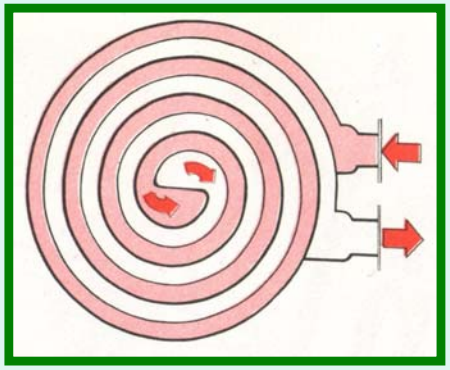
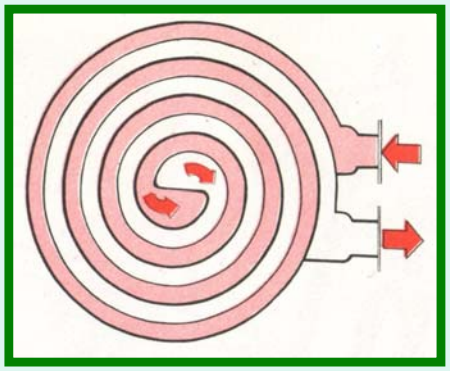


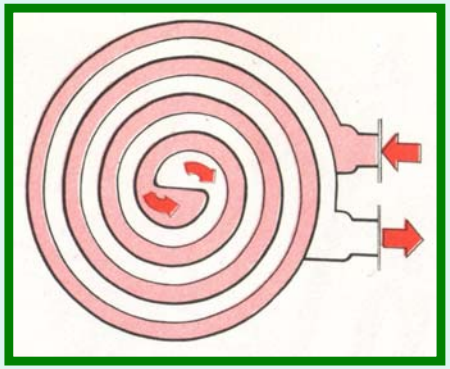
# SCHIMBATOARE DE CALDURA SPIRALE

# SCHIMBATOARE DE CALDURA SPIRALE

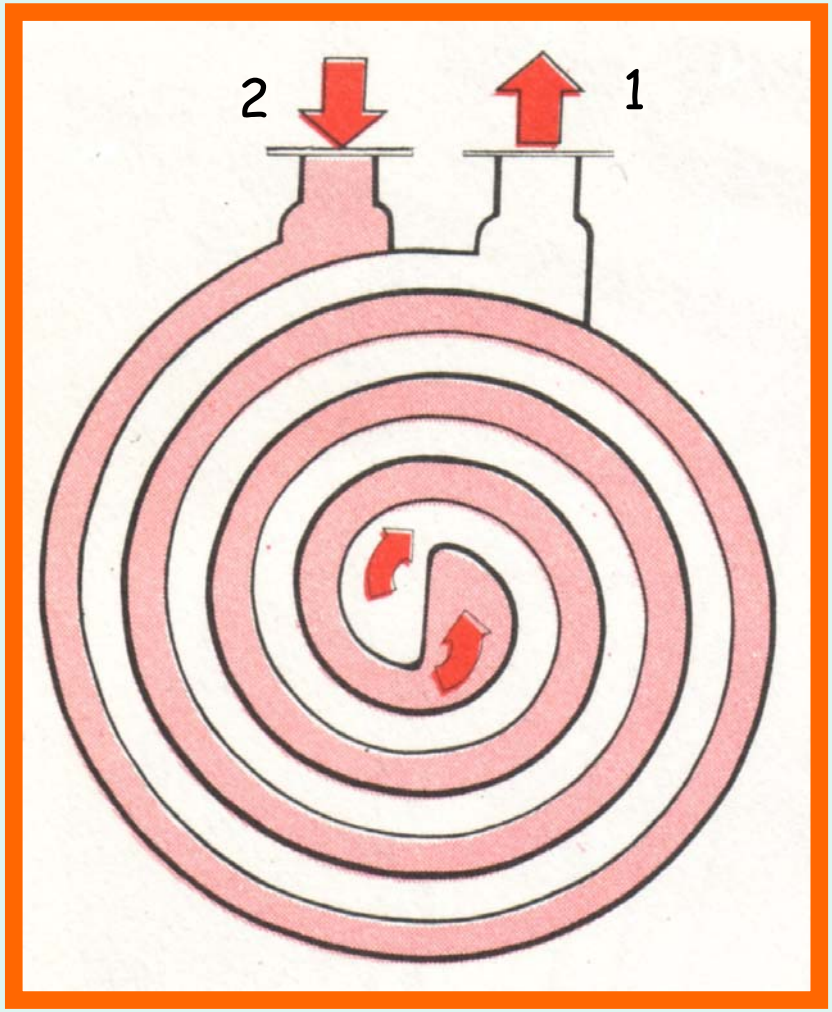


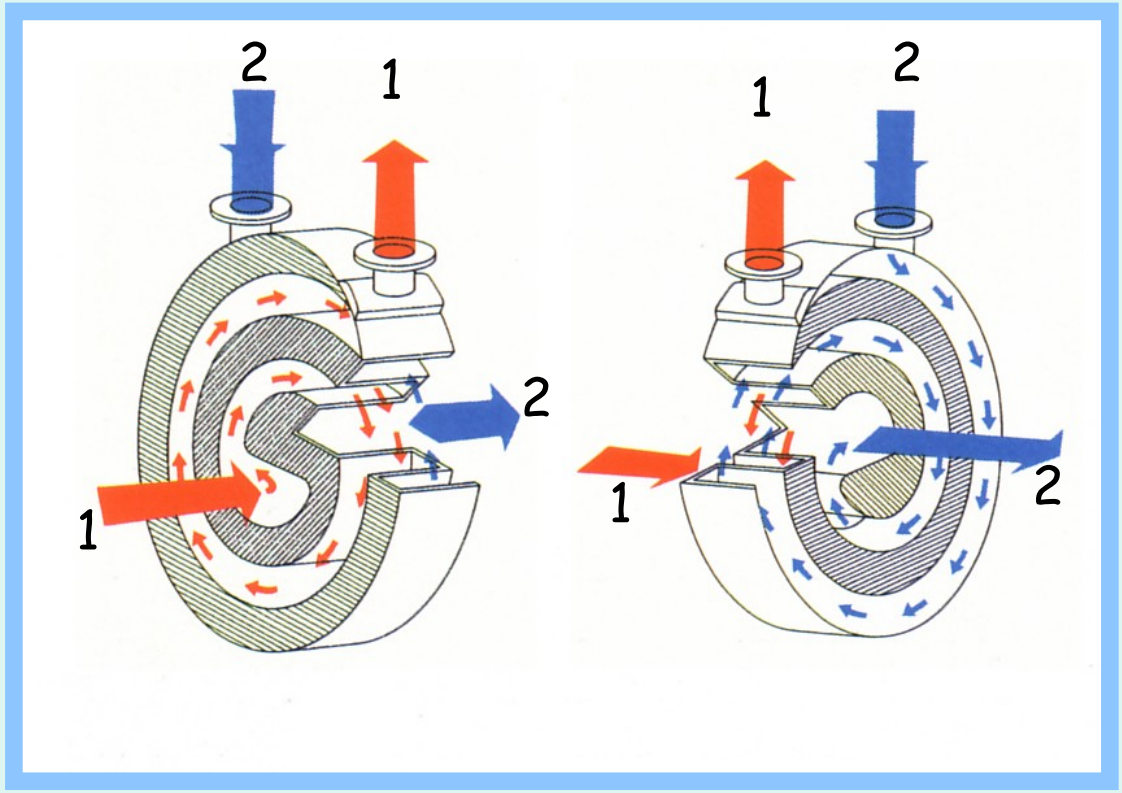
- Utilizate pentru prima oara de catre ROSENBLAD;
- Sunt alcatuite din doua fasii metalice infasurate a.i. formeaza doua canale paralele, cate unul pentru fiecare fluid;
- Latimea canalelor: 5 ÷ 20 mm;
- Ofera avantaje deosebite in aplicatiile la temperaturi extreme, oferind o suprafata mica de contact cu mediul exterior.

# SCHIMBATOARE DE CALDURA SPIRALE

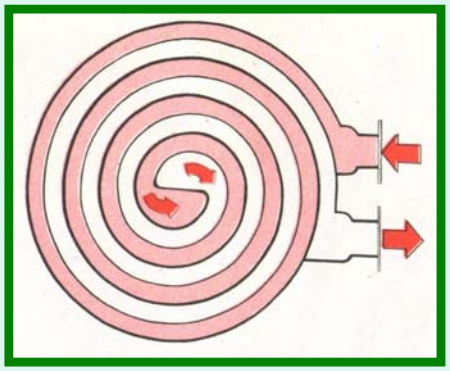


- **SCHEMA DE PRINCIPIU**



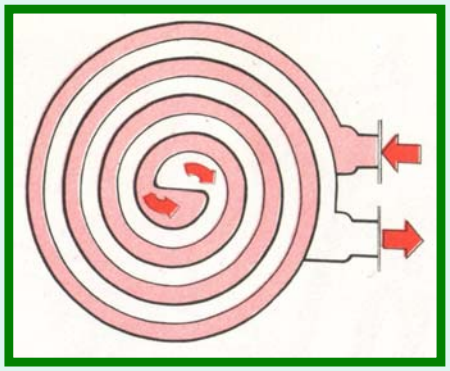
# SCHIMBATOARE DE CALDURA SPIRALE



## Avantaje:

- Coeficienti mari de transfer termic;
- Compactitate (A/V mare);
- $\Delta P$ mici;
- Rezistenta la murdarire;
- Curatire relativ usoara.

# SCHIMBATOARE DE CALDURA SPIRALE

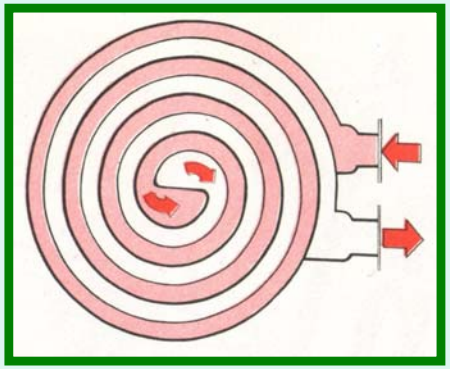


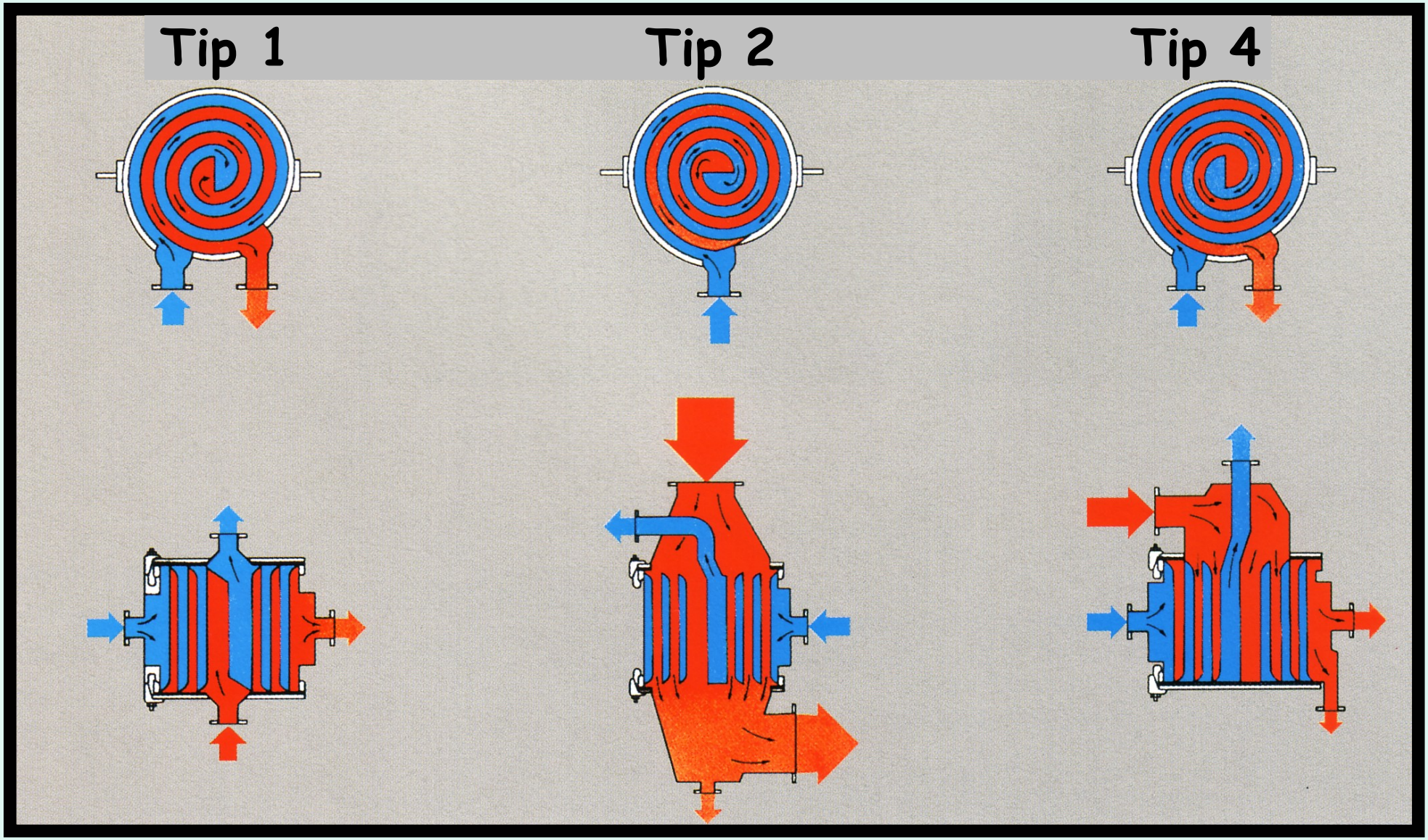
## Tipuri de SCS

(dupa distributia curgerii si a racordurilor):

1. Cu capace plate;
2. Cu curgere incrucisata;
3. Cu curgere combinata: spirala + incrucisata;
4. Cu curgere incrucisata si camera superioara de distributie.

# SCHIMBATOARE DE CALDURA SPIRALE



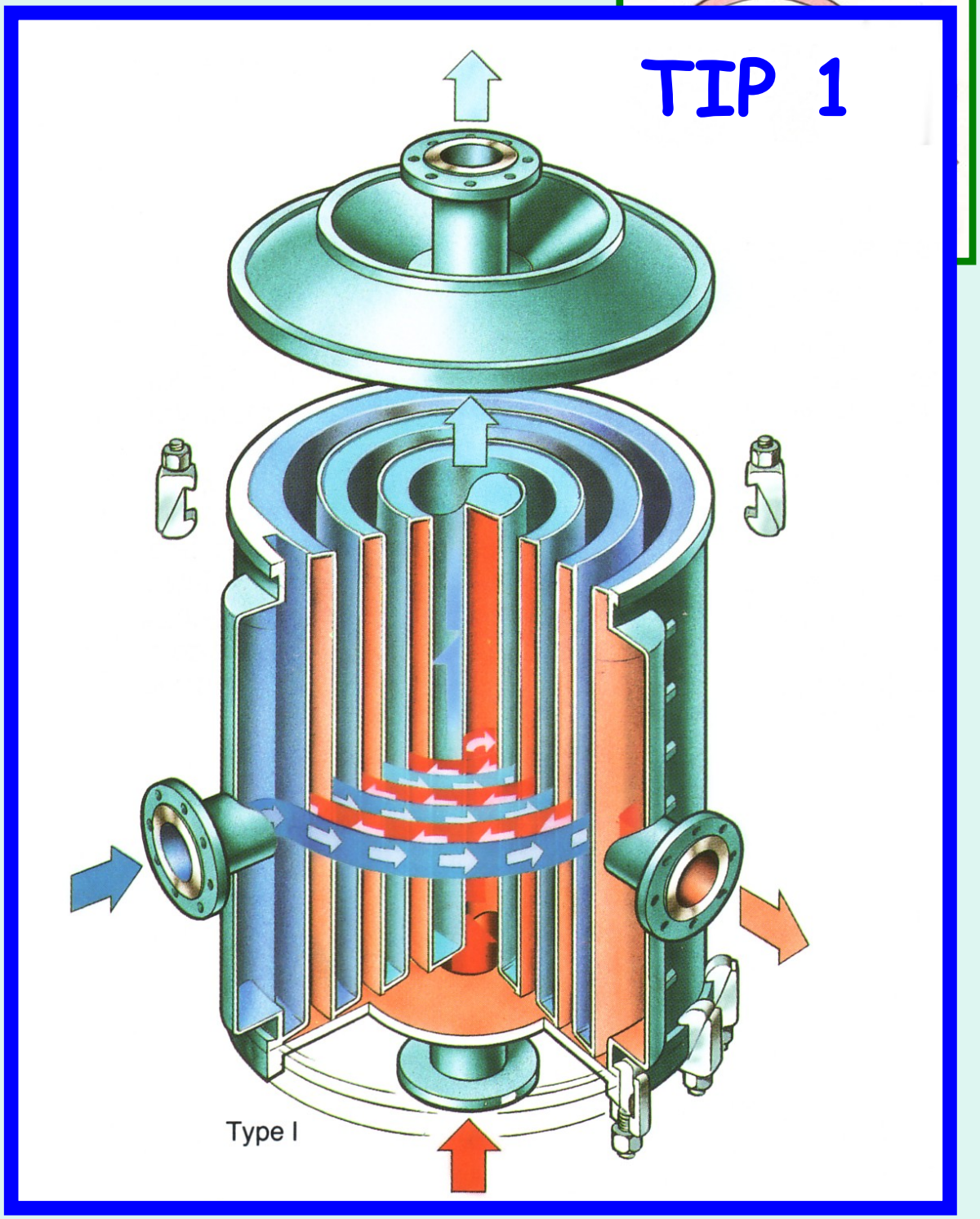


# SCHIMBATOARE DE CALDURA SPIRALE

- Contracurent pur;
- Autocuratirea depunerilor solide;
- Utilizat pentru:

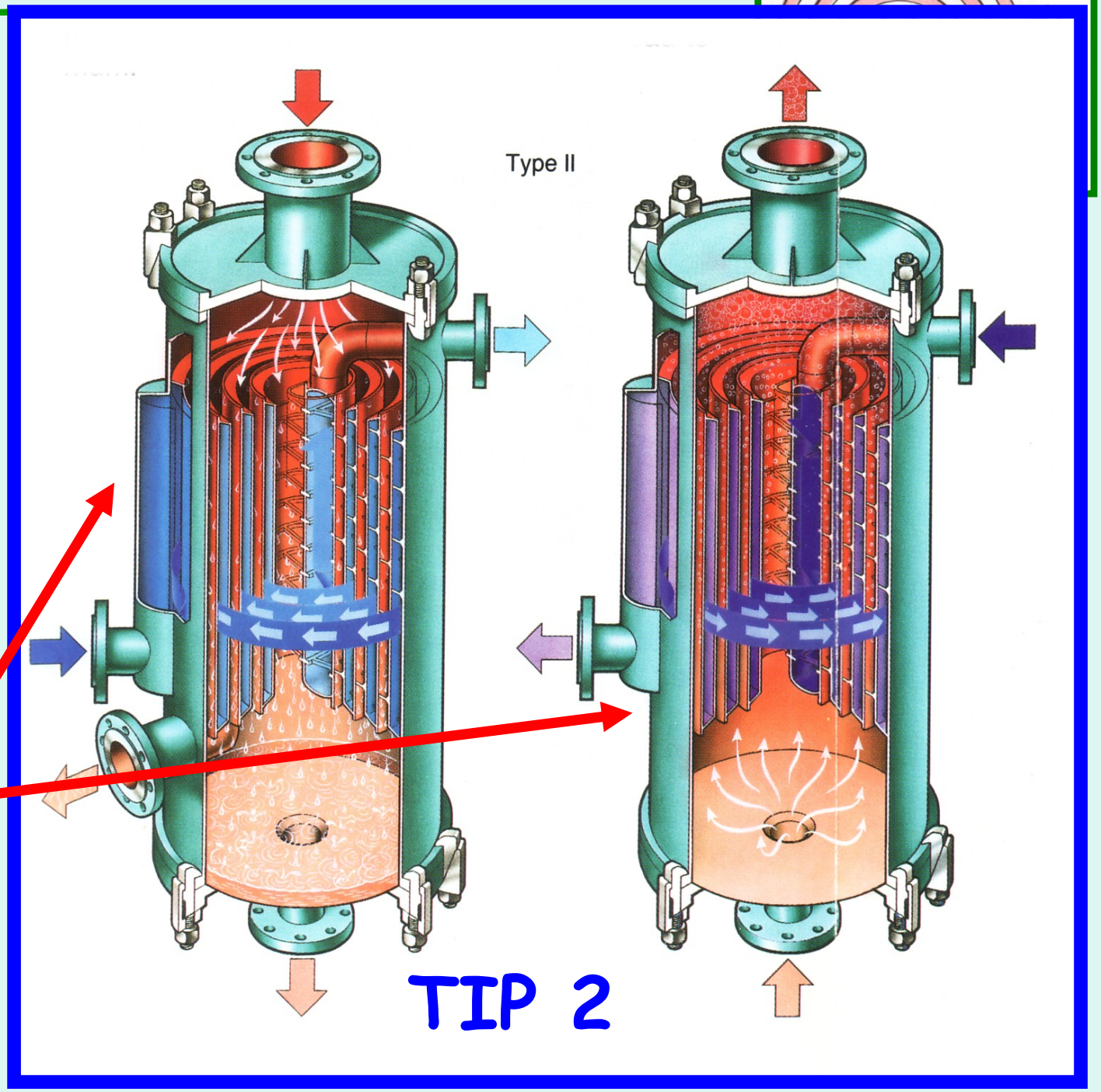
- Transfer L – L;
- Condensare*;
- Racire gaze*.

* Se monteaza vertical



# SCHIMBATOARE DE CALDURA SPIRALE

- Un singur fluid in curgere spirala (agentul termic):
- Condensator;
- Vaporizator.



# SCHIMBATOARE DE CALDURA SPIRALE

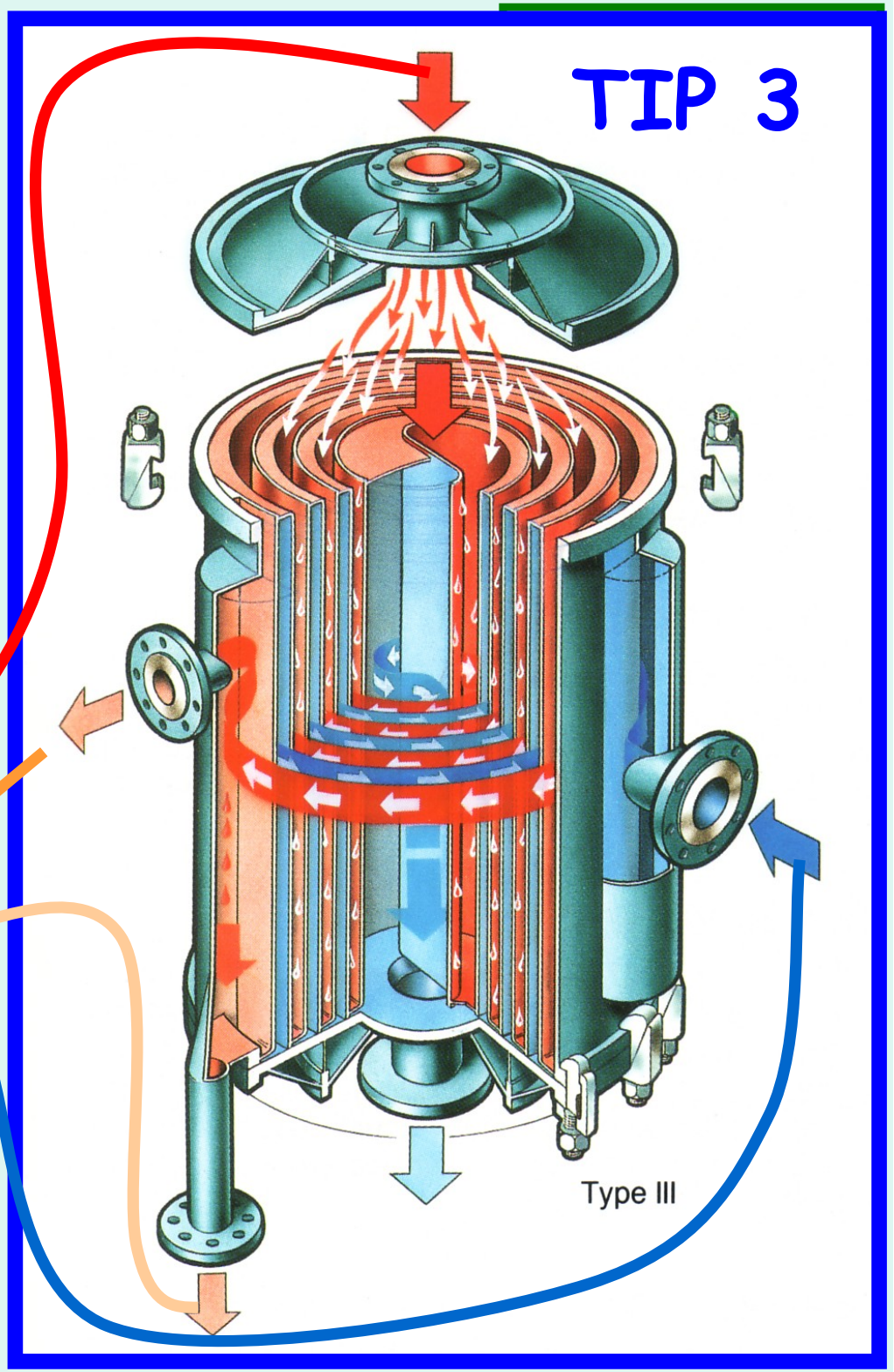
- Utilizat pentru condensare urmata de subracirea condensatului.

Vapori

Gaze necondensabile

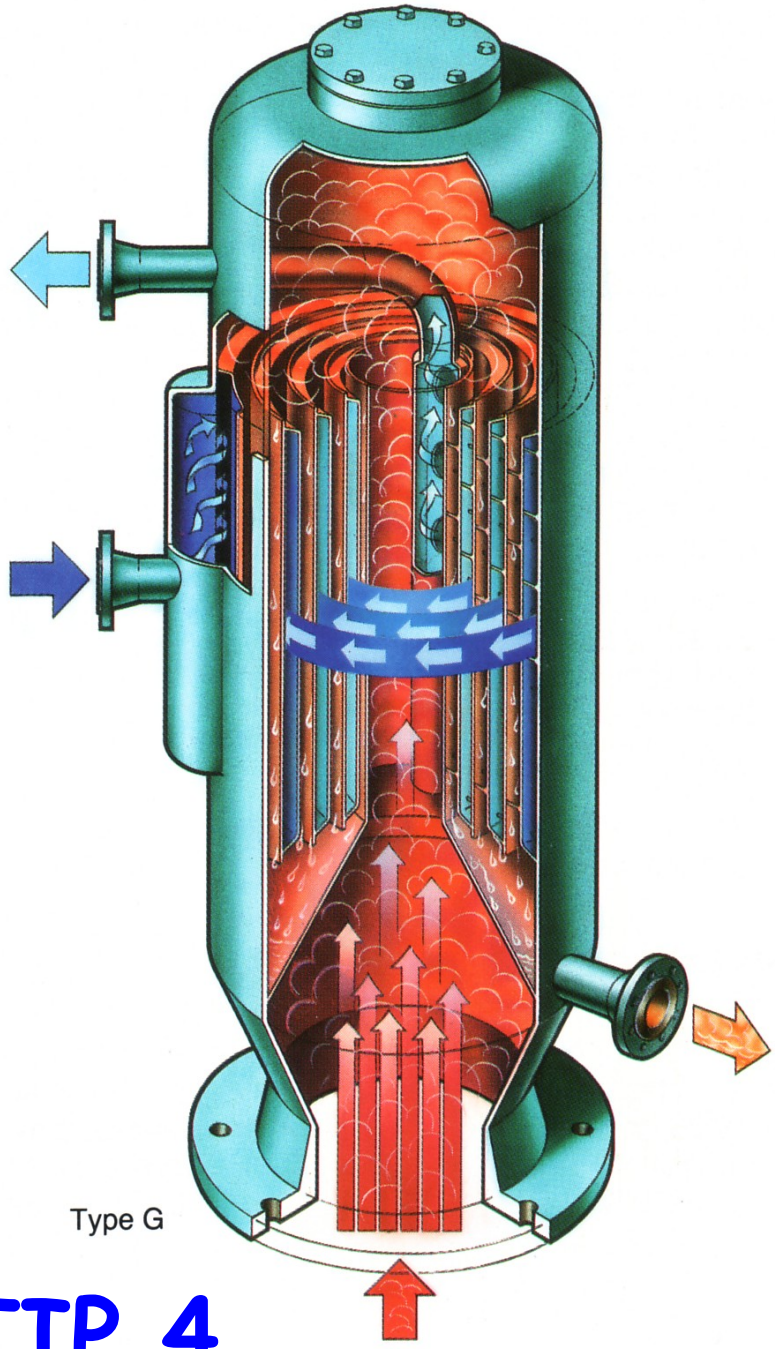
Condensat

Agent de racire



# SCHIMBATOARE DE CALDURA SPIRALE

- Se monteaza direct la varful coloanelor, reactoarelor etc., avand rol de condensator de varf.
- Elimina necesitatea conductelor de legatura cu coloana sau reactorul.

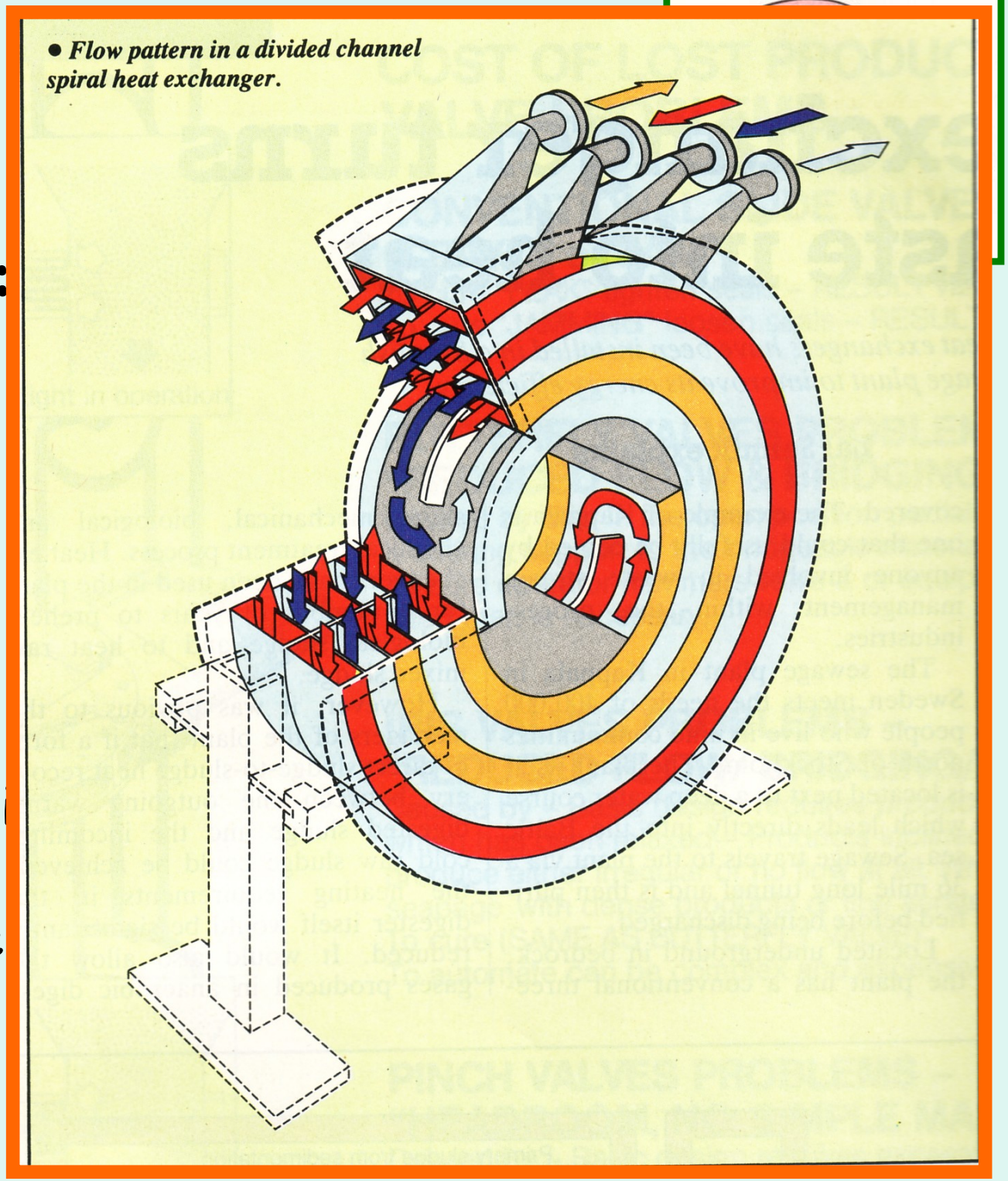



TIP 4

# SCHIMBATOARE DE CALDURA SPIRALE

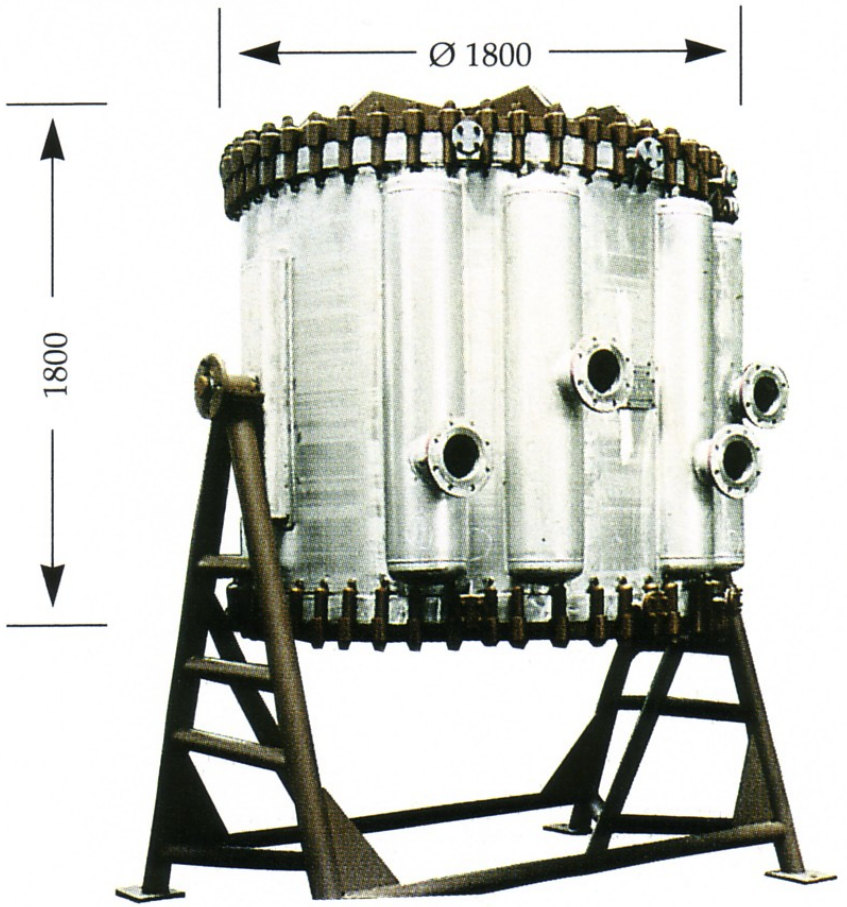
**Cu canale divizate:**

- Alimentarea si evacuarea pe la periferie;
- Intoarcere de 180° la centru, canalele fiind divizate in 2;
- Valorifica ΔT mici;
- Recuperarea calduri din suspensii;
- Acces usor la canale prin indepartarea capacelor.



# SCHIMBATOARE DE CALDURA SPIRALE

**Cu canale divizate:**

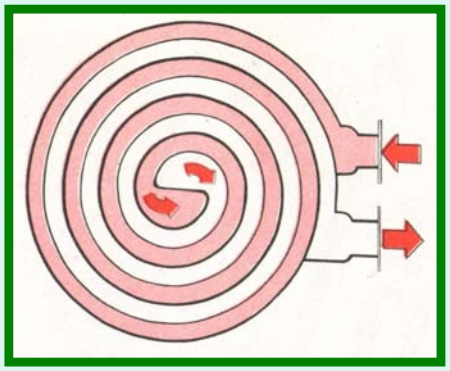



Double channel SHE's 580 m²

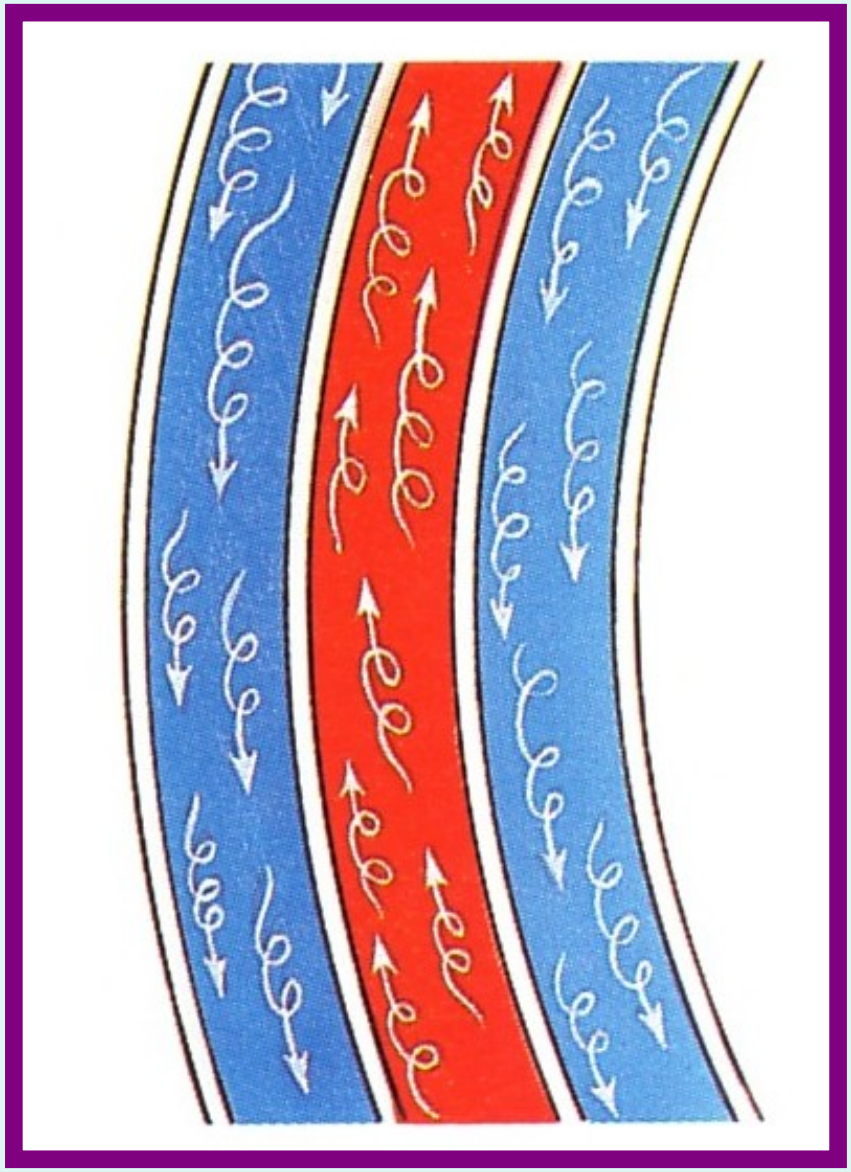
Typical sizes for type 1 units are:

| Heat Transfer Surface ($m^2$) | Overall Length (m) | Overall Diameter (m) |
|---|---|---|
| 450 – 650 | 2000 – 3000 | 1750 – 2300 |
| 185 – 420 | 1500 – 2000 | 1300 – 1750 |
| 45 – 140 | 900 – 1500 | 600 – 1300 |

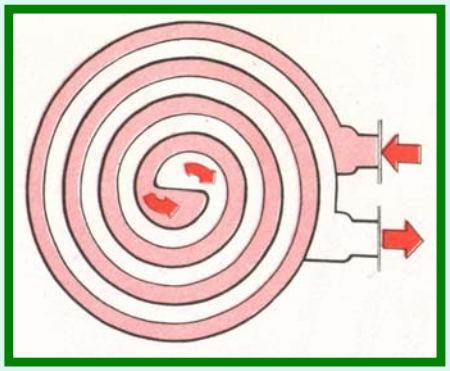
# SCHIMBATOARE DE CALDURA SPIRALE



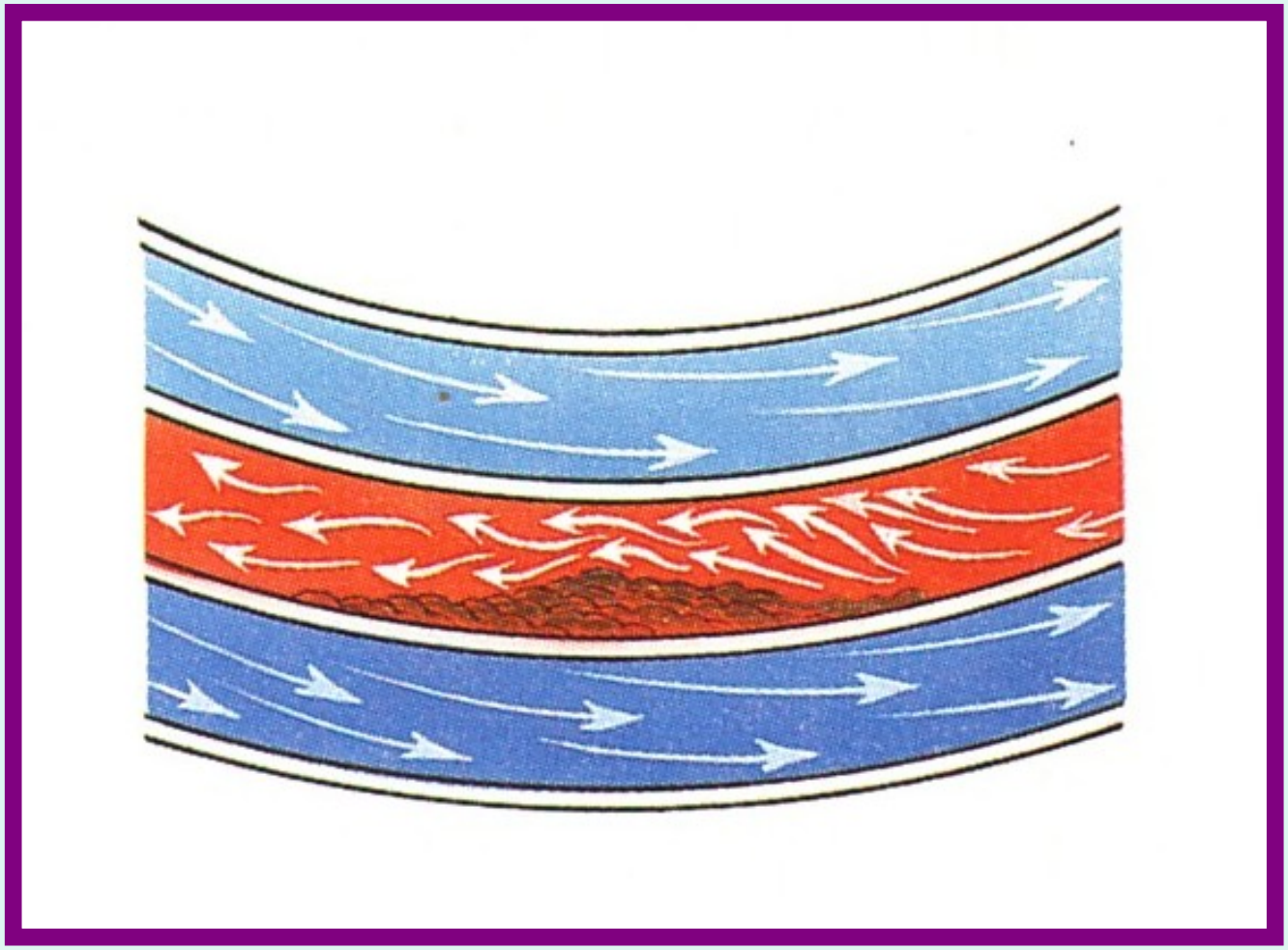
- Turbulenta ridicata



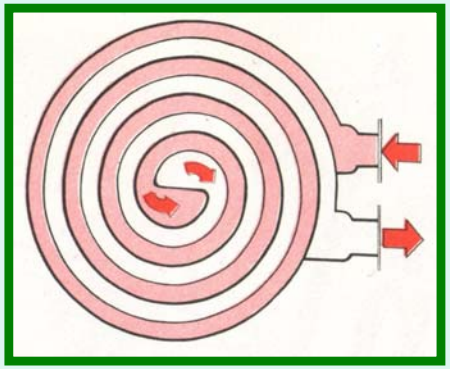
# SCHIMBATOARE DE CALDURA SPIRALE



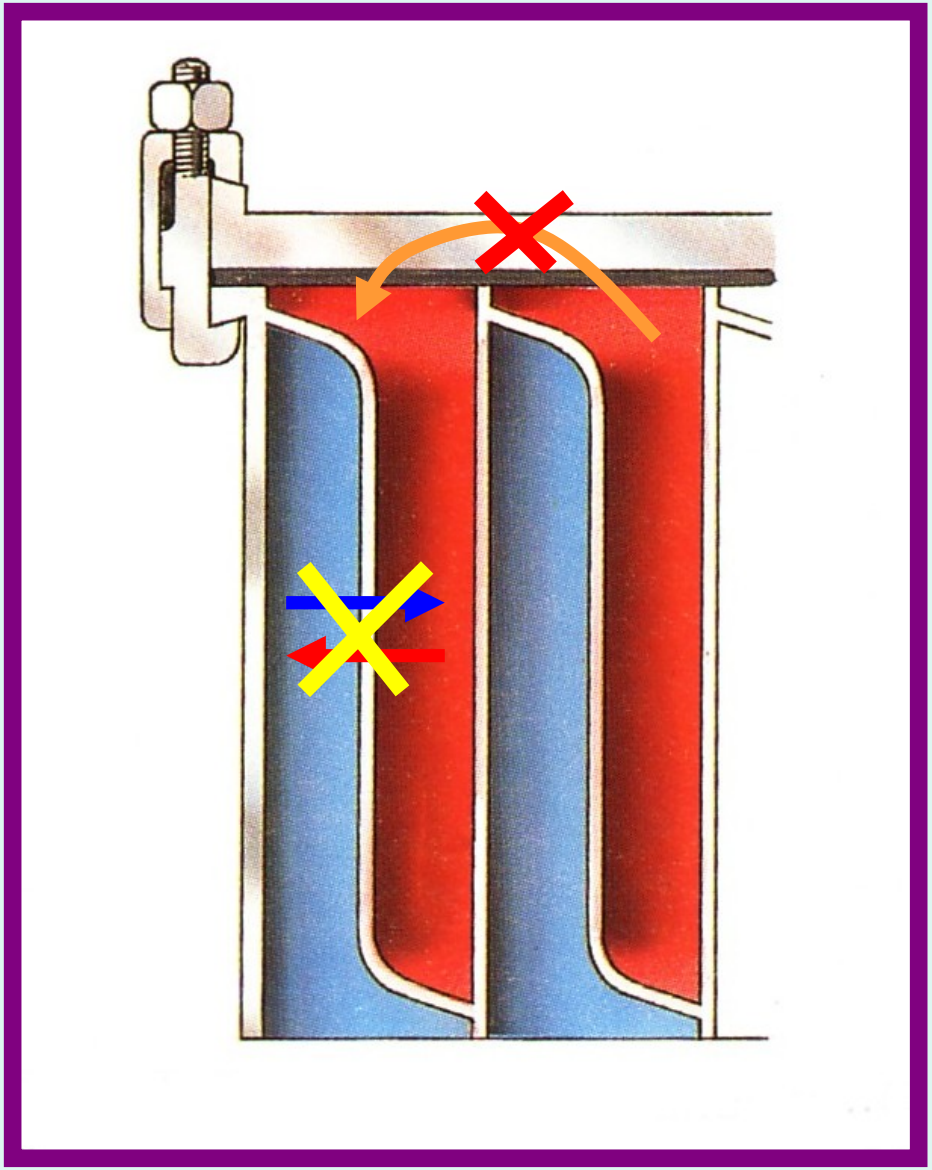
- Actiune de autocuratire



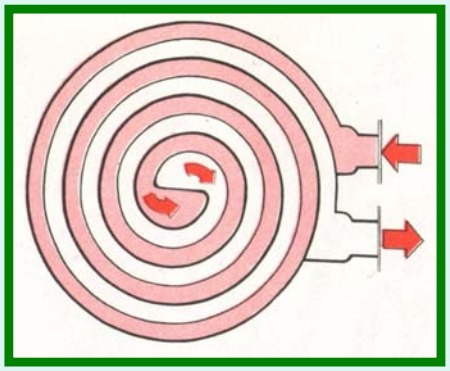
# SCHIMBATOARE DE CALDURA SPIRALE



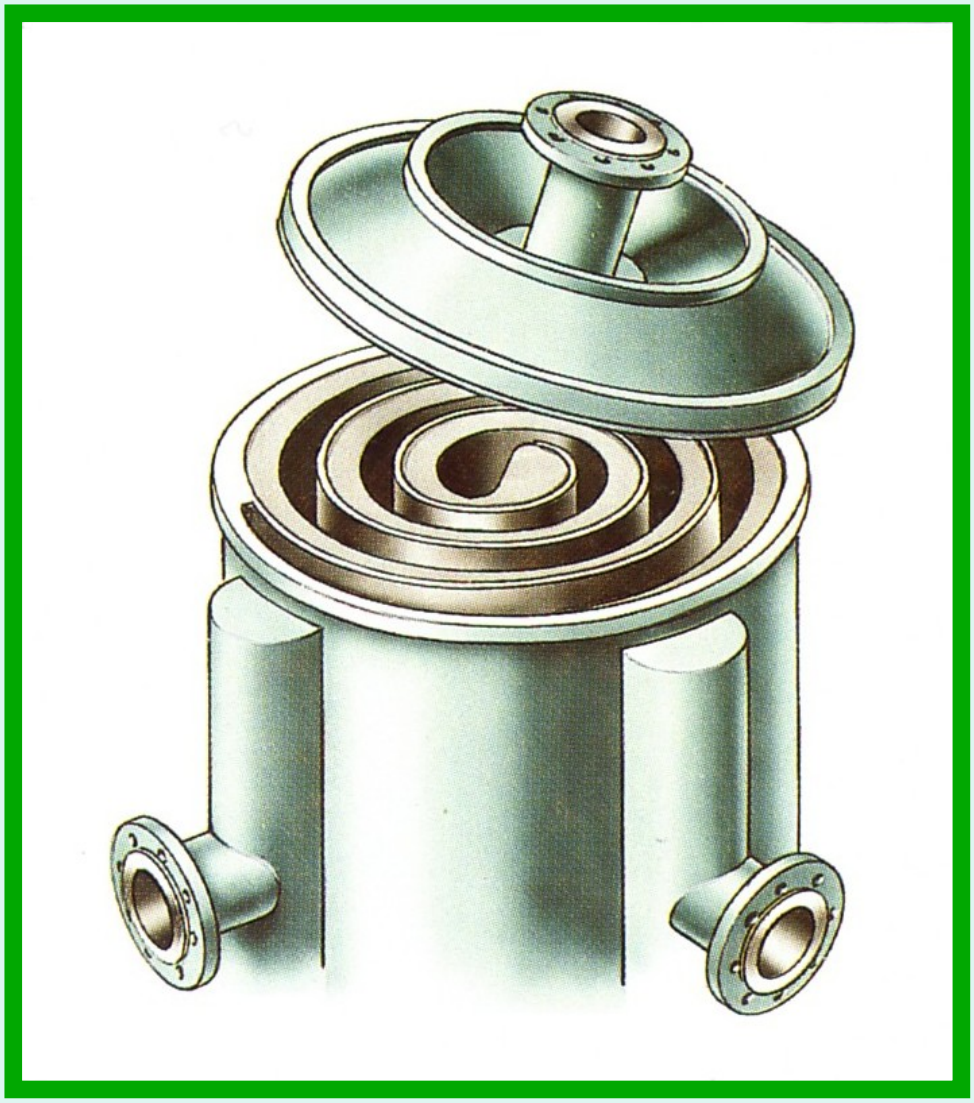
- Evitarea scurtcircuitarii curgerii fluidului;
- Evitarea amestecarii celor doua fluide.



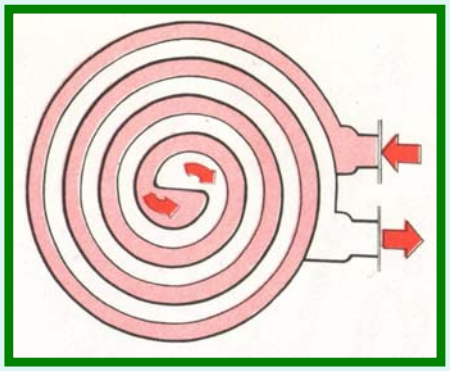
# SCHIMBATOARE DE CALDURA SPIRALE



- Acces usor la spatiile de curgere prin indepartarea capacelor



# SCHIMBATOARE DE CALDURA SPIRALE

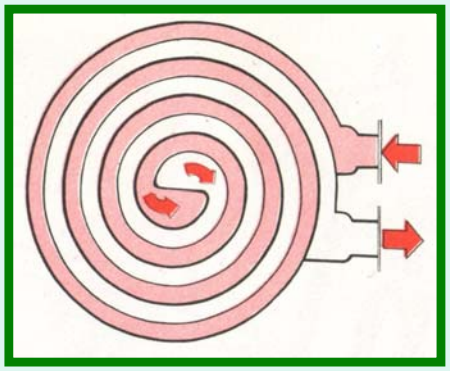


- **Viteza de curgere a fluidelor**:

- Pana la 2 m/s – lichide;
- Pana la 20 m/s - vapori sau gaze.

- **Coeficienti ridicati de transfer termic**: curgere curbilinie (similara curgerii prin serpentine curbe).
- **Rezistenta hidraulica redusa**: nu exista variatii bruste (marime, directie) ale vitezei.

# SCHIMBATOARE DE CALDURA SPIRALE



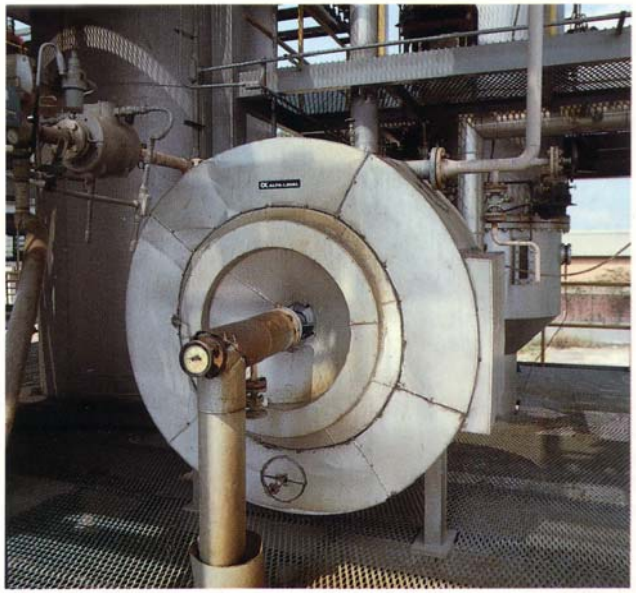
- **DEZAVANTAJE:**

- Fabricare complicata;
- Presiune de lucru redusa (max. 1,5 MPa);
- Cost relativ ridicat;
- Etansare dificil de realizat;
- Montare si curatire dificile.

# SCHIMBATOARE DE CALDURA SPIRALE

## APLICATII:

- Industria chimica

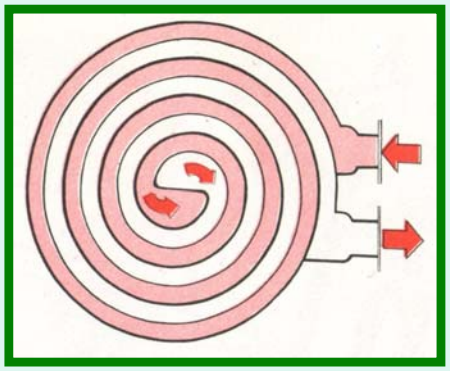


Singapore Polymer Corporation in Singapore chose the Type I spiral heat exchanger for its ability to keep the raw PVC slurry in suspension during heating.

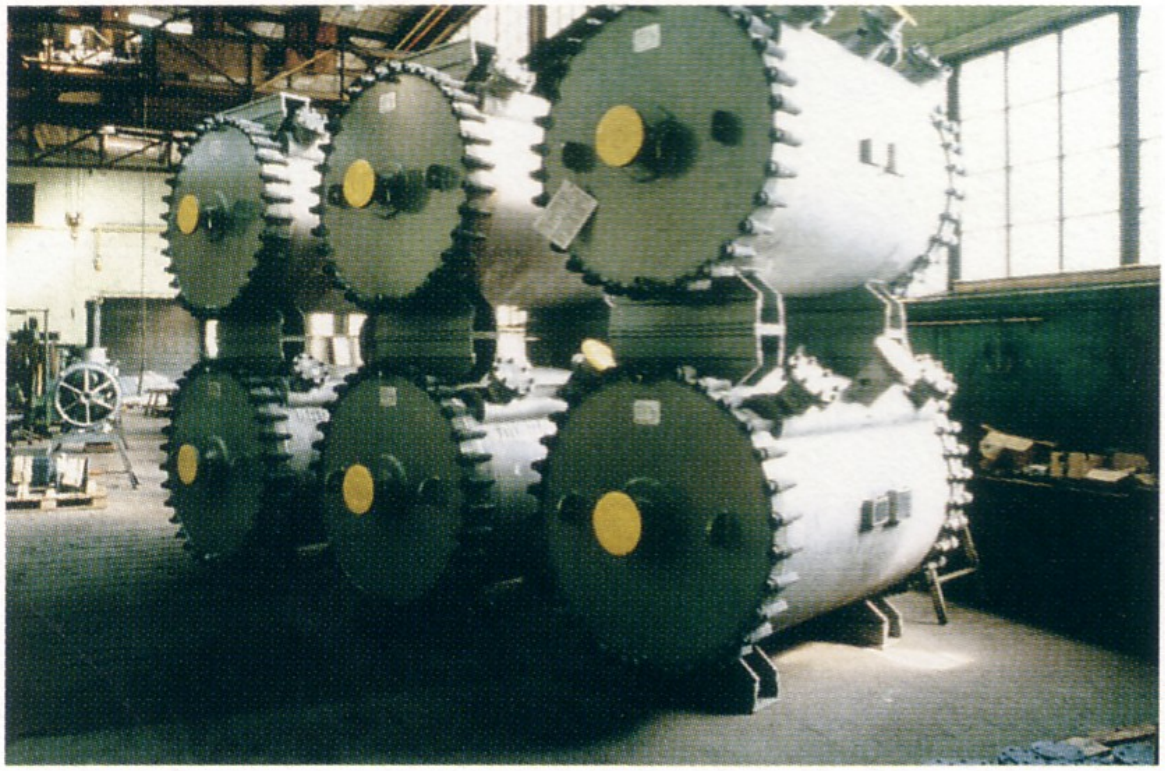
Queensland Alumina in Queensland, Australia, selected the spiral heat exchanger Type I for heating bauxite slurry.

Spiral heat exchanger units consisting of two spiral heat exchangers Type II mounted on top of each other are used by ICI in Billingham, the UK, as partial water vapour condensers in the ammonia plant.

# SCHIMBATOARE DE CALDURA SPIRALE



**APLICATII:** Industria metalurgica

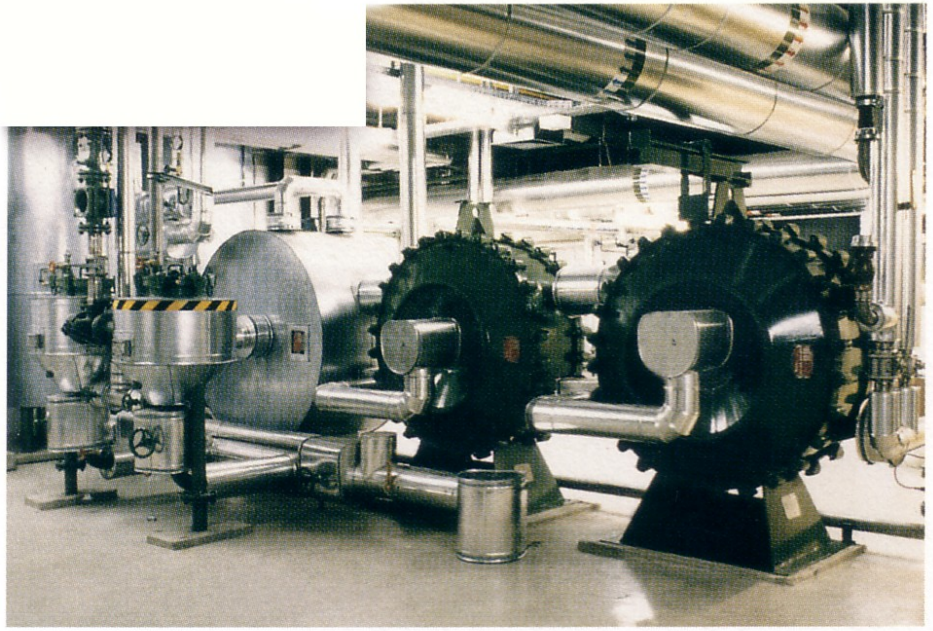


6 of 45 Spiral Heat Exchanger in same design Steel Industry

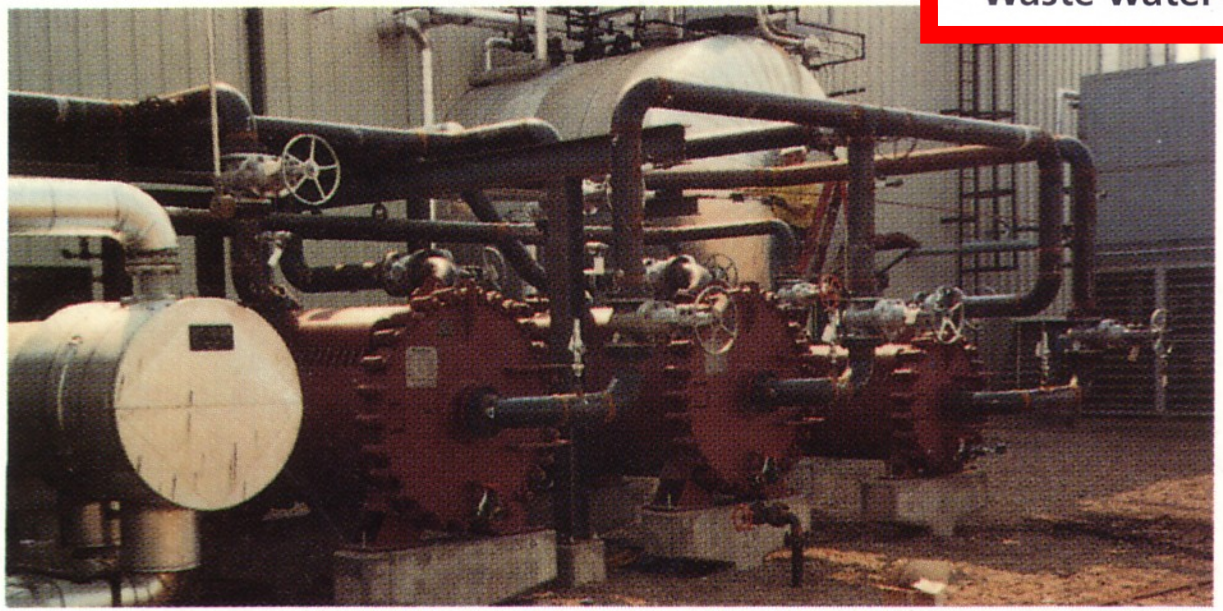
# SCHIMBATOARE DE CALDURA SPIRALE

## APLICATII:

- Tratarea si epurarea apelor



Waste water disinfection plant "Alino"



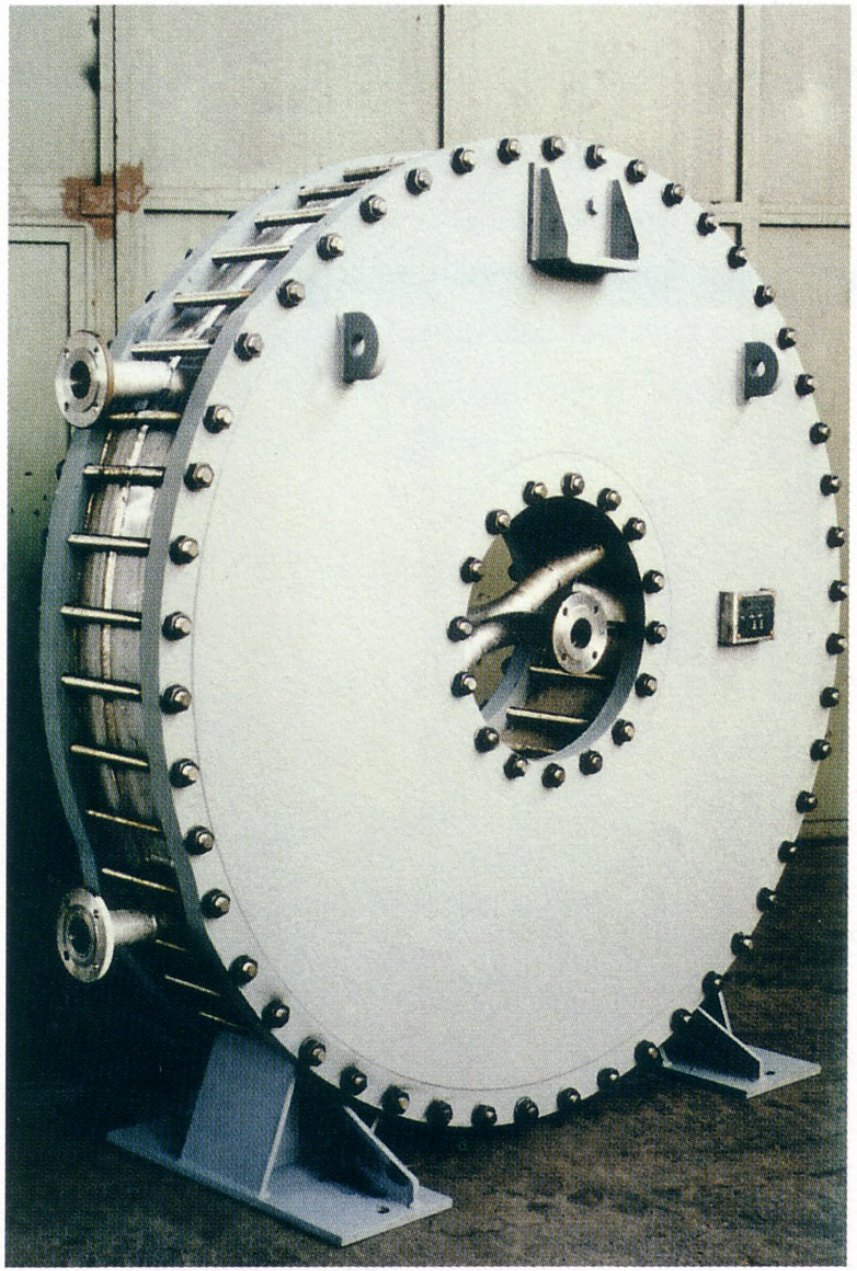
Shell Canada in Peace River, Alberta, Canada, use four spiral heat exchangers Type IH for preheating boiler feed water by means of produced water.

# SCHIMBATOARE DE CALDURA SPIRALE

## APLICATII:

- Industria alimentara

Spiral heat exchanger for disinfection with heated cover

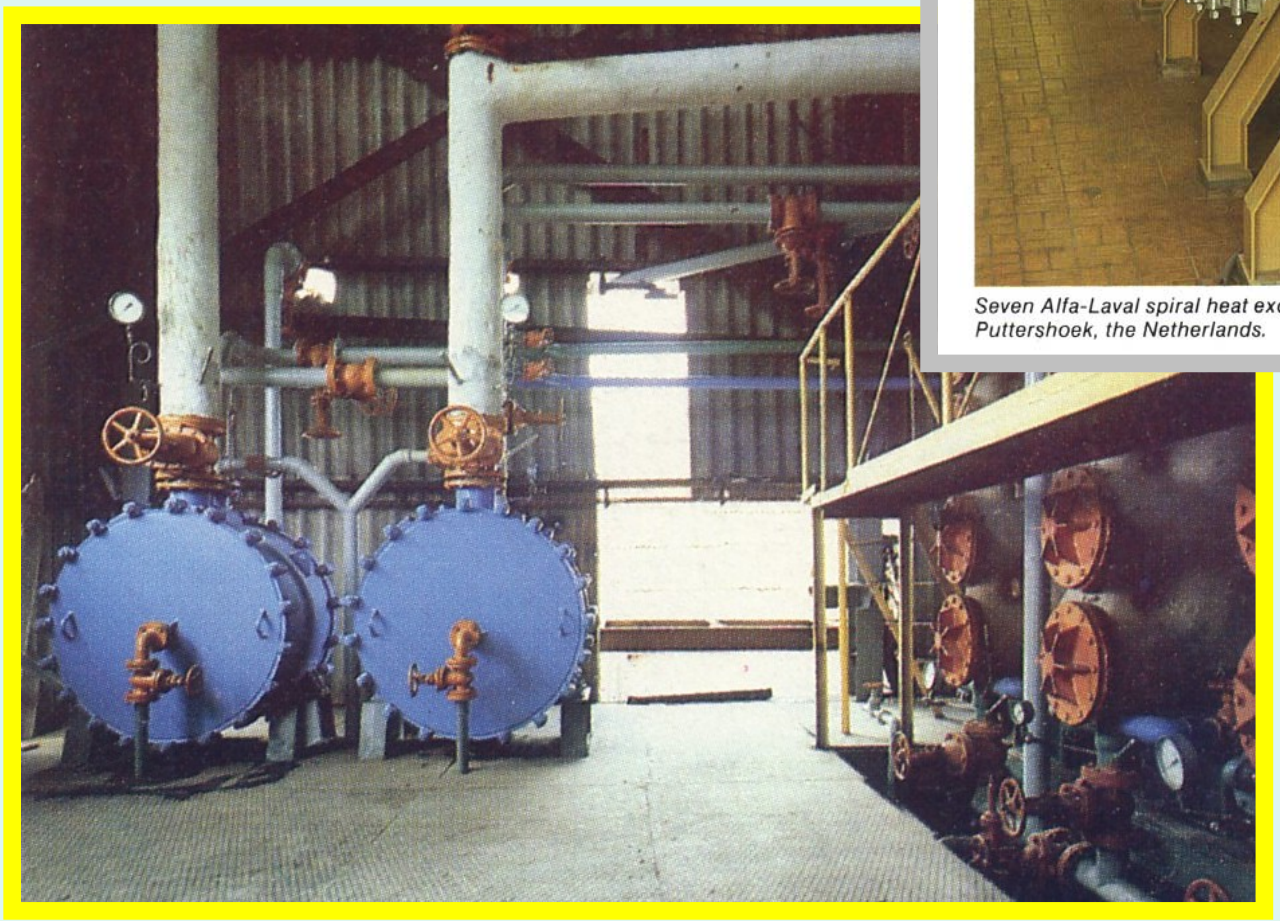


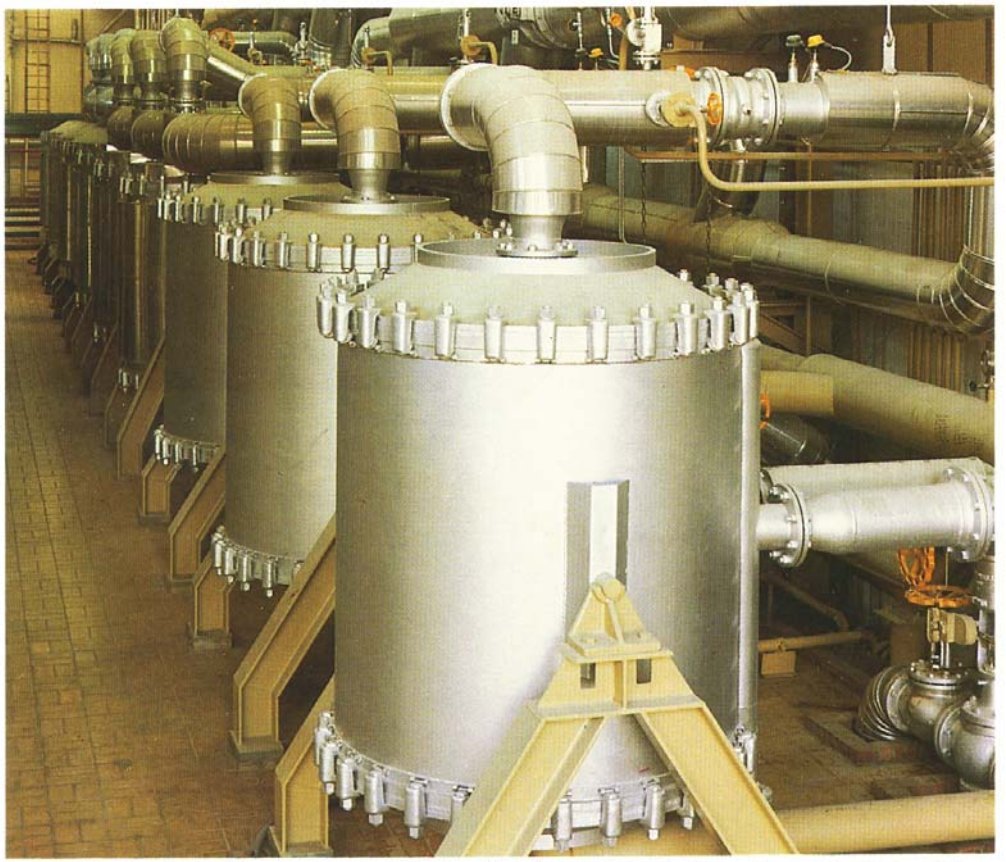
Core-Ø 700 with stud bolts heating of red wine mash

# SCHIMBATOARE DE CALDURA SPIRALE

## APLICATII:

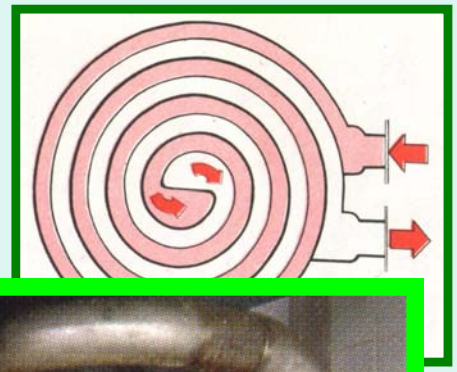
- Industria zaharului





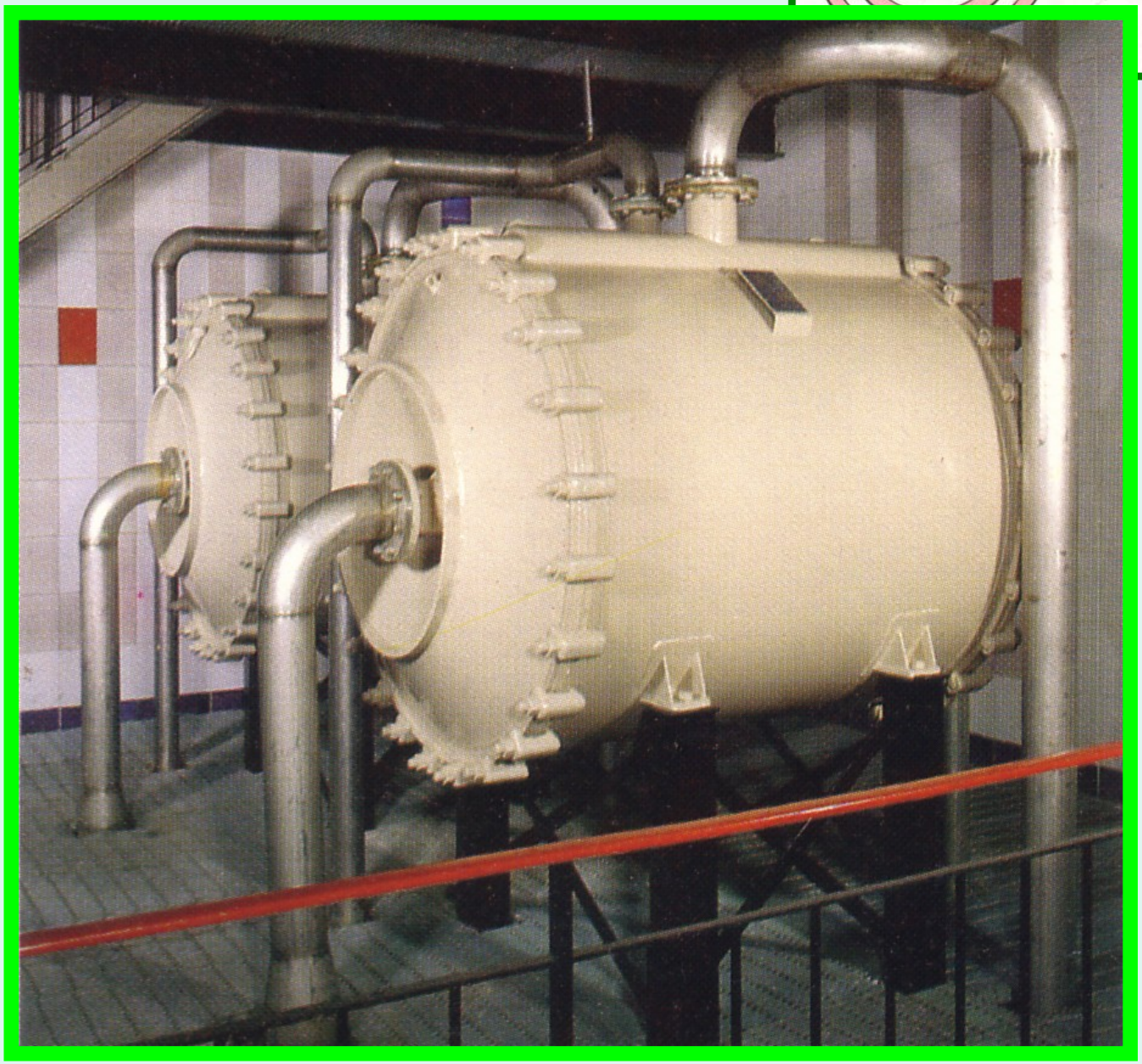
*Seven Alfa-Laval spiral heat exchangers heat prelimed sugar juice at Coop. Vereniging Suiker U A, Puttershoek, the Netherlands.*

# SCHIMBATOARE DE CALDURA SPIRALE

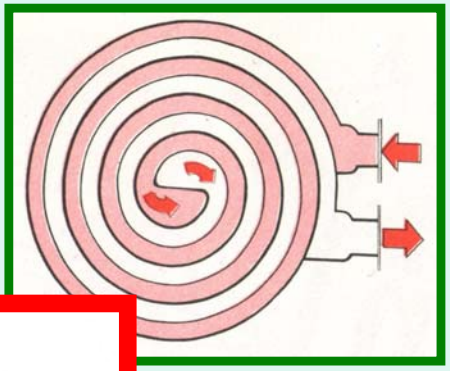


## APLICATII:

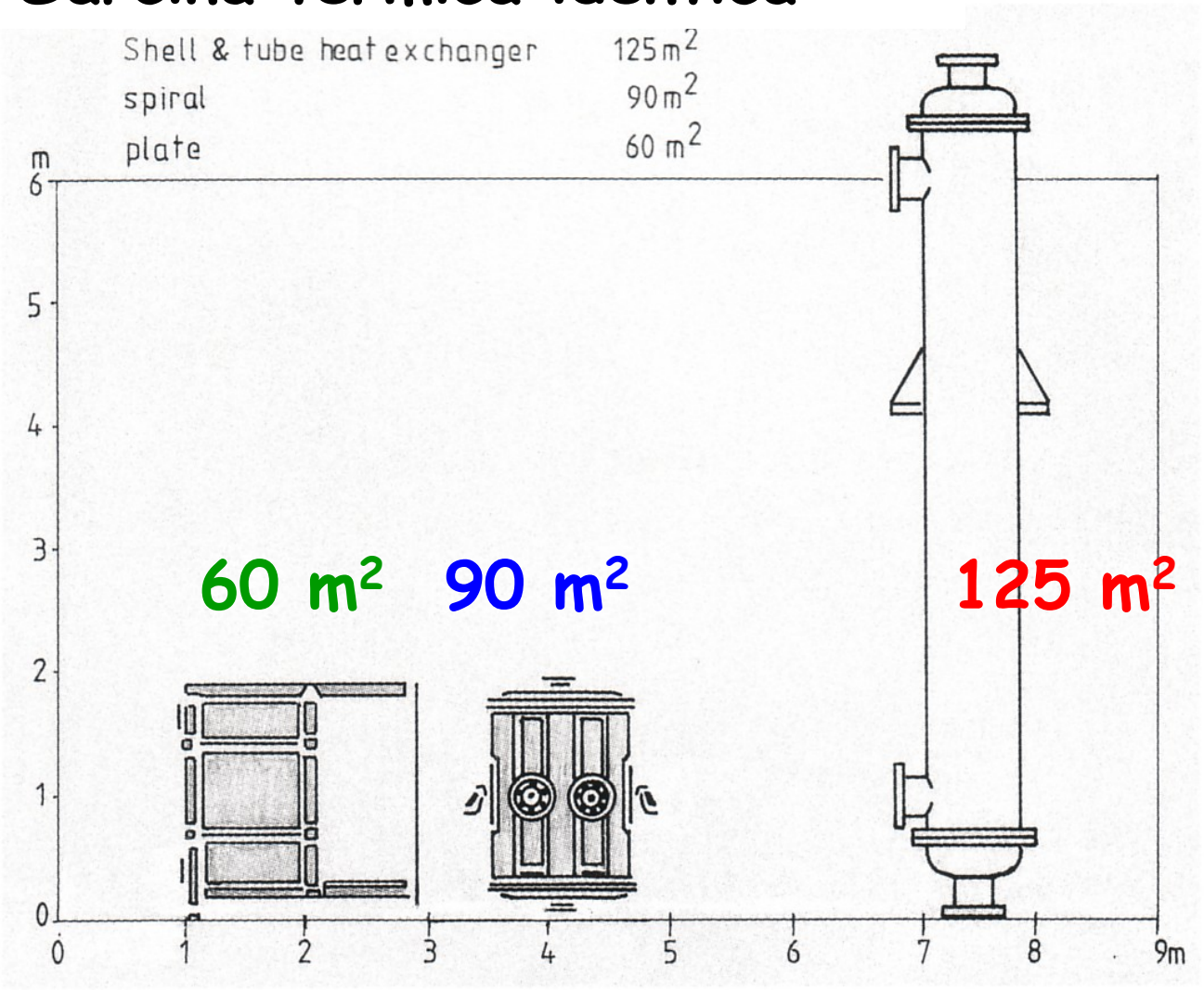
- Industria alcoolului



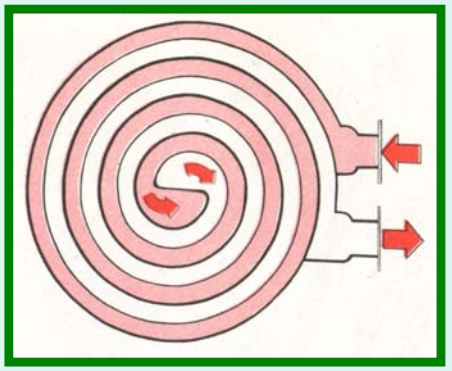
# SCHIMBATOARE DE CALDURA SPIRALE



## Sarcina termica identica



# SCHIMBATOARE DE CALDURA SPIRALE



- Calculul coeficientilor de transfer termic:

$$Nu = \frac{\alpha \cdot d_{ech}}{\lambda} = \pm \frac{\frac{b}{r_c}}{\ln\left[1 \pm \frac{b}{r_c} \cdot \frac{1}{Nu_0}\right]}$$

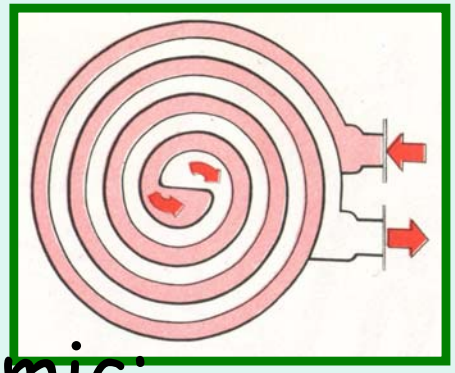
$r_c$ – raza de curbura a spirei;

"+" – partea exterioara a peretelui;

"-" – partea interioara a peretelui;

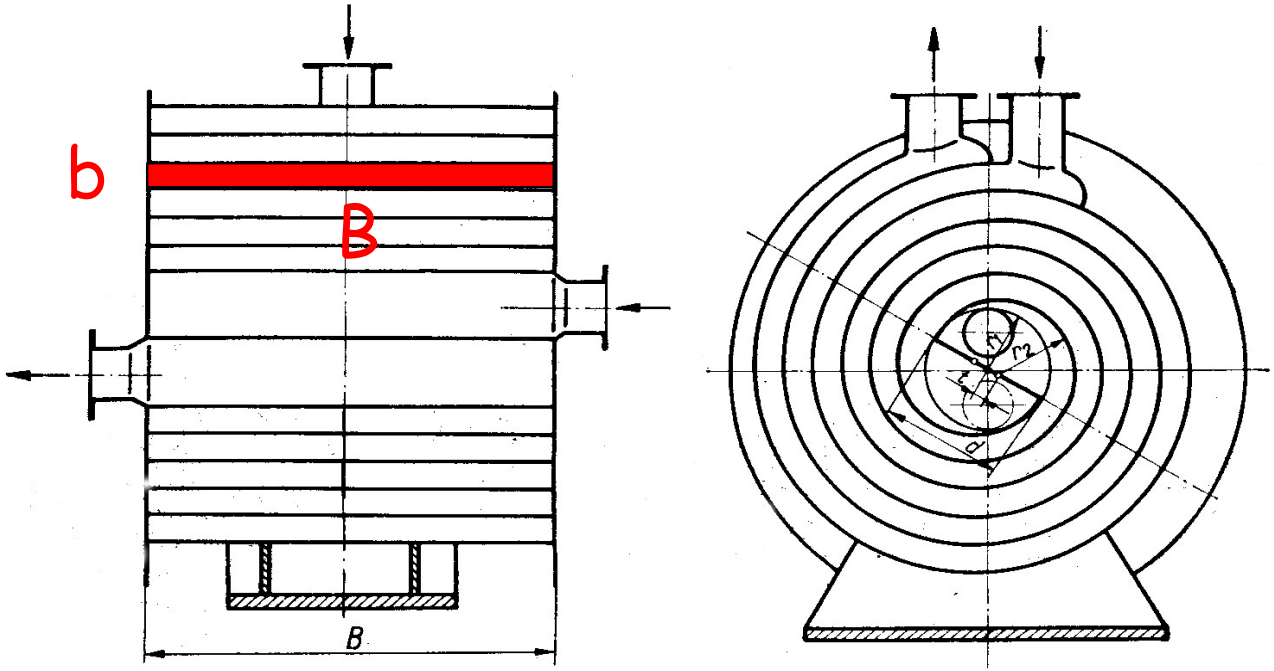
"0" – pentru conducta dreapta.

# SCHIMBATOARE DE CALDURA SPIRALE



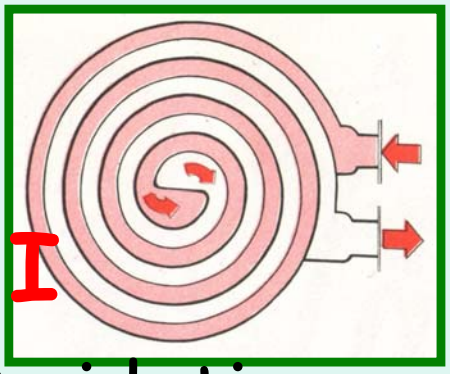
- Calculul coeficientilor de transfer termic:

$$d_{ech} = \frac{4A}{P_u} = \frac{4(b \times B)}{2(b+B)} = 2\frac{b \cdot B}{b+B}$$




Schimbător de căldură spiral

# SCHIMBATOARE DE CALDURA SPIRALE

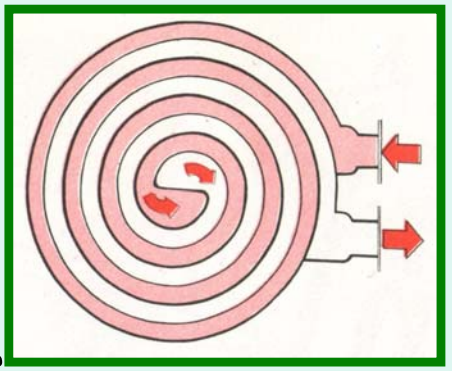


## DIMENSIONARE I

1. Se impun: diametrul initial al spirei (d) si latimea foii, B (350 ÷ 750 mm);
2. Se alege latimea canalului, b (6 ÷ 15 mm);
3. Se alege grosimea peretelui, δ (2 ÷ 8 mm);
4. Se calculeaza $T_{med\ 1,2}$ si prop. fluidelor;
5. Se calculeaza sarcina termica (din BT);
6. Se calculeaza $\Delta T_{med}$;
7. Se calculeaza $\alpha_1$, $\alpha_2$, K;
8. Se calculeaza A din ecuatia transferului termic;

# SCHIMBATOARE DE CALDURA SPIRALE

## DIMENSIONARE I



9. Se calculeaza lungimea utila a spirei, l:

$$l = \frac{A}{2B'} \; ; B' = B - 20\,mm$$

10. Se determina numarul de spire:

$$n = \frac{t-d}{4t} + \sqrt{\left(\frac{t-d}{4t}\right)^2 + \frac{l}{2\pi \cdot t}}$$

unde t = 2(b + δ) este pasul spirei;

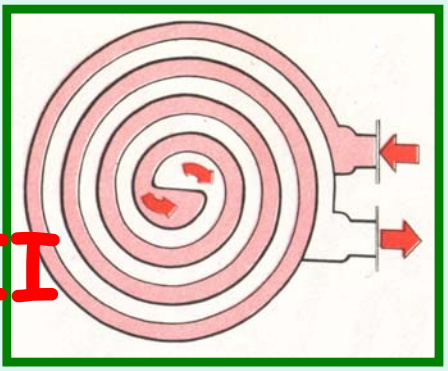
11. Se calculeaza diametrul exterior al SCS:

$$D = d + 2.n.t + \delta$$

12. Se calculeaza ΔP prin aparat.

# SCHIMBATOARE DE CALDURA SPIRALE

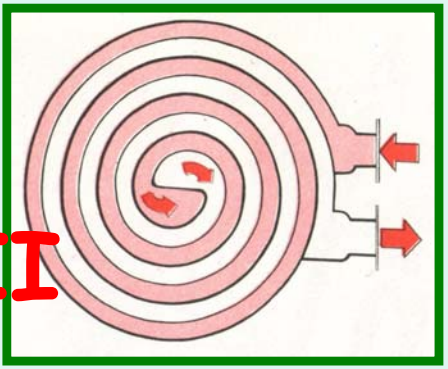
## DIMENSIONARE II



1. Se calculeaza $T_{med\ 1}$ si $T_{med\ 2}$ si se determina proprietatile fluidelor;
2. Se calculeaza sarcina termica a SCS (din BT);
3. Se calculeaza $\Delta T_{med}$;
4. Se estimeaza valoarea lui K;
5. Se calculeaza A din ec. transferului termic;

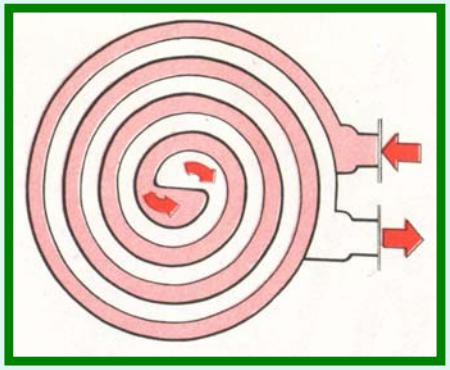
# SCHIMBATOARE DE CALDURA SPIRALE

## DIMENSIONARE II



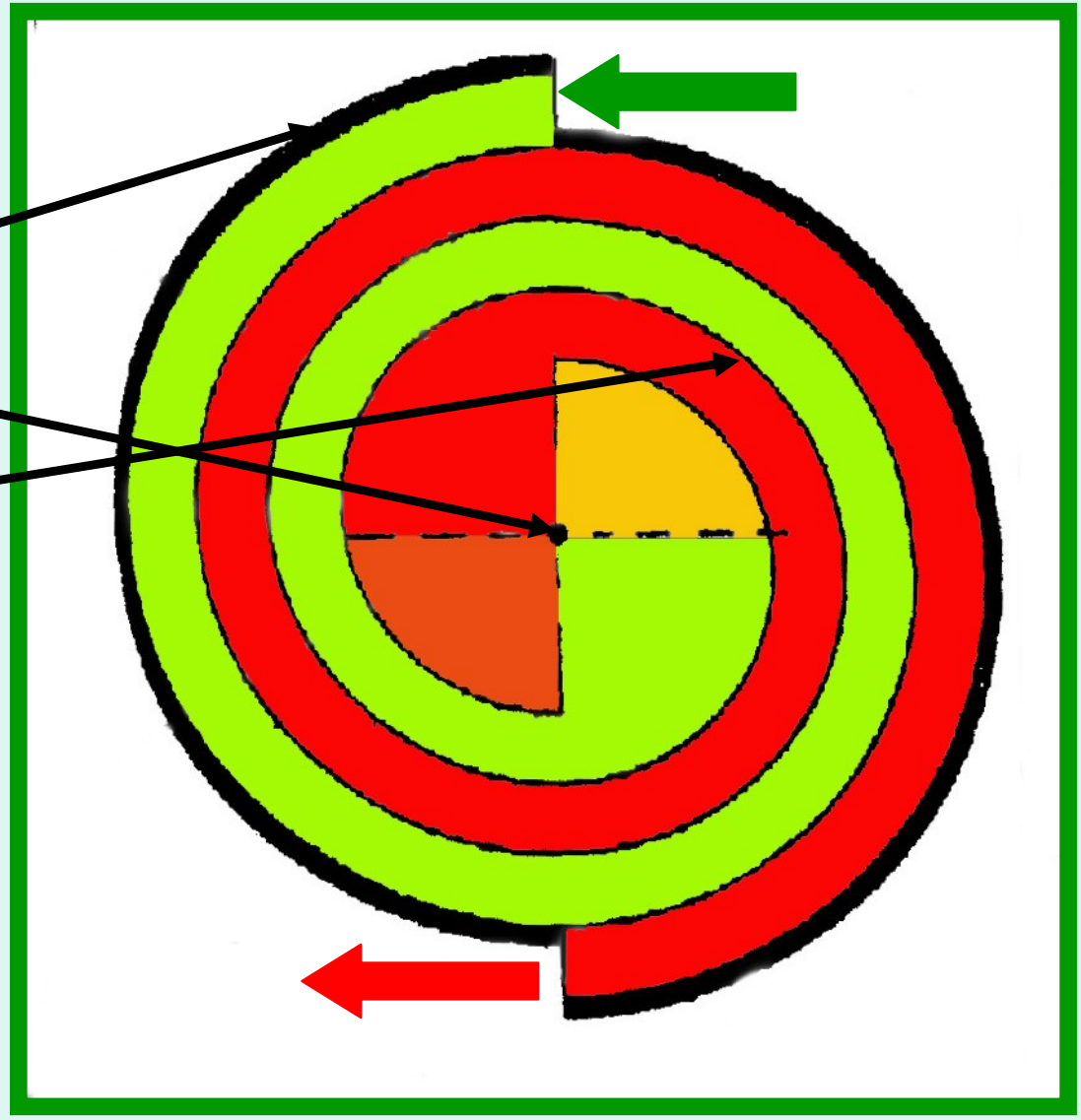
6. Se aleg (din tab.) valorile recomandate pentru vitezele fluidelor prin canale si se calculeaza sectiunea canalului;
7. Se alege latimea foii spirei;
8. Se calculeaza latimea canalului (din aria de curgere);
9. Se determina diametrul exterior al SCS;
10. Se calculeaza $\Delta P$ prin aparat.

# SCHIMBATOARE DE CALDURA
# SPIRALE SPECIALE



## INCINERATOR CATALITIC PENTRU AER CONTAMINAT

1. Izolatie termica;
2. Rezistenta electrica;
3. Strat catalitic;
4. Intrare curent rece;
5. Iesire curent incalzit.



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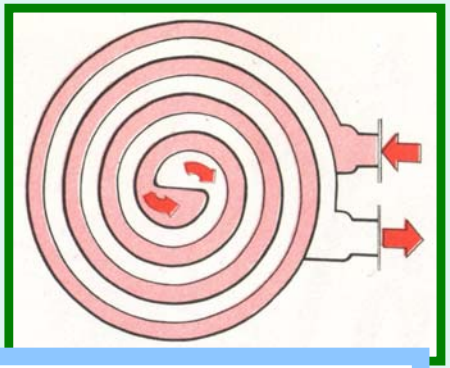
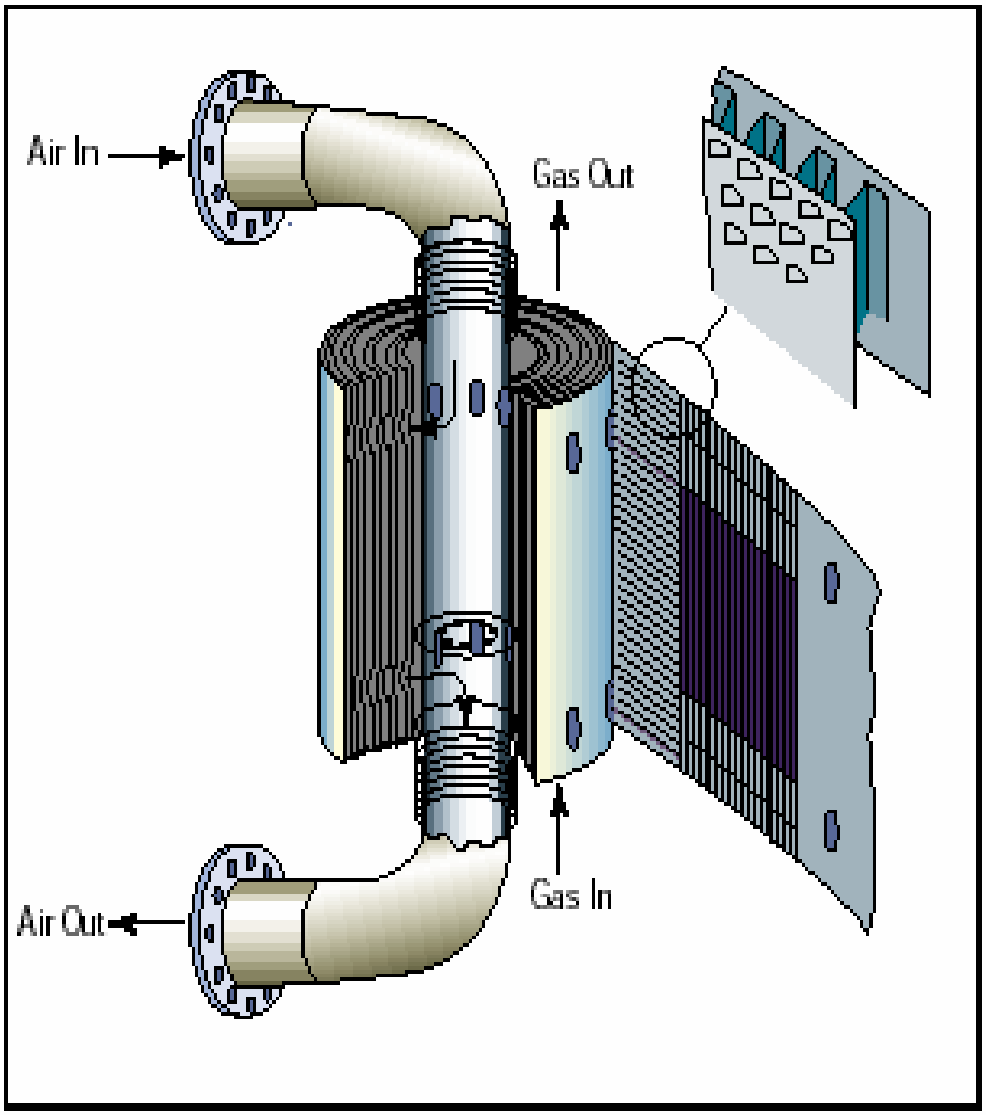


## RECUPERATOR DE CALDURA SPIRAL



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# SPIRALE SPECIALE