

The Economics of IRTC* Systems

40% faster make-ready

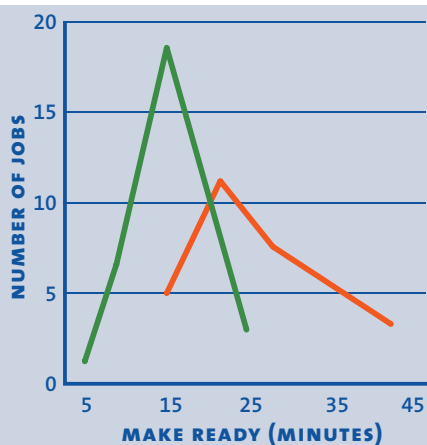
15% increased speed

30% greater capacity

57% fewer adjustments

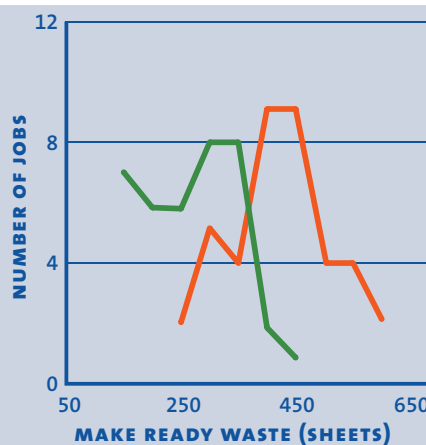
36% less waste

Faster Make Ready



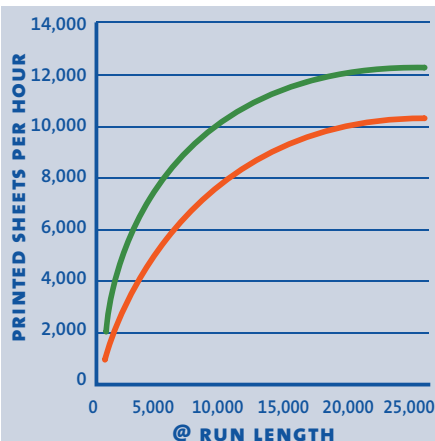
— Without IRTC
— With IRTC

Less Waste



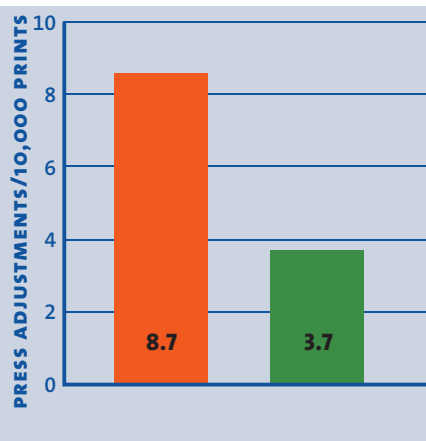
— Without IRTC
— With IRTC

Greater Production Capacity

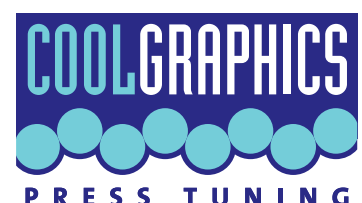
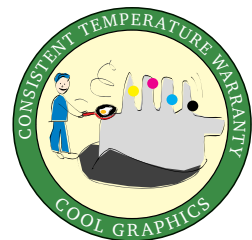


— Without IRTC
— With IRTC

Fewer Press Adjustments



— Without IRTC
— With IRTC



*Ink Roller Temperature Control

A study by a leading press manufacturer shows that 65% of all fluctuations in printing quality are caused by variations in ink roller surface temperatures.

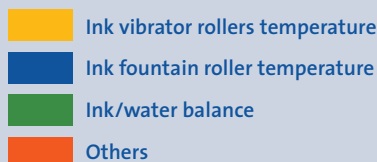
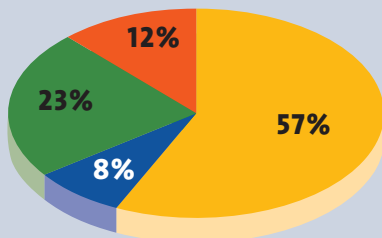
The correlation between printing quality and ink roller temperature is the ink viscosity, which is temperature sensitive. A variation of 1.0°C (1.8°F) changes the viscosity with 10% in conventional wet- and 5% in waterless-offset. 57% of the temperature variations come from the vibrator rollers and 8% from the ink fountain roller.

23% of the quality fluctuations are caused by variations in the ink/water balance, which again is affected by fluctuations in both inks and dampening water.

The quantity of dampening water on plates and rollers fluctuates with two parameters:

- **Surface tension**
(sensitive to the concentrations of IPA and fountain solution)
- **Viscosity**
(sensitive to temperature and concentration of IPA)

Conventional wet-offset Quality Fluctuation Causes



Fluctuations in the ink/water balance depend consequently on variations in ink viscosity (ink roller surface temperature), dampening water surface tension (dampening water quality) or dampening water viscosity (dampening water temperature and quality)—or on fluctuations in all three parameters at the same time!

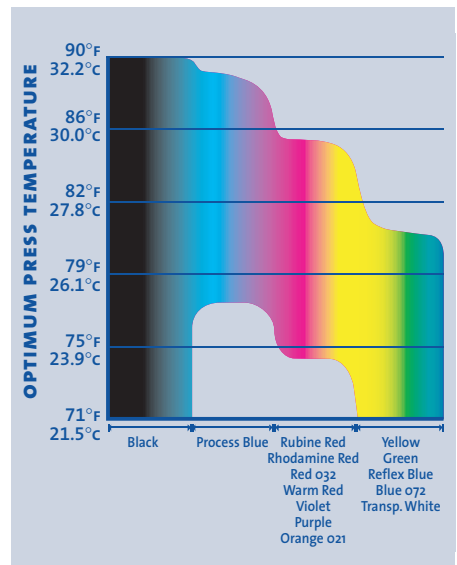
The remaining fluctuations (12%) come from other factors such as pressroom temperature and relative humidity.

TEMPERATURE CONTROL IS PREVENTION

The difference between preventing or correcting printing quality fluctuations has a fundamental impact on loss of production time and waste. Prevention does not generate loss or waste, while correction does.

The best IR sensors react to temperature fluctuations of 0.01°C (0.018°F) in less than 0.1 sec. They perform a continuous, dynamic control and measure directly where the fluctuations take place: on the rollers or on the plate surfaces. If the IRTC (Ink Roller Temperature Control) system is powerful, the time lag between detection and correction is nearly zero. In practice, this prevents any fluctuation in printing quality, because it is detected and corrected automatically even before the most skilled eye, densitometer or spectrophotometer observes anything.

Even the best press operator, assisted by the most advanced close-loop quality control system, cannot detect any quality fluctuation, before it is visible or measurable on sheets in the delivery pile. Obviously fluctuations are not prevented, but corrected, which means that bad sheets have been produced, waste has occurred, and a time to reproduce what was wasted is required. It is impossible to put specific figures on this waste and lost

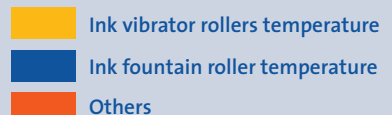
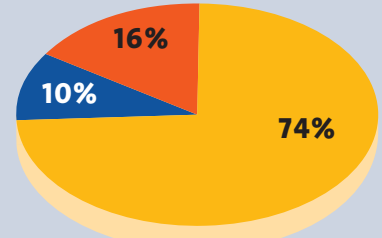


production time, because it depends on the skill of the printer and—in case of automatic quality control—how often sample sheets are controlled. But two facts are important to remember:

- **The printing process is dynamic**, so when quality fluctuations reach an unacceptable level, several sheets have already been produced with a nearly unacceptable level. (Decreased average printing quality or increased waste.)
- **It takes time to make a correction**, so after a correction it takes time for the press to get back to the new corrected settings.

If the press is running with 15,000 iph, it produces 250 sheets per minute. If it runs one minute with an unacceptable quality and it takes one minute to perform the corrections and one minute to get back to the correct settings, 750 sheets and 3 min-

Waterless-offset Quality Fluctuation Causes



utes have been wasted. It will take another 3 minutes to substitute the wasted sheets with good ones.

For many the advantage of an IRTC system is to make it possible to print during extreme temperature situations. But the real advantage of IRTC systems is the extremely fast and highly efficient quality control, which detects and corrects quality fluctuations quickly and in this way improve the average printing quality, productivity, profitability and convenience of operation.

A PRINT TEST AND A TEST PRESS

To optimize the printing quality the correlation between advanced IRTC systems and printing quality was studied. The test press was a fully equipped 4-color, 16,000 iph, 40" press with the newest spectrophotometric close-loop quality control system. The chosen total-zone IRTC system included one temperature circuit per roller per unit (16 in total).

62 different jobs were printed, 38 with IRTC and 24 without.

WATERLESS OFFSET

The test was made in conventional wet-off-set. Waterless offset has no ink/water balance so switching to this process should in principle eliminate 23% of all printing problems in conventional wet offset.

But waterless offset inks are only half as temperature sensitive as conventional wet-off-set inks, so fluctuations in printing quality within a given temperature range are also halved. Press adjustments and waste during make-ready and printing should in principle also be the half, reducing the overall printing problems with even more than 23%. On top of this, maintenance of the dampening system is eliminated, which changes down time into production time,

Faster Make Ready



Less Waste



while the costs for maintaining the dampening system (rollers wear and tear) at the same time is eliminated.

40% REDUCED MAKE-READY TIMES

Without total-zone IRTC the make-ready times varied between 15 and 40 min. (@ 22.2 min.) With total-zone IRTC the fluctuation was between 5 and 25 min. (@ 13.3 min.). A reduction of 40% (8.9 min.). The difference between the quickest and slowest make-ready was reduced from 25 to 20 min. So total-zone IRTC reduced both the average make-ready time and variation around it.

Today's typical job has a run length of 5,000 or less. With an average make ready time of 20 min. and high printing speeds, the average production time is 45 min., which makes room for 10 jobs per shift.

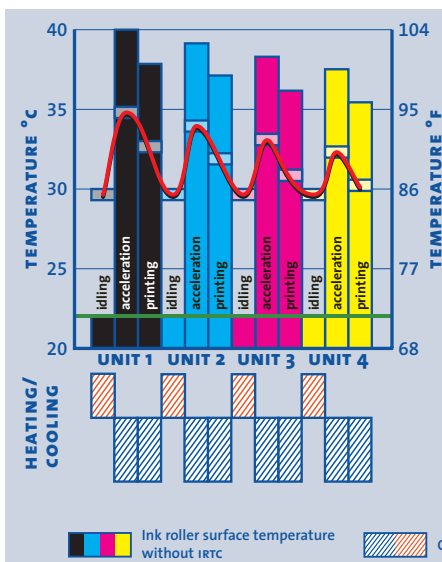
Adding total-zone IRTC saves 89 min. per shift and allows for 2 extra jobs.

The additional savings for waterless offset are app. 4 min. per job, which makes room for an additional third job.

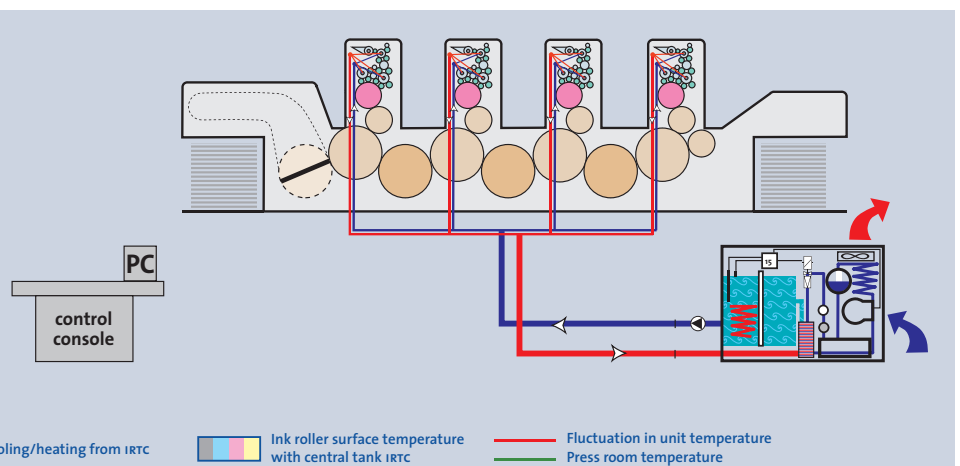
36% REDUCTION IN WASTE

The waste for the 62 jobs fluctuated between 250 and 600 (@419) without, and 150 and 430 (@ 268) with total-zone IRTC. The average reduction was 151 sheets or 36%. This corresponds to 1,510 sheets at 10 jobs per day. (As total-zone IRTC increased the capacity to 12 job, the saving is actually 1,812 sheets).

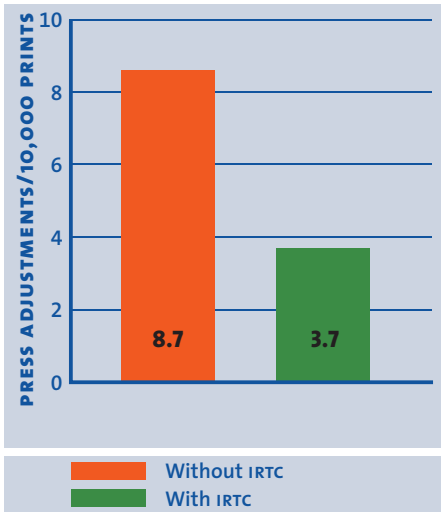
Printing in waterless offset saves an additional 30% waste. This corresponds to 45 sheets extra per job. The total savings for the 13 jobs are 2,548 sheets, where 585 come from printing waterless offset.



1 Cooling Systems: one cooling system with heater for all printing units



Fewer Press Adjustments



57% REDUCTION IN RUNNING ADJUSTMENTS

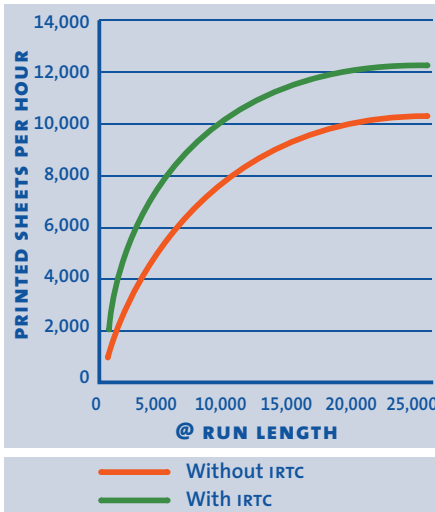
Press adjustments for ink duct sweep, profile and ink/water balance during printing was reduced 57% from once every 1,153 sheets to once every 2,702 sheets. This means that necessary press adjustments to maintain the quality at 15,000 iph were reduced from once every fourth to once every tenth minute.

The test does not report about the running waste, but a logical assumption should be that the reduction in running waste corresponds to the 57% reduction in running adjustments.

15% INCREASED PRODUCTION SPEEDS

Very few printers have succeeded in making their presses run full speed under normal working conditions, except for longer runs. The reason being that the required adjustments to reach a higher speed takes so much

Greater Production Capacity



more time that the job is produced faster at a lower speed with less adjustments.

An advanced IRTC system reduces the running adjustments and makes it easier to print with a higher press speed. The reduction in running adjustments and running waste also change down time into production time, so the production speed will actually increase even more than the press speed and can easily increase with 15%. This figure depends on the run length and will increase the shorter it is.

30% IMPROVED PRODUCTION CAPACITY

40% improved make-ready times and a 15% improved production speed give an improved printing capacity. (This depends on the average run length. A typical run of 5,000 copies is produced roughly 32% faster, and in even shorter runs the improvement can exceed 50%.)

The general assumption is that IRTC systems are only important for long runs. But real IRTC systems, which maintain a specific and consistent temperature based on both cooling and heating capabilities to maintain a consistent ink dot has its most significant impact on shorter runs.

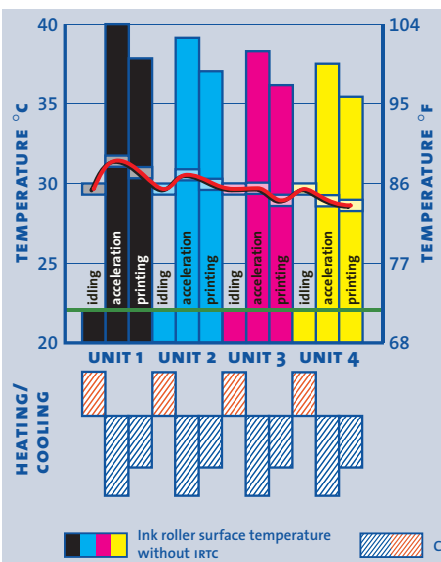
This is because it is temperature fluctuations—not temperature levels—that create the variations in printing quality. Temperature fluctuations are generated by fluctuations in heat generation, which occur in connection with make-readies and variations in printing speed. It is the starts/stops and the acceleration/deceleration of the press, which generates the quality variations. This will happen until the press has obtained its stable printing speed. Then the heat fluctuations, but not heat generation, stop.

At a stable high printing speed any press generates heat. The simple question is, if it generates more than the pressroom air can absorb. (This depends on the size of the pressroom, air circulation and outside air temperature). If the press generates more heat than the air can absorb, it will continue to get warmer and sooner or later the offset process collapses. In such situations press cooling is required. It is easy for an IRTC system to prevent a press from overheating.

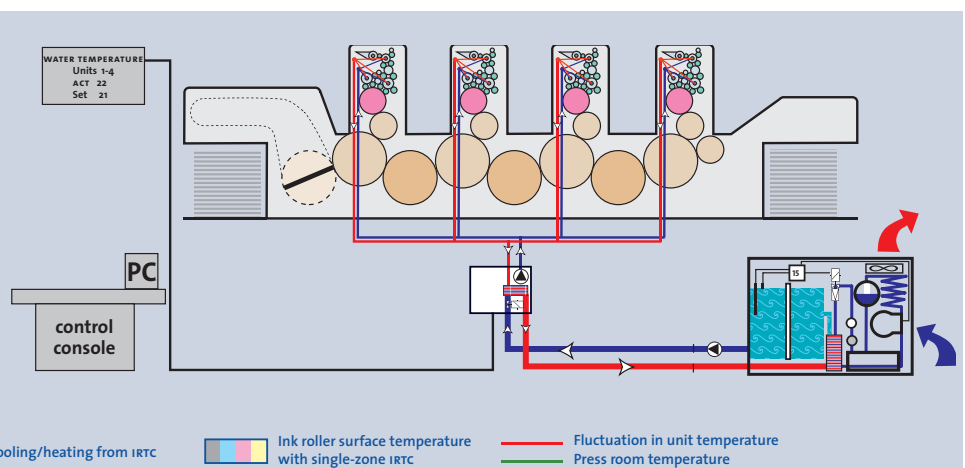
Reacting to a lot of fluctuations in heat generation is a much more complicated job. Reacting to large fluctuations requires much more cooling and heating capacity, a high flow and quick reacting sensors and controllers. So it is a much bigger challenge for an IRTC system to maintain a specific temperature than simply perform cooling.

THE EFFICIENCY OF VARIOUS IRTC CONCEPTS

The market considers IRTC systems as anything from simple cooling systems to the



2 Single-zone IRTC systems: one joint temperature circuit for all printing units



most sophisticated IRTC systems controlling each chilled roller in each unit with its own temperature circuit and IR sensor.

The market also considers that advanced multi-zone IRTC is only required in waterless offset, while single-zone IRTC is good enough for conventional wet-offset. This consideration is based on the assumption that the objective is to prevent overheating, while maintaining a consistent printing quality during both make-ready and printing simply is forgotten. As the viscosity fluctuations for conventional wet-offset inks within a specific temperature range is the double of waterless ink's, and as the ink/water balance also is temperature sensitive, the conventional wet-offset process is a much more obvious candidate for multi-zone IRTC.

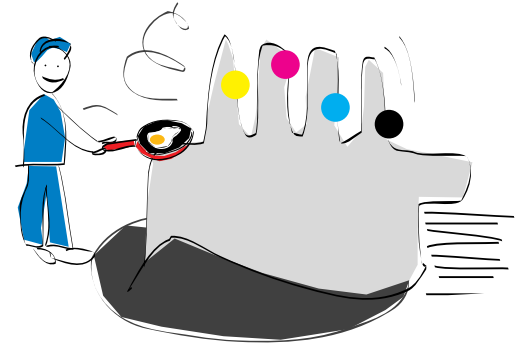
No tests are available showing the performance differences between the various system configurations, but some conclusions can be made from the press manufacturer's observations for advanced IRTC systems.

1 Cooling systems: one cooling circuit for all printing units

A cooling system without heating only prevents the press from exceeding a specific temperature. Below this temperature the system has no impact on press. The ideal pressroom temperature is 22°C (72°F), while the ideal IRTC water temperature (depending on the press) in conventional wet-offset is 24-28°C (76-82°F), so the cooling system will not have an impact on temperature fluctuations during make-ready and short run printing. (The cooling water can never be warmer than the temperature in the area, where the cooling system is installed).

The test figures show that around 55% of the advantages of a real IRTC system are

Relative Increase in Production Capacity



A modern offset press generates a significant quantity of heat, when it prints. Without an IRTC system only the dampening water and the air in the pressroom can cool it.

related to make-ready, so depending on the run length the efficiency of a cooling system is between 0% and 45% of an advanced IRTC system. Cooling systems are, however, excellent to maintain a consistent press temperature and prevent overheating during longer runs.

The cooling system can be improved by adding an immersion heater in the water tank. This makes it possible to select a correct water temperature above room temperature and obtain some impact on temperature fluctuations during make-ready too.

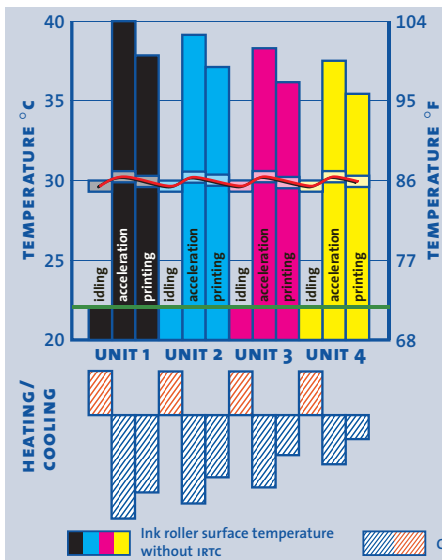
Ideally IRTC systems should adjust their cooling capacity dynamically to the fluctuations in the press' heat generation to maintain a consistent press temperature. This can be done by either adjusting the flow rate or the water temperature. A cooling system (also with an immersion heater) with a large water tank, one central circulation pump and a constant water tem-

perature cannot do this. Its cooling capacity will always remain constant, and therefore fluctuations in the press temperature (and printing quality) will occur during make-ready—or until a constant production speed is obtained.

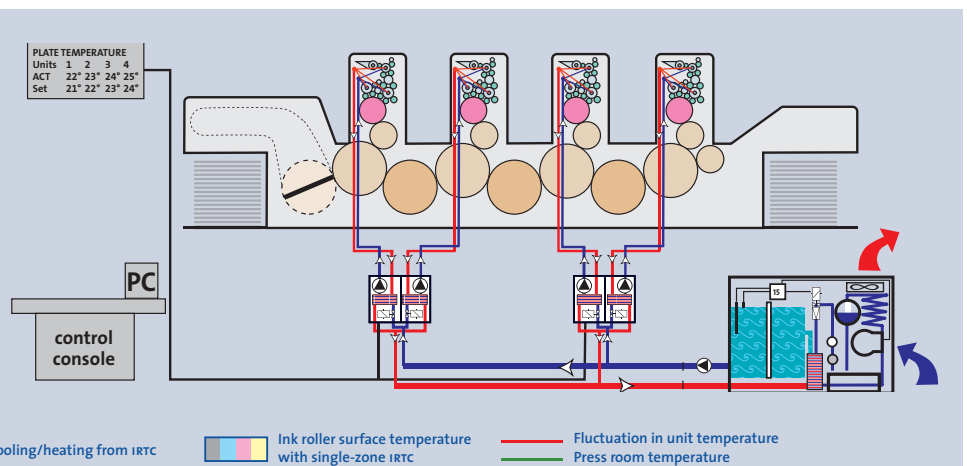
It is impossible to apply IR sensors, as it is impossible to change the water temperature in relation to heat generation.

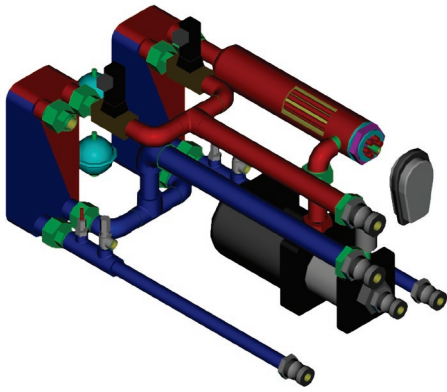
2 Single-zone IRTC systems: one central temperature circuit for all printing units.

Single-zone IRTC systems maintain a water temperature depending on the press' total heat generation. With a small quantity of water in the central temperature circuit a single-zone system adjusts its cooling capacity by adjusting the water temperature. An increased press heat generation will be compensated by a reduction in the IRTC water temperature. Single-zone IRTC systems



3 Multi-zone IRTC systems: one separate temperature circuit for each printing unit





The internal components of the Cool Graphics irtc system with one closed temperature circuit per printing unit. Each circuit has its own plate heat exchanger, circulation pump and heating element. The flow of cold water through each printing unit is constant (and high) as the cooling capacity is regulated via the flow of cold water into the secondary side of the heat plate exchanger.

can maintain the overall press temperature at a constant level during both make-ready and printing.

The heat generation in a printing unit depends on the press speed, roller frictions, type of inks and form of jobs. Big solids give more heat generation than small text areas. The test figures show a difference in heat generation of up to 30% between the units during printing. Even the most powerful single-zone IRTC system can never compensate for these fluctuations and therefore fluctuations in the individual unit temperatures and printing quality will occur.

It is not practical to apply IR sensors, as it is impossible to determine, which printing unit shall control the total system.

3 Multi-zone IRTC systems: one separate temperature circuit for each printing unit

Multi-zone IRTC systems have one temperature circuit per printing unit, which can match the heat generation from its printing unit independently of the heat generation in the other units. This is the only way to maintain the same consistent temperature in all printing units during make-ready and printing without considering the fluctuating heat generation coming from press speed,

roller frictions, printing inks and different job forms. Multi-zone systems can also maintain temperature differences between the printing units. This is a clear advantage as each printing ink has its own ideal temperature, and this is very important in relation to PMS colors, which are much more temperature sensitive than process colors.

4 Multi-zone IRTC systems with IR sensors: one separate temperature circuit for each printing unit controlled by an IR sensor

IR sensors can be used with multi-zone IRTC systems to maintain a consistent unit temperature. The sensors will measure either on the plate surface or on a form roller. This will allow the system to maintain a constant ink roller surface temperature instead of a constant water temperature (inside of the rollers).

5 Total-zone IRTC systems: one separate temperature circuit for each chilled roller in each printing unit

One separate temperature circuit for each chilled ink roller in each printing unit makes it possible to compensate for the variations in heat generation within a printing unit.

This gives a more consistent flow of inks and a faster reaction to temperature fluctuations. The test figures show significant temperature fluctuations between the 3 vibrator rollers. The upper vibrator consumes around 40% of the cooling power, while the 2 lower vibrators in contact with the form rollers consume 26% each. The ink fountain roller consumes the remaining 8%. These figures will vary with the configuration of the inking system, and presses with 2 chilled vibrators will require an increased cooling consumption for the ink fountain roller.

A total-zone IRTC system gives the ultimate control over the heat generation and the most consistent flow of inks through the inking system.

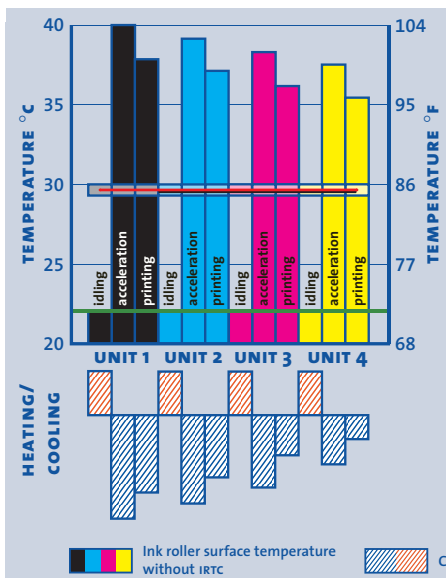
IR sensors can be used to maintain a consistent unit temperature. Measuring directly on each chilled roller significantly reduces the reaction time to temperature fluctuations, which implies a more consistent printing quality

SEPARATE INK FOUNTAIN ROLLER CONTROL

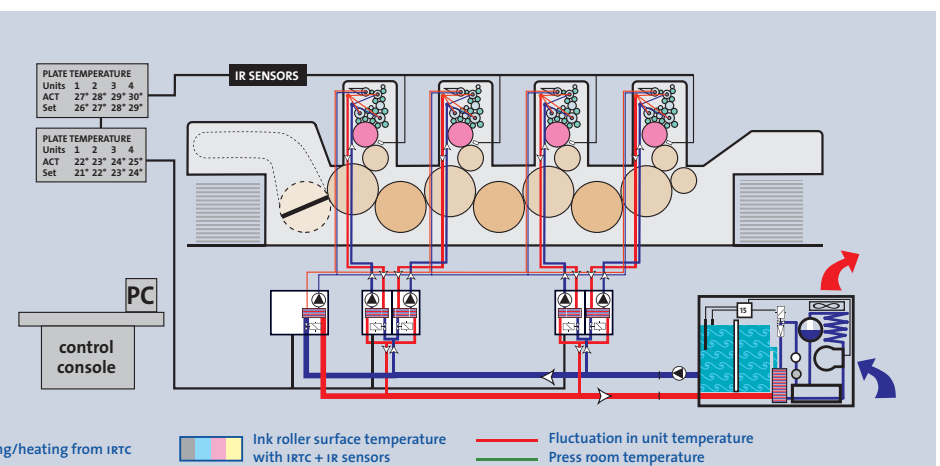
The heat generation in the ink fountain roller is totally different from the vibrator rollers, so it is advisable to keep the fountain rollers in separate temperature circuits.

Plate scanners and ctp equipment base their function on a correlation between the amount of inks on a specific area and an ink key opening. This is calculated as a figure between 0% and 100%. The assumption is that a specific mechanical ink key opening always will give a specific amount of ink on the sheet. But this is only the case at a specific ink viscosity.

To get the best efficiency of modern *pre-press* equipment it is fundamental that *the press* operates under controlled conditions, where the ink film on the fountain roller is consistent and corresponds to the ink film



4 Multi-zone IRTC systems with IR sensors: one separate temperature circuit for each printing unit (shown here with a separate temperature circuit for the fountain rollers.)





Cool Graphics Aquacool Compact and Jumbo remote water coolers are easy to install. If the Aquacools are installed in a remote area, they remove a significant quantity of heat from the press, making it easier to maintain a consistent temperature and humidity (and printing quality) in the pressroom.



One or more compact irtc boxes each with 1 or more temperature zones can be installed next to each other under the catwalk or as a compact tower configuration next to the press

assumed by the pre-press equipment. This can only be obtained with a consistent ink viscosity, which assumes a consistent ink temperature.

COST VS. PROFIT EVALUATION

Controlling the press' temperature creates reductions in costs and an increased production capacity. There are two different ways to evaluate the return on the investment in an IRTC system:

- Investment vs. the reduced costs
- Investment vs. the sum of improved earnings and reduced costs

REDUCED COSTS

The simplest way to justify an IRTC investment is to look at the waste reductions. Measured on a two shifts operation the pay back times for all 4 alternatives are between 1 and 2 years. The multi-zone IRTC system performs better than the single-zone system, which again performs better than the simple cooling system.

This evaluation method is correct if fast delivery times, reduced working times or increased printing capacity is without importance. This is the case, if the capacity of the press is only partly used.

IMPROVED EARNINGS BY IMPROVED CAPACITY

The correct way to evaluate an IRTC investment includes the improved earnings obtained from increased production capacity. This way of calculating assumes that the increased production capacity can be sold. There might be a lot of reasons for a print shop to have some excess production capacity, but in general the capacity must correspond to the sales, so the optimal use of the production plant is reached. Anything else does not make sense.

We base our evaluation on the assumption that the additional printing capacity can be sold. In this case the pay back times drop to between 6 months or less! The advanced IRTC systems are the best performers and the differences in increased profits between the various system configurations are dramatic.

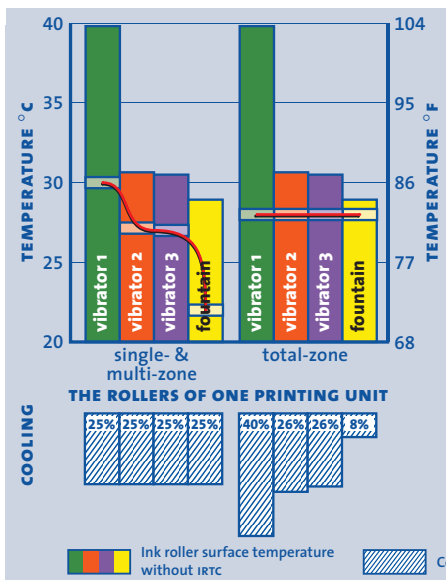
With an average run length of 5,000 copies, an average job is produced in 45 minutes. This gives around 2.5 million additional good sheets per shift per year. As a significant part of the productivity increase comes from reduced make-ready times, the relative advantage will increase the shorter the run length. The gross profit from these sheets is in fact a net profit going directly

to bottom line, because overheads—the printing equipment and its manning—remain the same.

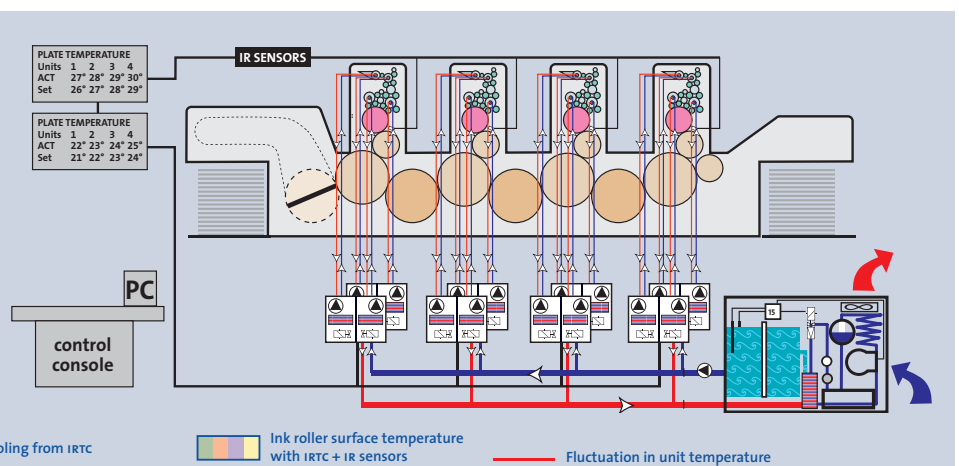
WATERLESS OFFSET

Most printers consider waterless offset to be an expensive printing process for superb quality printing, because of the costs of the plates. The assumption is that the savings in paper waste, alcohol and other materials do not justify the increased plate costs. It is correct that the plates are more expensive, and it is correct that waterless offset has a competitive edge in the segment for superb printing quality. But it is also excellent for normal printing, and here it is much more important to focus on the improved printing capacity and the improved convenience in operating a press without the complicated ink/water balance.

With an advanced IRTC system, the extra production capacity for printing in waterless offset is around 23% (measured against a wet offset press using the same sophisticated IRTC system)—or 380 hours per shift per year. The earnings from this extra capacity plus the savings in waste and materials generate an increase in gross profit, which far exceeds the additional costs of the plates.



5 Total-zone IRTC systems with IR sensors: one separate temperature circuit with IR control for each roller per printing unit



“A study by a leading press manufacturer shows that 88% of all fluctuations in printing quality are caused by variations in ink roller surface temperatures and ink/water balance.”



| værdier kaldet det nu tryk i rdk rdk kldk kaldt i tryk | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|
| digiprint | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt |
| digiprint | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt |
| digiprint | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt |
| digiprint | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt |
| digiprint | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt |
| digiprint | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt |
| digiprint | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt |
| digiprint | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt |
| digiprint | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt |
| digiprint | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt |
| digiprint | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt |
| digiprint | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt |
| digiprint | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt |
| digiprint | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt |
| digiprint | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt |
| digiprint | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt |
| digiprint | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt | 10pt |
| digiprint | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt | 8pt |
| digiprint | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt | 6pt |
| digiprint | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt | 5pt |
| digiprint | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt | 4pt |
| digiprint | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt | 3pt |
| digiprint | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt | 2pt |
| digiprint | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt | 1pt |

Cool Graphics has developed a computer program, which makes it possible to evaluate the impact of IRTC systems under various conditions. Make ready times, running speeds, run lengths, material costs etc. can be adjusted to simulate various printing conditions. The program can be obtained by contacting Cool Graphics or its representatives.

This half of the color bar shows reflex blue printed at ideal temperature conditions.

Waterless offset allows printing negative type at smaller point sizes

10pt + 45 3940 2012

8pt + 45 3940 2012

6pt + 45 3940 2012

5pt + 45 3940 2012

4pt + 45 3940 2012

3pt + 45 3940 2012

2pt + 45 3940 2012

1pt + 45 3940 2012

This half of the color bar shows reflex blue printed at a variant temperature. The ink is the same but a change in the color is visible due to the temperature variation.

10pt + 45 3940 2012

8pt + 45 3940 2012

6pt + 45 3940 2012

5pt + 45 3940 2012

4pt + 45 3940 2012

3pt + 45 3940 2012

2pt + 45 3940 2012

1pt + 45 3940 2012



Cool Graphics ApS
Strandvejen 203, 2900, Hellerup, Denmark
Tel: 45 3940 2012 | Fax: 45 3940 2022
E-mail: sales@coolgraphics.dk
www.coolgraphics.dk

Cool Graphics is a Danish company, which develops and manufactures dampening water premixers, ink roller temperature control systems and other ancillary equipment for offset presses to improve press performance, productivity and impact on the environment.

PRODUCT LINE



Aquacool Compact & Jumbo compressor water coolers with water/air and water/water condensers



FreeCool remote condenser for nature's own cooling (free of charge) of ancillary equipment



Ecotemp & Digitemp single- and multi-zone ink roller temperature controllers



Clearwater Combi is a compact combination of a fast flow high filtration dampening water circulator and a powerful single-zone ink roller temperature controller



Clearwater Digimix RO combines a reverse osmosis system (RO) with digital doser pumps and a premixer tank into a total dampening water premixer system.