PRIMARY
~~SECONDARY~~ REFRIGERATION SYSTEM (HAVING INTERMEDIATE CLOSED COOLING CIRCUIT) CHEMICAL TREATMENT SOFTWARE

FEATURES -

The software deals with operational cost calculations of
[a] Buffered Nitrite treatment and
[b] Buffered Glycol based treatment.
which indirectly optimizes treatment program.

Action involved

[1]Select the program [a] or [b] and start filling Operating parameters like system hold up volume,make up water quantity,quantities of chemicals on ppm basis as desired and their individual costs in the prescribed blanks. Hints are available in the form of range of treatment expected.
[3] To be practical, fort nightly water chemical analysis is recommended as a routine check and kept filled in the sticky note available on the software. The exercise shall monitor time to time the quantum of corrosion rate from values of dissolved Iron and Copper found on ppm or ppb basis
[2] Monthly and yearly costs get exhibited instantly.
[3] The format is so easy that it can be filled as and when required and say each month end, with variations, if any.

TECHNICAL hints

[a] Buffered Nitrite Treatment-

(1)Brine based circuit uses 10 to 15 % of Brine(say NaCl or CaCl2) solution as per the design (being buffered at pH range of 10 to 10.5.)
(2)System is targeted to cool, say a room or machine above zero deg. Cent e. g. +25 deg or + 5 deg. Cent.
(3)Certain Biocide and Anti Scalent are used as per the make up water quality requirement.

[b] Buffered Glycol based treatment-

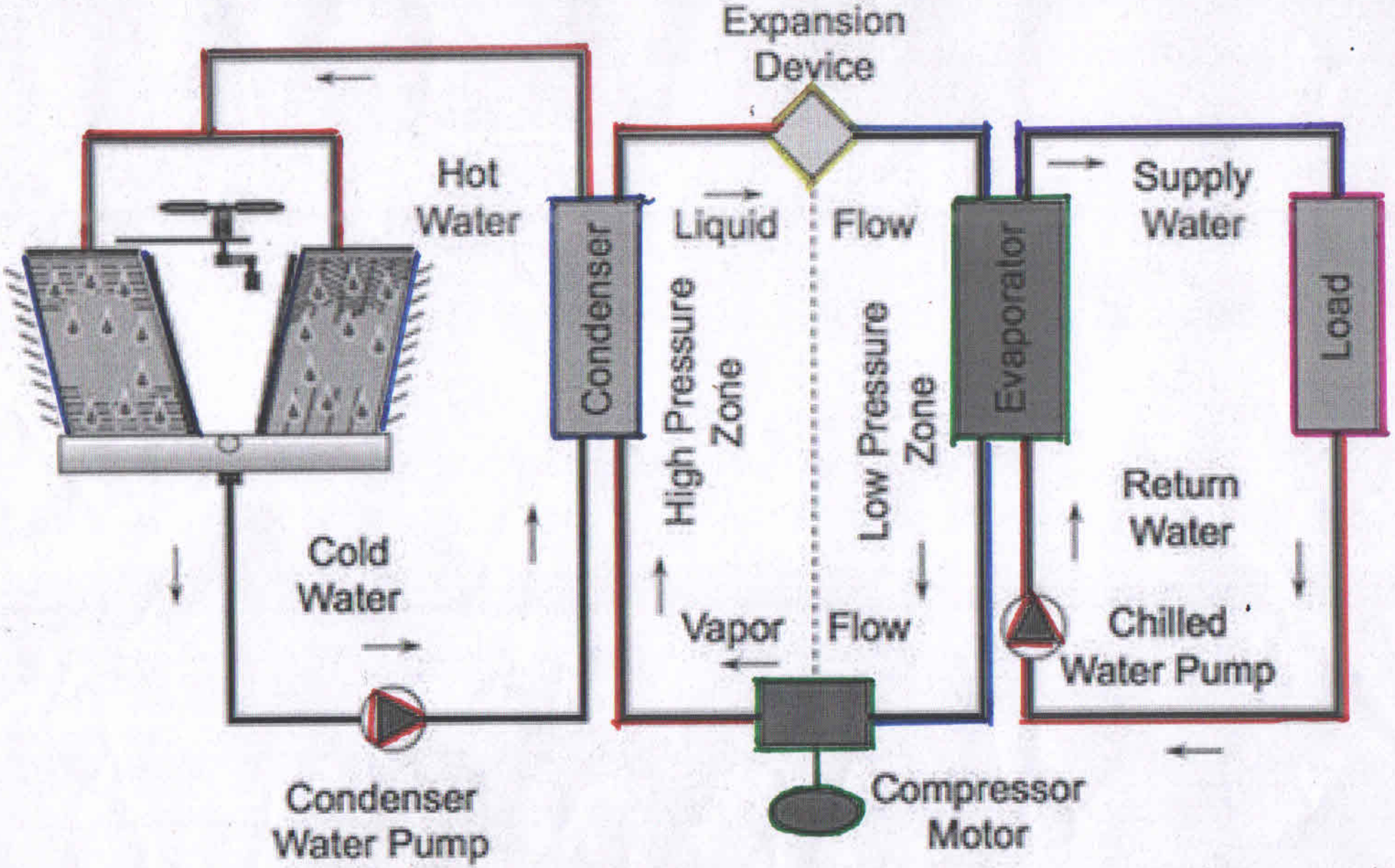
(1) 10% Glycol based treatment is used when the object say, Air Conditioning Room needs to be cooled below zero deg. Cent. This usually is the case for Cold Storage where below zero deg. Cent temperature say -20 to -30 deg Cent is mandatory for long periods.
(2) The treatment is functional with buffered pH between 8 to 10.0.
(3) Ethylene Glycol is preferred over Methylene Glycol as the later is toxic.
(4) Certain Biocide and Anti Scalant are used as per the make up water quality.

Operating Directives

(1)Nitrite treatment in the make up water should be kept higher than the total number of corrosive Anions like chloride+ Sulphate + Nitrate.
(2)In case of DM Water used as make up then 50 to 100 ppm Nitrite level is good enough.
(3)pH of the closed Circuit is based upon the metallurgy involved like Copper,Brass,Ms,S.S. etc. However, in case of mixed metallurgy a pH of 8.5 to 9.5 is recommended (by inclusion of suitable Buffer in the treatment program.)
(4)It is observed that along with Molybdate addition , the Nitrite treatment decreases.
(5)In case of Soft water being used as make up then Total Hardness in it should be kept below 50 ppm all times to avoid Scaling tendency inside the circuit.
(6)Usually for make up in the closed circuit Make Up water tank is provided and the drain valve below the tank serves in removing any undesirables.

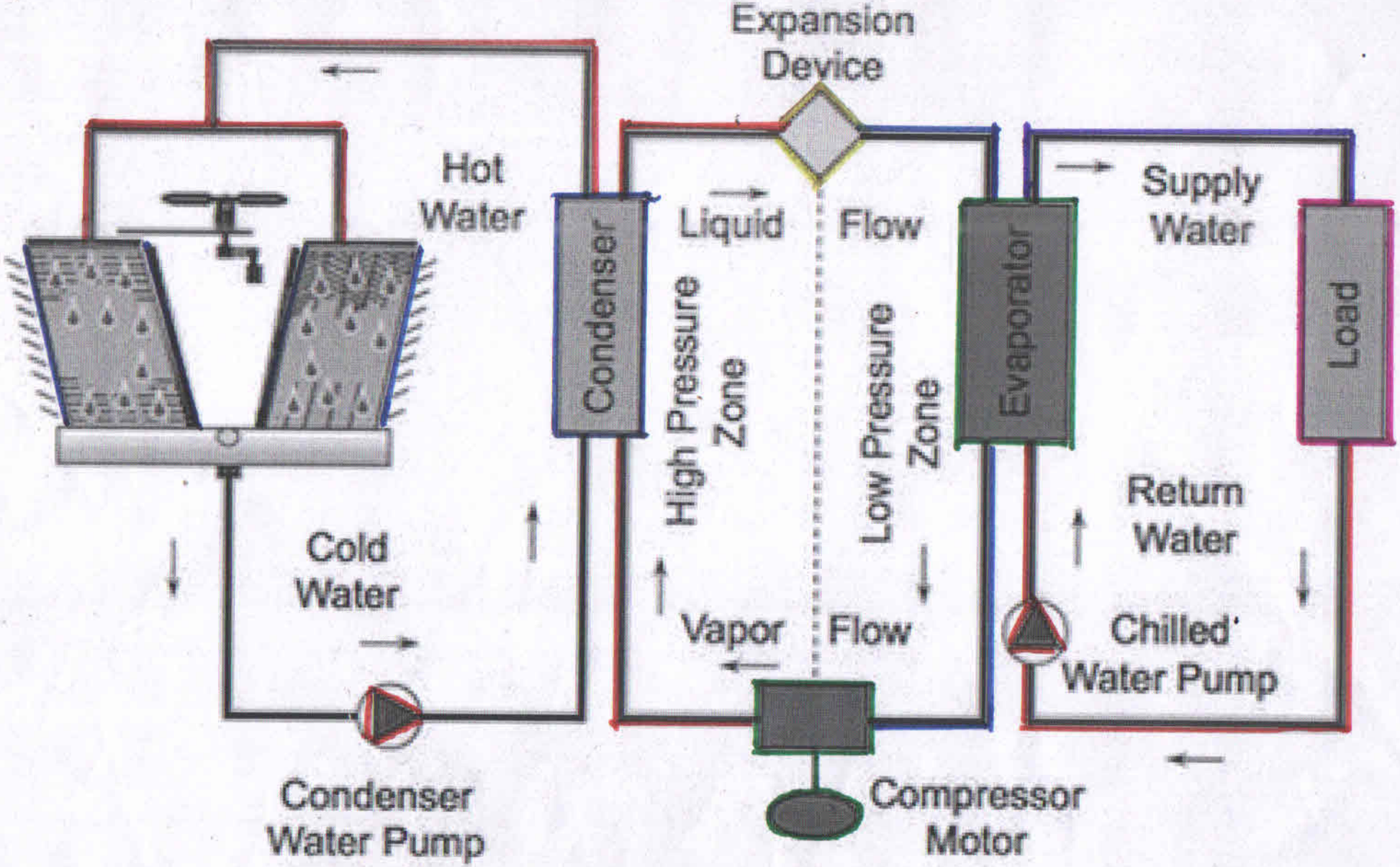
Operational Annual cost then can be compared with the targeted budget and problems are identified when undue consumption are practically noted.

Cooling Tower and Chiller Plant Piping



Typical water-cooled centrifugal chiller schematic

Cooling Tower and Chiller Plant Piping

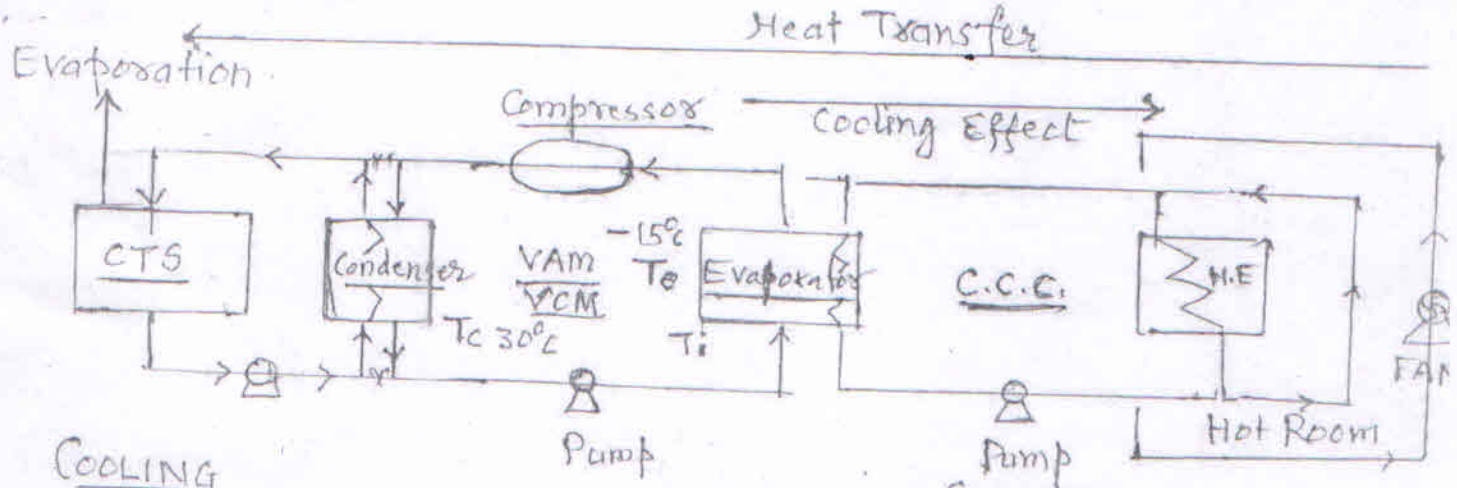


Typical water-cooled centrifugal chiller schematic

SECONDARY	REFRIGERATION	SYSTEM IS.Code-2010.	LIMITING	PARAMETERS
Primary	Refrigeration using Refrigerant-Absorbant-TR.-	(VCM)(+5+25 degC.) FreonGas-22/11 Ammonia 150-200-300	(VAM)(+0-30 deg.C.) DM.Water. LiBr. 30-50	Machine(Temp : Range deg.C.)
PARAMETER	UNITS	NITRITE BASE +(15%NaCl or 20%CaCl2)	PropeleneGLYCOL(>20%) BASED	REMARKS
pH		9.0-9.5	9.0-10.2	
TDS	ppm	<1000	<2000	
Sp.Cond.	(us/cm)	<1500	<3000	
P-Alkalinity	Ppm as CaCO3	<80	<100	
M-Alkalinity	Ppm as CaCO3	<500	<600	
Total Hardness	Ppm as CaCO3	<50	<50	
Ca.Hardness	Ppm as CaCO3	-	-	
Mg.hardness	Ppm as CaCO3	-	-	
Chloride	Ppm as Chloride	<0.5	<0.5	
Sulphate	Ppm as Sulphate	<250	<350	
Fe.	Ppm as Iron	<0.5	<0.5	
Turbidity	NTU	<15	<15	
Sus.Solids	ppm	<5	<5	
Cu.	Ppm as Copper	<0.2	<0.2	
Ammonia.	Ppm as Ammonia	<5	<5	
Nitrite.	Ppm as Nitrite	1000-1500	700-1000	For fresh system start with 3000 ppm
Nitrate	Ppm as Nitrate	10	10	
Make Up Water		DMW>Soft>R.O	DMW>Soft>R.O	Ultra Filtration
MICTOBIOLOGICAL			LIMITS.	
Anaerobic	Organisms/ml.	<1000	<1000	
Aerobic Particles	Org./ml	<100	<100	
Fe.bactria.	Org./ml or Counts/ml	nil	nil	
SRB.	Org./ml. Or Counts/100ml.	nil	nil	
Corrosion Rate by Coupon Test.	Mpy-Cu/Alloy. MS	<0.2 <<0.5	<0.2 <0.5	

EFFICIENCY of PRIMARY REFRIJERATION SYSTEM

COP is theoretical uncooled range/fraction divided by actual cooling range/fraction practically achieved.



COOLING TOWER

- Antiscalant
- Anticorrosive
- Non-Oxy Biocide
- Oxy Biocide
- Dispersant
- Biodispersant

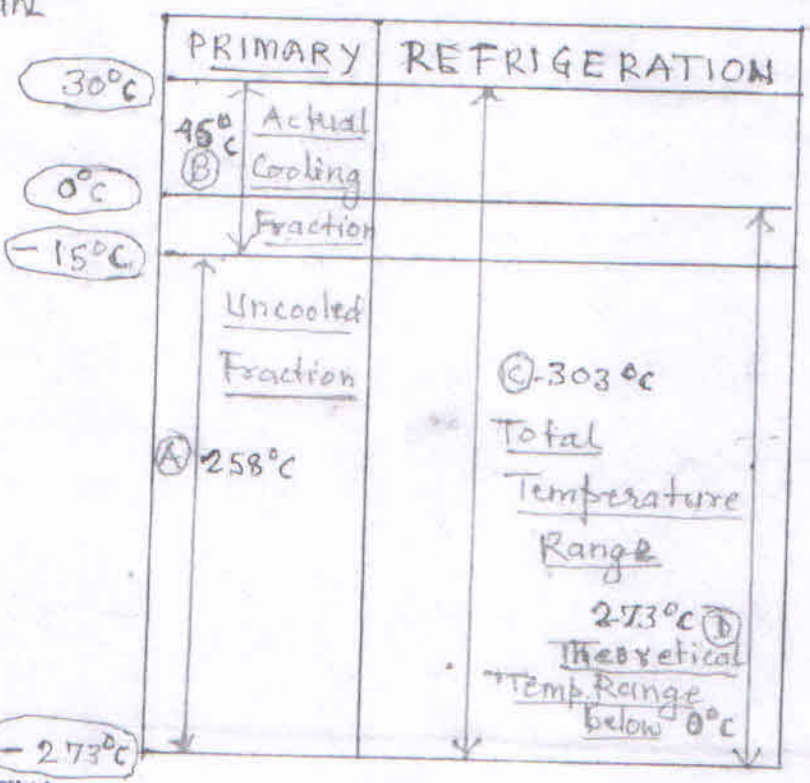
PRIMARY REFRIJERATION AIR CONDITIONER

- $LiBr_2$ + Ammonia
- or
- Freon Gas

Secondary REFRIJERATION

- with
- DMW
- Brine
- Nitrite
- Glycol
- Biocide

Treatment



Heat Transfer Coefficient $\propto \frac{T_c - T_e}{(30+273)-(15+273)}$

$$\frac{COP}{11} = \frac{\text{Coefficient of performance}}{(5.7)} = \frac{\text{Remaining Uncooled fraction [A]}}{\text{Actual Cooling fraction [B]}} = \frac{T_e\ (258°C)}{(T_c - T_e)} \quad \frac{(-15+273)}{(303-258°C)}$$

by S.R.