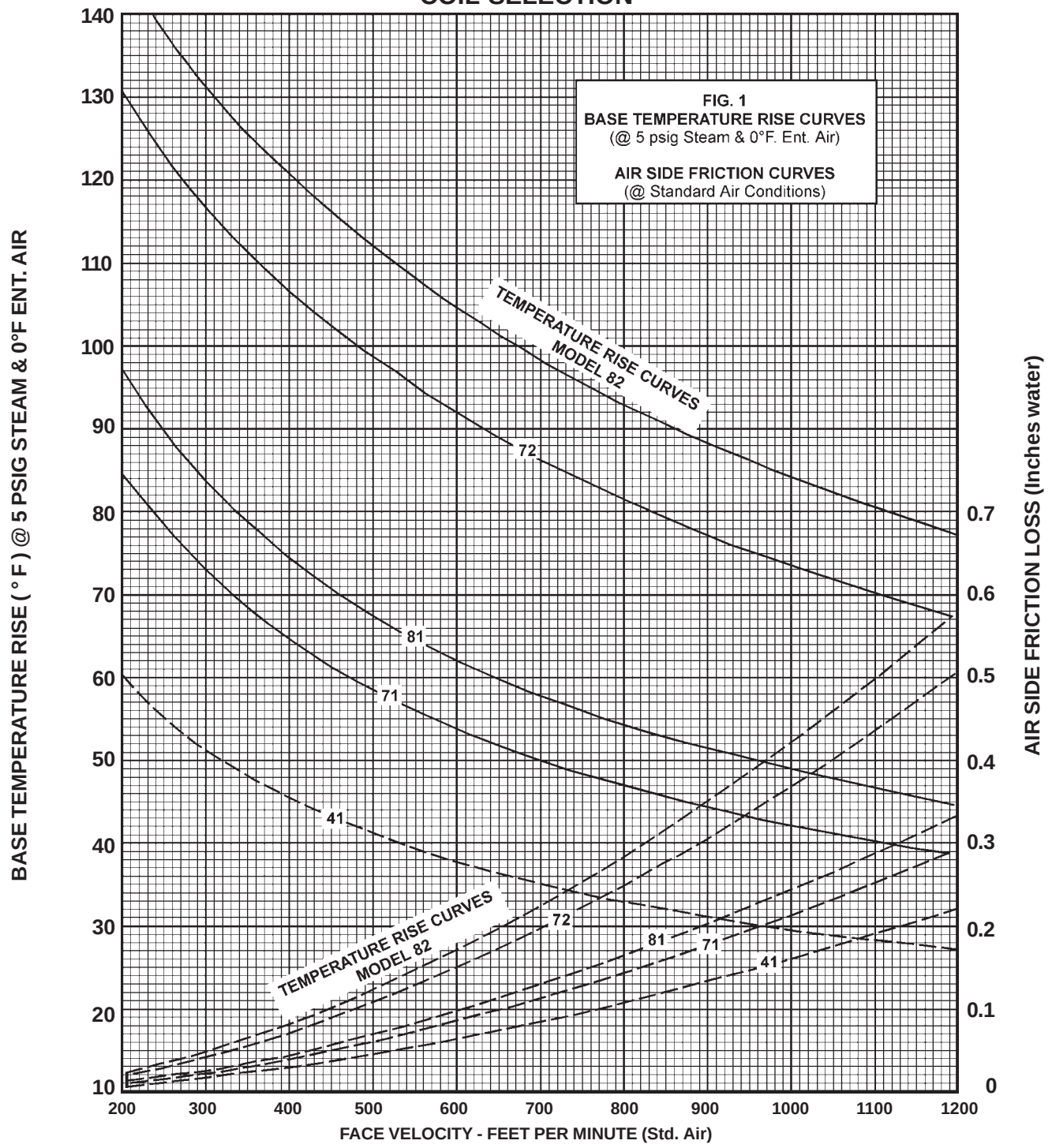


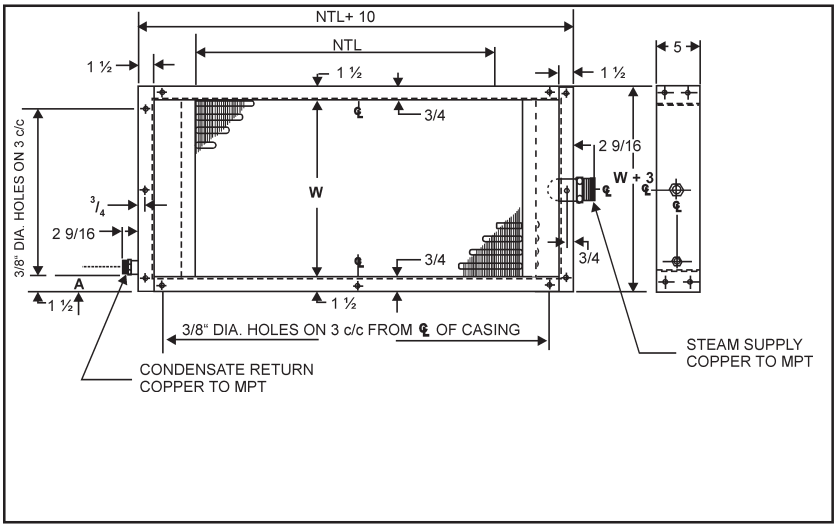
TABLE 3 **COIL SIZES - NOMINAL FACE AREA - SQ. FT.**

"W"	NOMINAL TUBE LENGTH - NTL - (INCHES)																					
INCHES	12	15	18	21	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
6	.50	.62	.75	.87	1.00	1.25	1.50	1.75	2.0	2.2	2.5	2.7	3.0								
9	.75	.94	1.12	1.31	1.50	1.87	2.25	2.62	3.0	3.4	3.7	4.1	4.5								
12	1.00	1.25	1.50	1.75	2.00	2.50	3.00	3.50	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
15		1.56	1.87	2.19	2.50	3.12	3.75	4.37	5.0	5.6	6.2	6.9	7.5	8.1	8.7	9.4	10.0	10.6	11.2	11.9	12.5
18			2.25	2.62	3.00	3.75	4.50	5.25	6.0	6.7	7.5	8.2	9.0	9.7	10.5	11.2	12.0	12.7	13.5	14.2	15.0
21				3.06	3.50	4.37	5.25	6.12	7.0	7.9	8.7	9.6	10.5	11.4	12.2	13.1	14.0	14.9	15.7	16.6	17.5
24					4.00	5.00	6.00	7.00	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
27						5.62	6.75	7.87	9.0	10.1	11.2	12.4	13.5	14.6	15.7	16.9	18.0	19.1	20.2	21.4	22.5
30						6.25	7.50	8.75	10.0	11.2	12.5	13.7	15.0	16.2	17.5	18.7	20.0	21.2	22.5	23.7	25.0
33							8.25	9.62	11.0	12.4	13.7	15.1	16.5	17.9	19.2	20.6	22.0	23.4	24.7	26.1	27.5
36							9.00	10.50	12.0	13.5	15.0	16.5	18.0	19.5	21.0	22.5	24.0	25.5	27.0	28.5	30.0

SPECIFICATIONS

PRIMARY SURFACE - 5/8" O.D. round copper tube on 1-1 /2" centres.
SECONDARY SURFACE - Rippled, full plate type, aluminum fins. (Copper fins available on special order.)
HEADERS - Extra heavy seamless copper tubing.
HEADER END CAPS - Heavy gauge, die formed copper.
BRAZING - All core joints are made with copper brazing alloys.
CASING - Die formed, 16 gauge (or heavier), galvanized steel, with3/8" bolt holes in mounting flanges. Casing design permits coil to "float" under expansion and contraction.
TESTS - Completed core tested at 300 psig air under water.
CONNECTIONS - Male pipe thread.
OPERATING CONDITIONS - Standard cores are recommended to 25 psig steam pressures and temperatures up to 240°F.
COILS - are single tube for standard application.

DIMENSIONAL DATA



Rows Deep	"W" Dim.	24" to 48" Fin. Lgth. Supply	Return	49" to 72" Fin. Lgth. Supply	Return	73" to 96" Fin. Lgth. Supply	Return	97" to 120" Fin. Lgth. Supply	Return
1	3" to 12" 2 to 8 Rows High	1 1/4"	1"	1 1/4"	1"	1 1/4"	1"	1 1/4"	1"
2		1 1/2"	1 1/4"	1 1/2"	1 1/4"	1 1/2"	1 1/4"	1 1/2"	1 1/4"
1	13 1/2" to 18" 9 to 12 Rows High	1 1/4"	1"	1 1/4"	1"	1 1/2"	1 1/4"	1 1/2"	1 1/4"
2		1 1/2"	1 1/4"	1 1/2"	1 1/4"	2"	1 1/2"	2"	1 1/2"
1	19 1/2" to 24" 13 to 16 Rows High	1 1/4"	1"	1 1/2"	1 1/4"	1 1/2"	1 1/4"	2"	1 1/2"
2		1 1/2"	1 1/4"	2"	1/1/2"	2"	1 1/2"	2 1/2"	1 1/2"
1	31 1/2" to 39" 21 to 26 Rows High	1 1/4"	1"	1 1/2"	1 1/4"	2"	1 1/2"	2"	1 1/2"
2		1 1/2"	1 1/4"	2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"
1	25 1/2" to 30" 17 to 20 Rows High	1 1/2"	1 1/4"	2"	1 1/2"	2"	1 1/2"	2 1/2"	1 1/2"
2		2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"

* Finned length may vary from N.T.L. depending on rows and supply connection used:
1 ROW 1 1/4" MPT – + 1/2" MPT–STANDARD 2" – -1" 2 1/2" – -1 1/4"
2 ROW 1 1/2" MPT, 2" MPT, 2 1/2" MPT – -2 1/4"

INSTALLATION RECOMMENDATIONS

1. All piping shall be in accordance with accepted industry standards.
2. Whenever possible, coils should be installed with tubes in a vertical position. When coils are installed with tubes in a horizontal position, pitch coil towards return tap a minimum of 1/4" per foot - use a spirit level.
3. Support piping independently of coils and provide swing joints to prevent damage from expansion and contraction.
4. Do not bush return connection-run piping full size to trap.
5. Provide proper vents to expel air and other non condensibles to avoid "air binding".
6. Do not drip steam mains through coils.
7. Coils in series in the air flow (coils having unlike condensate loads) should be individually trapped.
8. Coils side by side (having similar condensate loads) can be controlled by a common valve and common trap providing individual check valves are used. However, it is always preferable to use individual traps.
9. Each coil or group of coils that is individually controlled must be individually trapped.
10. Exercise caution in selecting steam coils, valves and traps. Do not OVERSIZE coils and valves - do not UNDERSIZE traps. Always install strainers ahead of valves and traps.
11. Provision should always be made to thoroughly mix fresh and return air before it enters coil. Also, temperature control elements must be properly located to obtain true air mixture temperatures.
12. FOR ENTERING AIR TEMPERATURE BELOW 35°F. special precaution must be taken to prevent damage due to freeze-up of Steam Coils -

A. SPECIAL STEAM DISTRIBUTING TYPE COILS SHOULD BE USED. Consult local KeepRite Sales Representative for recommendations.

B. VALVE CONTROL (Atmospheric and Vacuum Systems only).
   1. TWO POSITION VALVE: Steam supply pressure to valve must be maintained at 5 psig (minimum) at all times. Control element should be located in entering air stream and set to open valve wide when entering air drops to 35°F.
   2. MODULATING "V" PORT TYPE VALVE: Modulating valves are not recommended for use with steam coils when entering air temperature is below 35°F.

C. FACE AND BY PASS DAMPER CONTROL (Atmospheric, Vacuum and Pressure Systems): Steam supply pressure on coil must be maintained at 5 psig (minimum) at all times.

D. FRESH AIR DAMPERS: Provision must be made to close fresh air dampers if steam supply pressure fails below minimum specified. Damper motor must be spring return type and damper blades must be overlapping and tight fitting - preferably gasketed. Control system must delay opening of fresh air dampers for 10 minutes at startup of system.

E. Use of a vacuum breaker piping arrangement is recommended to prevent back flow of condensate at high return main pressure.

KeepRite® REFRIGERATION

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c UL us

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