VICINAY CADENAS, S.A.
BILBAO

# SYNTHESIS REPORT
# Project: Brite 5309 "QWELD"



September 96

## *Synthesis Report*

### 1. QWELD **PROJECT OBJECTIVES**

As described in 1992, the basic objectives of the Qweld project were as follows:

1 Achieve a level of quality assurance in the production of welded products, and in particular links of chain welded using the ***Flash butt*** *welding system,* which would mean that not all of the weld inspections would have to be performed.

2 Reduce quality costs from 16% to **6%** including industrial problems like defects, rejects, repairs, recoveries, unnecessary inspection times, queues of products with processing unfinished because they are in interrnediate processes, warehouse surpluses, etc.

3 Reduce chain weight by 15% to enable the manufacturer to produce these goods with material weighing 1 00Mpas when the current standards reach 860' Mpas.

4 Develop a theoretical and scientific quality control system that enables the manufacturer to control 20 parameters of the welding process in 'real time.

5 Enable the gathering and management of information in a highly polluted industrial environment, particularly electromagnetic and solid particle pollution;

6 Incorporate in each individual manufacturing phase data coming from the raw material, heat treatment, load tests, etc.

'7 Full traceability in the products "mentioned to each individual manufacturing phase of the industrial high-tech chain process.

'S Lay the foundations for a standard or, at least, a pre-standard applicable to manufacture and placement on the high-tech chain market.

Success of each phase measured in ascending order from 1 to 10.

## 2 COMPARISON OF ORIGINAL FEATURES AND OBJECTIVES ACHIEVED

Of the above points, the following has been achieved:

*1 Reduction to a **level** lower than 100% of link inspections*

This was not achieved as the cases of potential defects in links makes it unadvisable.

Even so, the capacity to recognise in real time many of the links that may be defective was achieved. Such identification is estimated at 80°/0 of all cases. Coverage: 8.

*2 **Reduce** quality **costs from 16%** to* 6 %

The figure of 6% was studied in great detail, and it soon became clear that it was not a realistic target, as not even firms with the highest quality levels in the world achieve it. In the case of Vicinay Cadenas, the figure was reduced from 16% to 12%, giving a coverage level of: 7.

3 *__Reduce__ chain weights by __up__ to __15%__*

As a consequence of the project, chains of 1000Mpa were achieved and an alternative product known as VGW was also developed. Between the two, chain weights are being reduced by up to 30%.

The project has given rise to a new product project known as UCL which aims to reduce chain weight by up to 60%. Coverage: 9.

*__4 Do__ the theoretical and __scientific__ groundwork required to __handle__ 20 parameters of the weld process in __real__ time*

Up to 30 parameters were controlled and managed, some of them with a read-off frequency of one reading per 10 millisec. Coverage: 8.

5 *Work in* ***an industrial*** *environment*

Work was carried out in highly-polluted industrial environments, with electromagnetic and dust pollution produced by the solidification of liquids and metal vapour emitted during the welding process.

Seii has also been able to apply Qweld project technology to gathering environmental information to control critical parameters in large cities, and in, among others, the oil, petrochemical, chemical and metal industries. Coverage: 8."

6 *Incorporate each* ***industrial phase*** *of the welding process from raw material* ***to*** *treatment and* ***load testing***

By the end of the project, a system had been developed to predict the mechanical properties of the materials according to the chain manufacture and heat treatment parameters.

A new project called ***QHeat*** was developed. In the new project, the heat treatment system is subjected to controls as accurate and rigorous as those in ***Qweld***.

A non-destructive, ultrasound inspection system, known as ***Quse***, was also developed. Here all the information is computerised and related to the individual links developed with full traceability in ***Qweld***.

In this heading, the project was essential to progress in chain manufacturing technology. Coverage: 8.

7 *Ensure* ***full*** *traceability for each individual phase of* ***the*** *links*

The traceability required was achieved by incorporating all the relative movements of position of the links throughout the industrial process.

This fact is particularly relevant bearing in mind that the links do not have individual identification using bar or alphanumerical codes. Nevertheless, with the current system, the Traceability safety level is 70%, which increases to 95% with manual aid.

This is one feature being improved in the foil owing phase of the project which Vicinay Cadenas has just contracted out to the Labein Technology Centre in Bilbao. Coverage 7.

*8 Development of standards for manufacture and use of high-tech chains in the offshore industry*

***Det Norske Veritas*** has developed a standard known as CN:6 which came into effect for the whole high-tech c1 iain market in July 1996. Coverage: 8.

In view of these results, the project can be considered a complete success from the scientific point of view, although the parties acknowledge that industrial development for its market placement is rather less advanced in the areas of welding, However, it has provided exceptional grounding for its application in other industrial areas such as the environment.

## 3. RESOURCES

**To** achieve the objectives mentioned at the beginning, neither of the main contractors, i.e., Vicinay Cadenas, S.A. and Seii (with between them more than 90°A of the responsibility for the project), have spared either human or technological resources.

The fact is that Sei suffered severe economic problems that led to the company being declared bankrupt. The new owners of the firm, the *Fournie-Grospand* group, made an enormous effort, actually taking the risky decision to commit part of the future of the ncw company to

satisfying in, full the previously-acquired commitments of the original firm.

Vicinay Cadenas also made a remarkable effort, with 4 staff members giving 100% of their time to the project throughout the 3 and a half years of its duration.

Vicinay Cadenas also acquired the computer equipment it needed to make a prototype unit and spread knowledge and application to the industrial units.

The extension of the application to the industrial world threw up stiff resistance, which has compelled the firm to prolong the project, internally at least, for a further year. In this case, the extension is being performed under an agreement signed, with the Labein technology centre in August 1996.

## 4. CONCLUSIONS

The project can be considered reasonably successful. As mentioned earlier, the main objectives were achieved, some to as much as 90°/0, with others to a lower, although still highly significant, percentage.

The main contractors, Vicinay Cadenas and Seii, have both improved their positions in their specific markets, thanks to. the performances achieved in the project.

The former because it has gained status as a leader on the world high-tech chain market, through having been the undisputed champion of *new* products such as:

- Studless chains and **VGW** chains.

- Development of **UCL** chains, a new, potentially revolutionary product which should be out on the market by 1999.

- Vicinay has also taken advantage of the technological and development know-how thrown up by the project to start parallel research projects, such as:

  - Fatigue on real scale, with the Labein technology centre

  - *Qheat*, for the control and traceability of continuous heat treatments, run by Vicinay staff

  - *Quse*, for computerisation and digital treatment of nondestructive, particularly ultrasound, test inspections

As a consequence of the Qweld project, information from all these projects can be threaded and then linked to an individual component, thereby providing a. history of all the significant events in the production cycle of the individual product in question, beginning with the raw materials and ending with the final part of the manufacturing process.

## 5. ACKNOWLEDGEMENTS

Qweld project management would like to thank all the members of the project for their efforts, dedication and interest. A good, cooperative working environment was created between everyone involved, proving vital to the success of the project, the achievement of the objectives and the results presented herein.

## 6. TABLES

Diagrams of the most significant parts of the Qweld, Qheat and Fatiga project-all of them linked in the Master Qweld project—are attached.

Presion de recalcado

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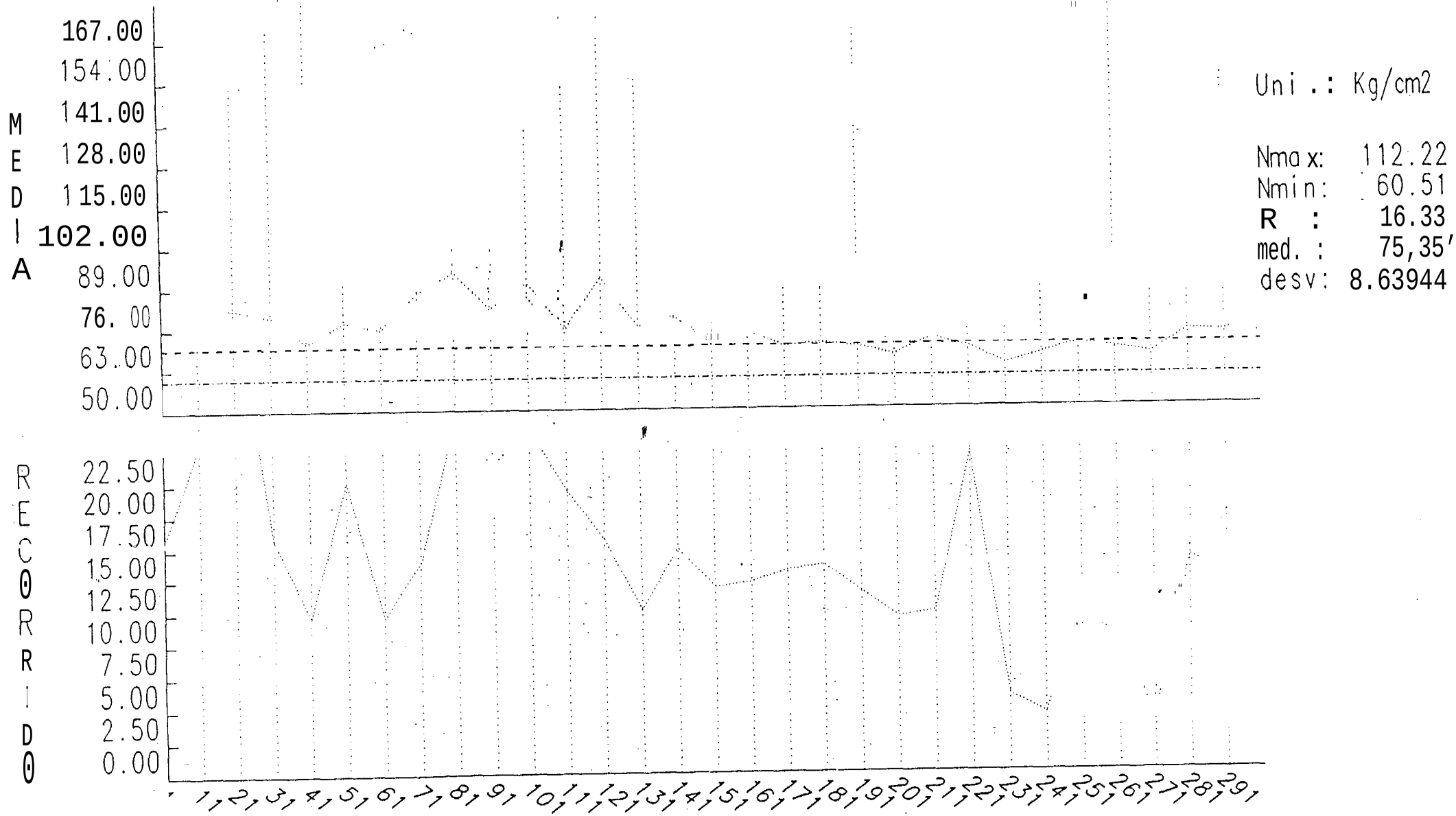
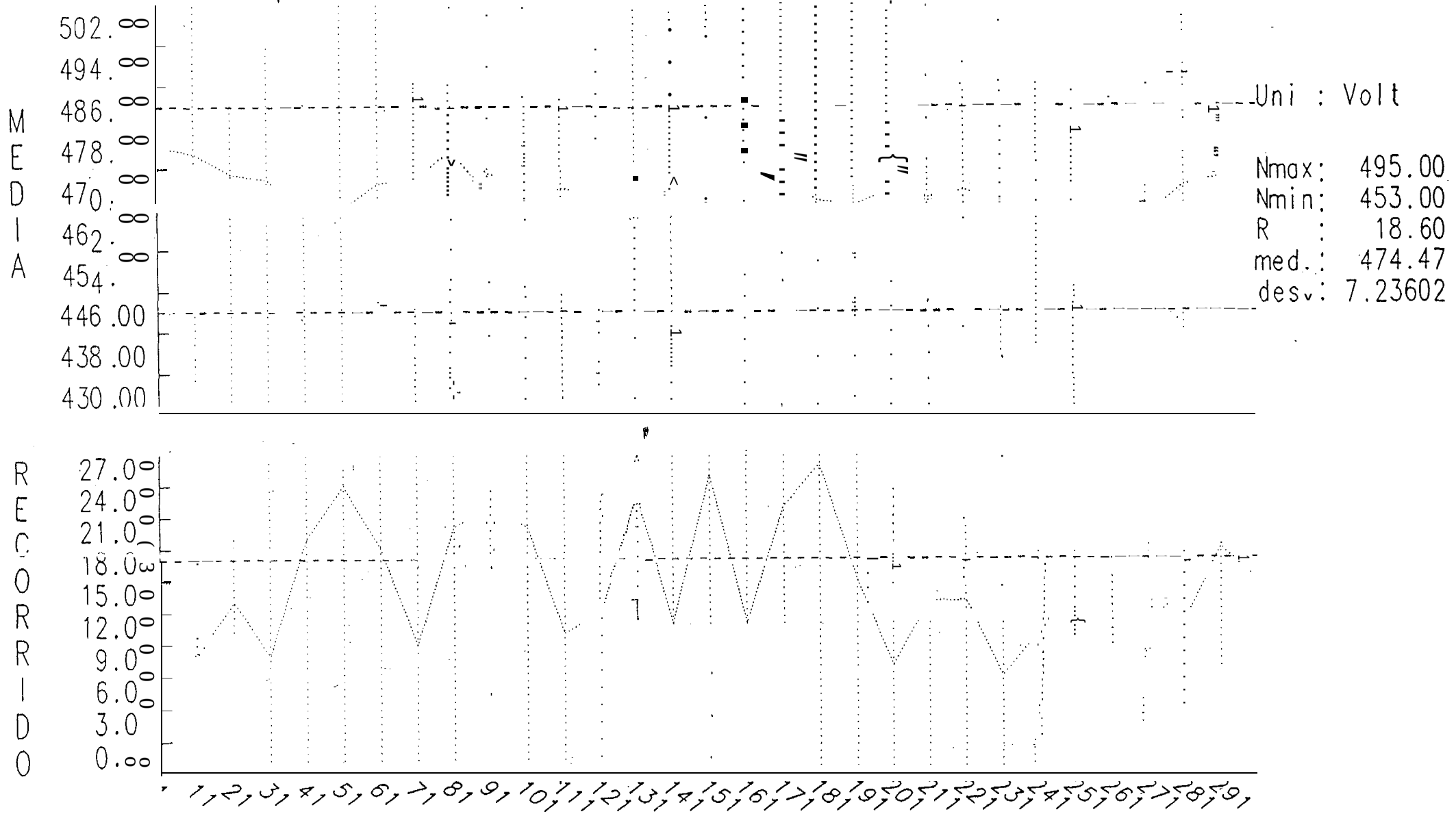



VI CINAY CADENAS SA

(SE I- ISEI)

Tension primaria

Maquina 1 - Fecha fab 7 5 96 - u largo 6 4097 6 26 00

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Velocidad a in de acceleracion

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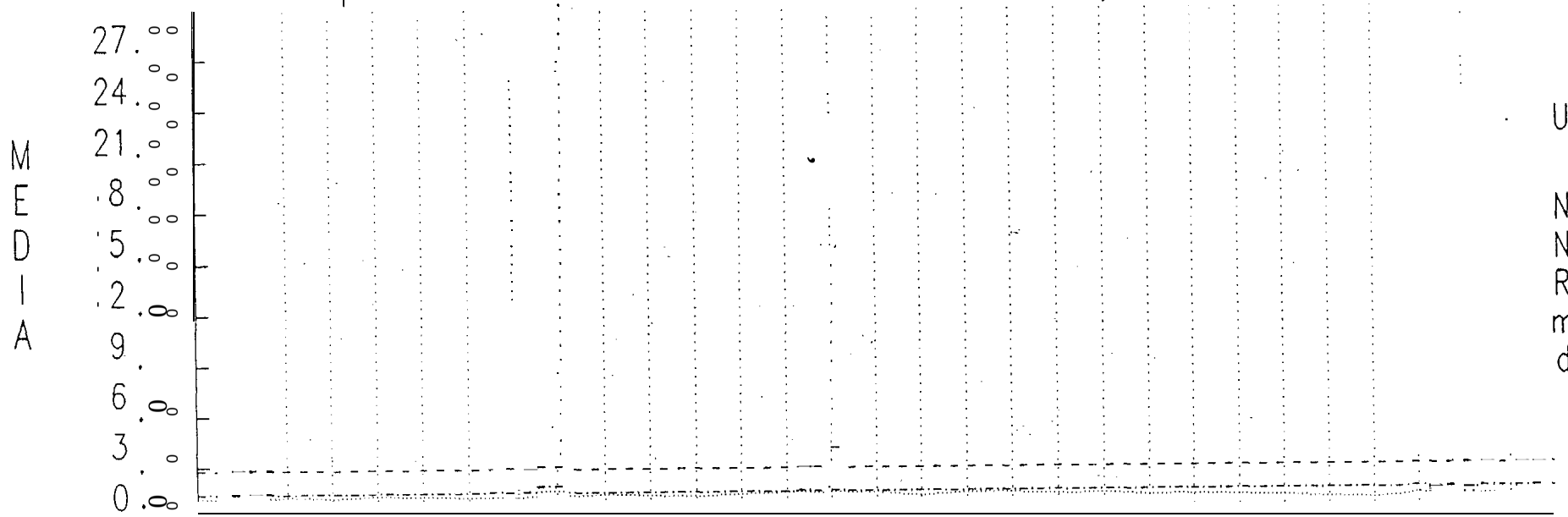
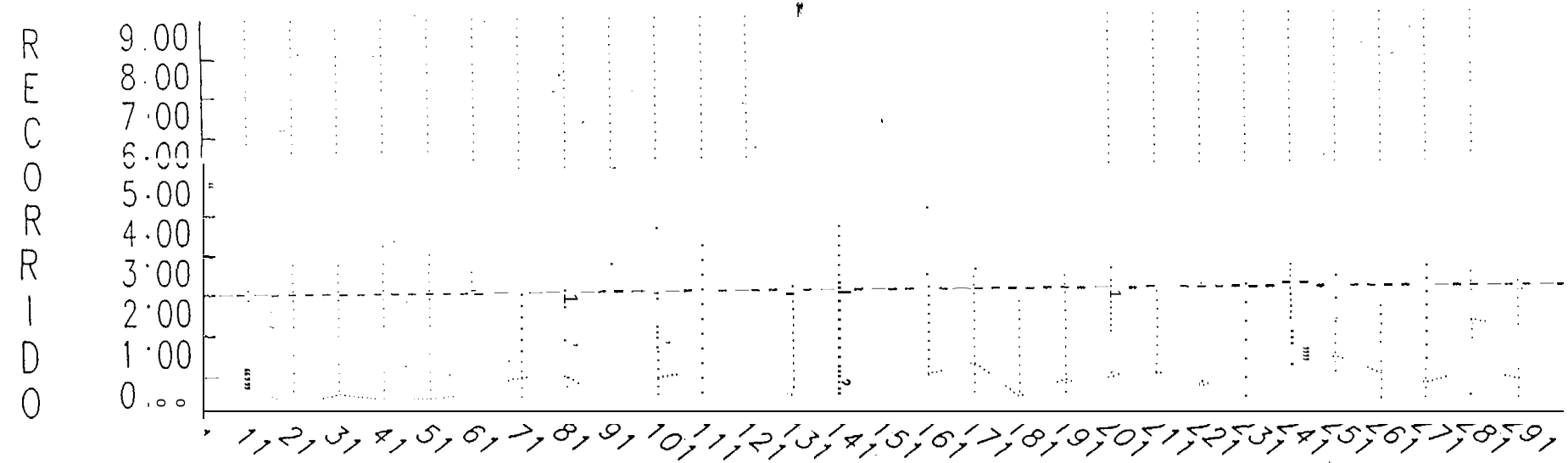



Uni.: mm/sec

Nmax: 1.86
Nmin: 0..1
R : 0..7
med.: 1..8
desv: 0.264=75

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VICINAY CADENAS A

(SE -ISE )

Presión de cierre o de ero

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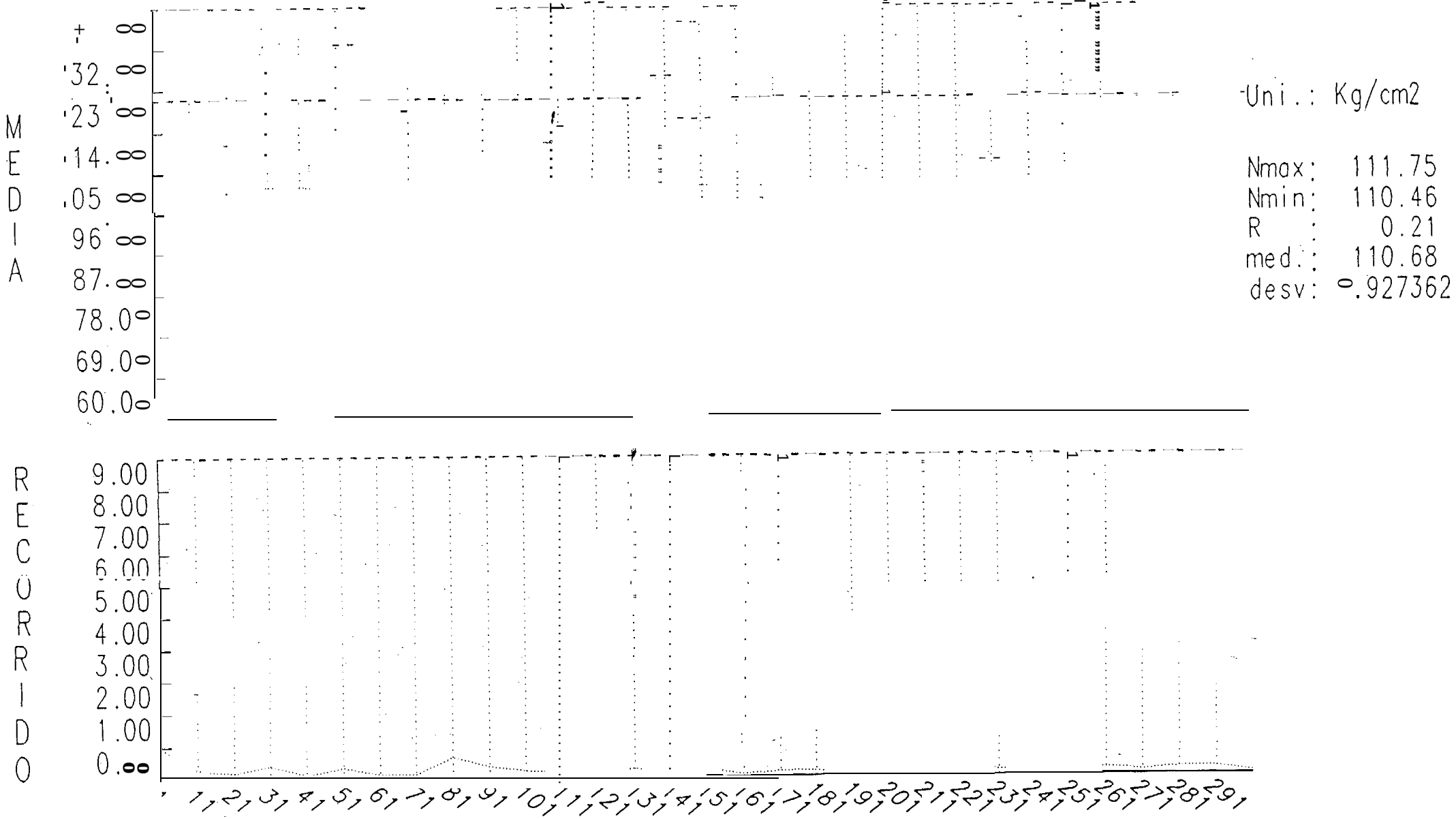


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Recorrido de reca cad...

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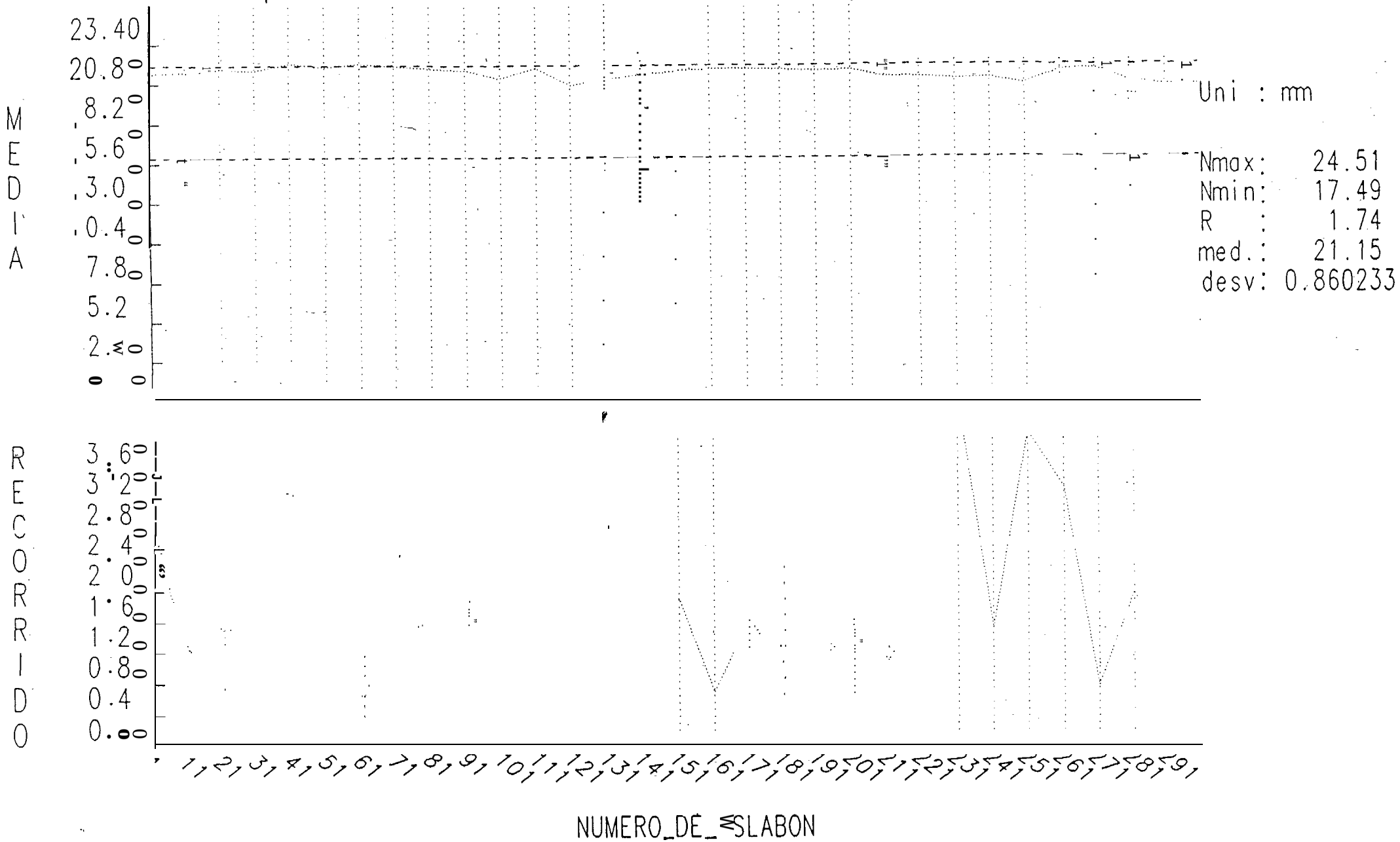

Tiempo de soldadura

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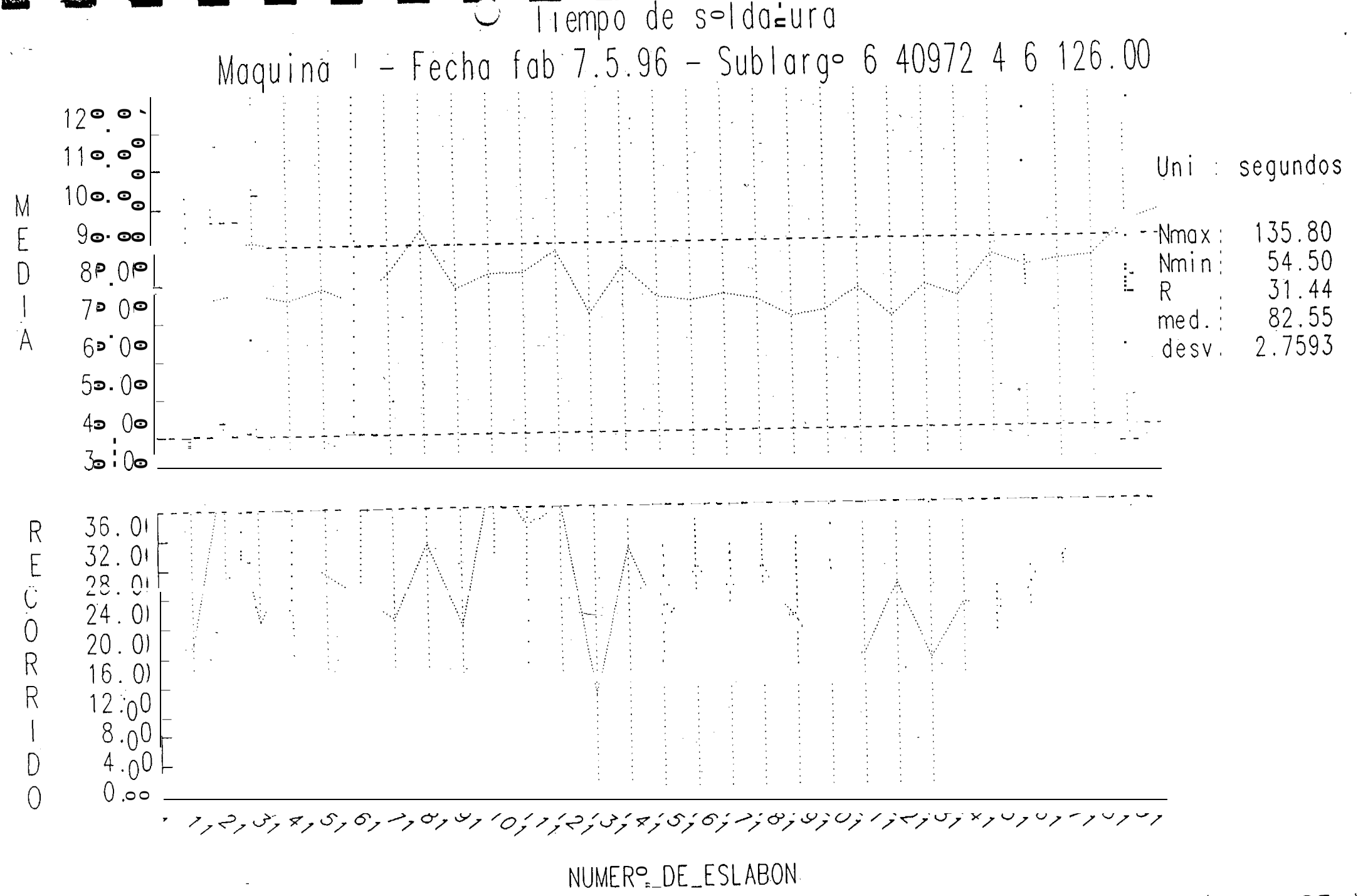


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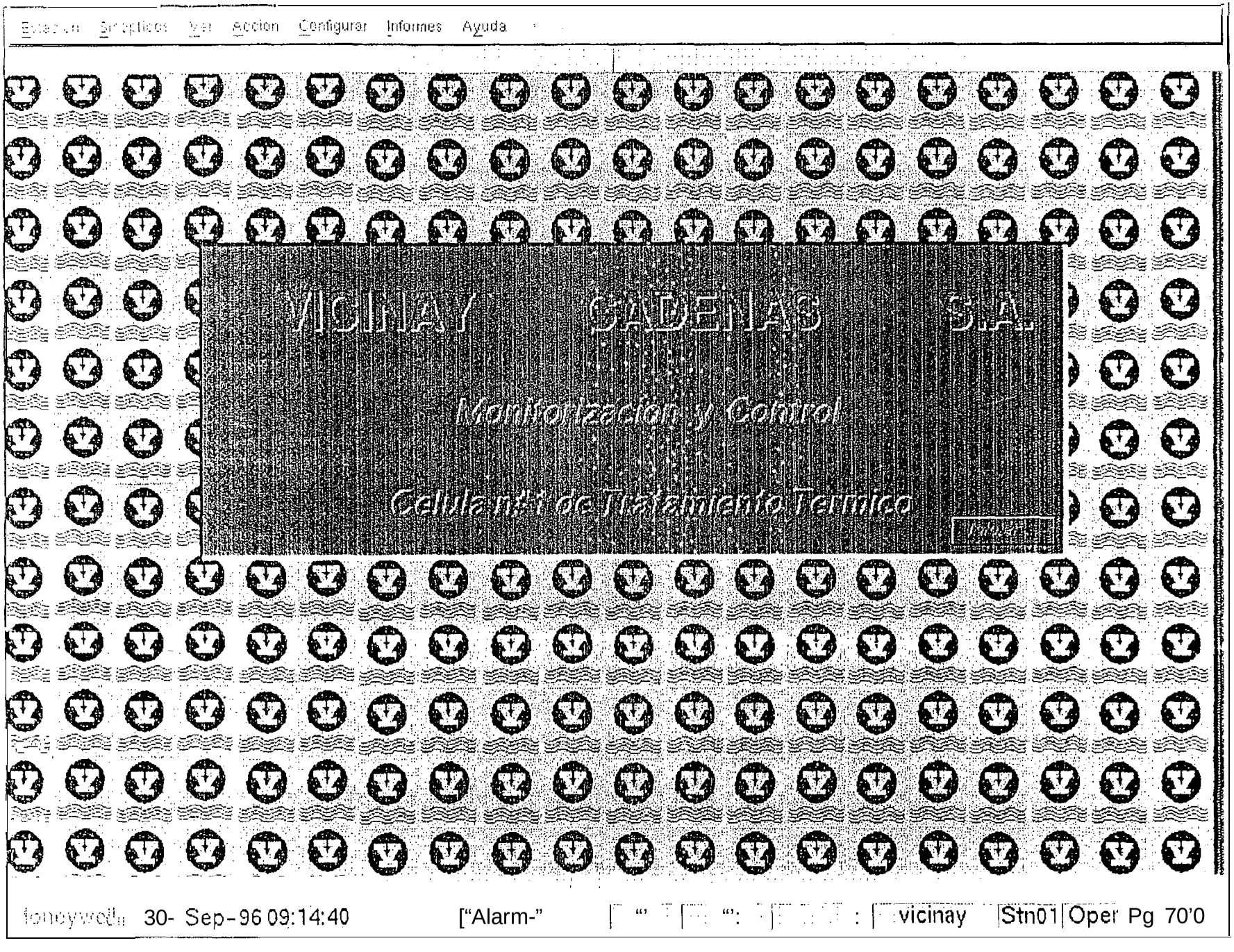
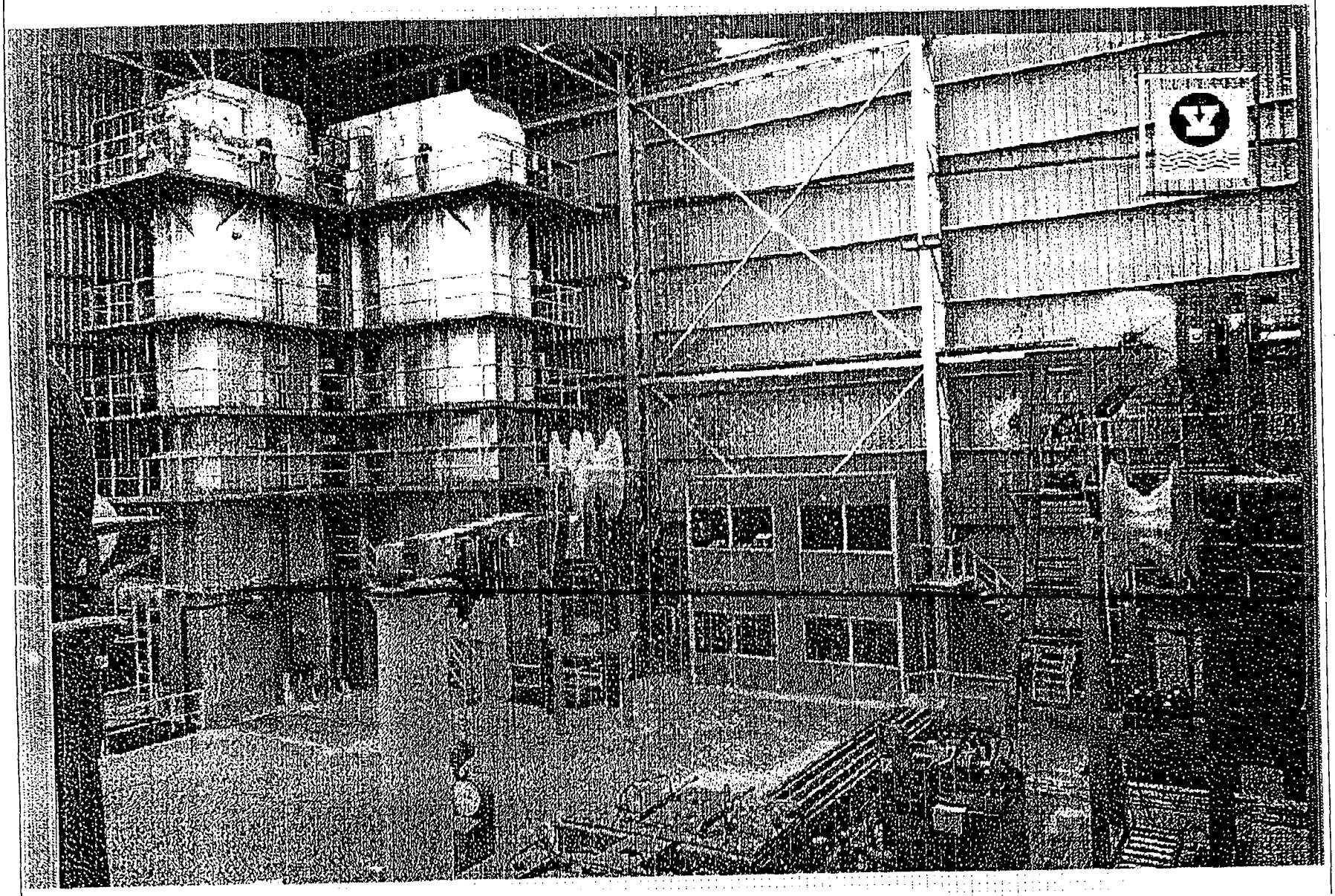
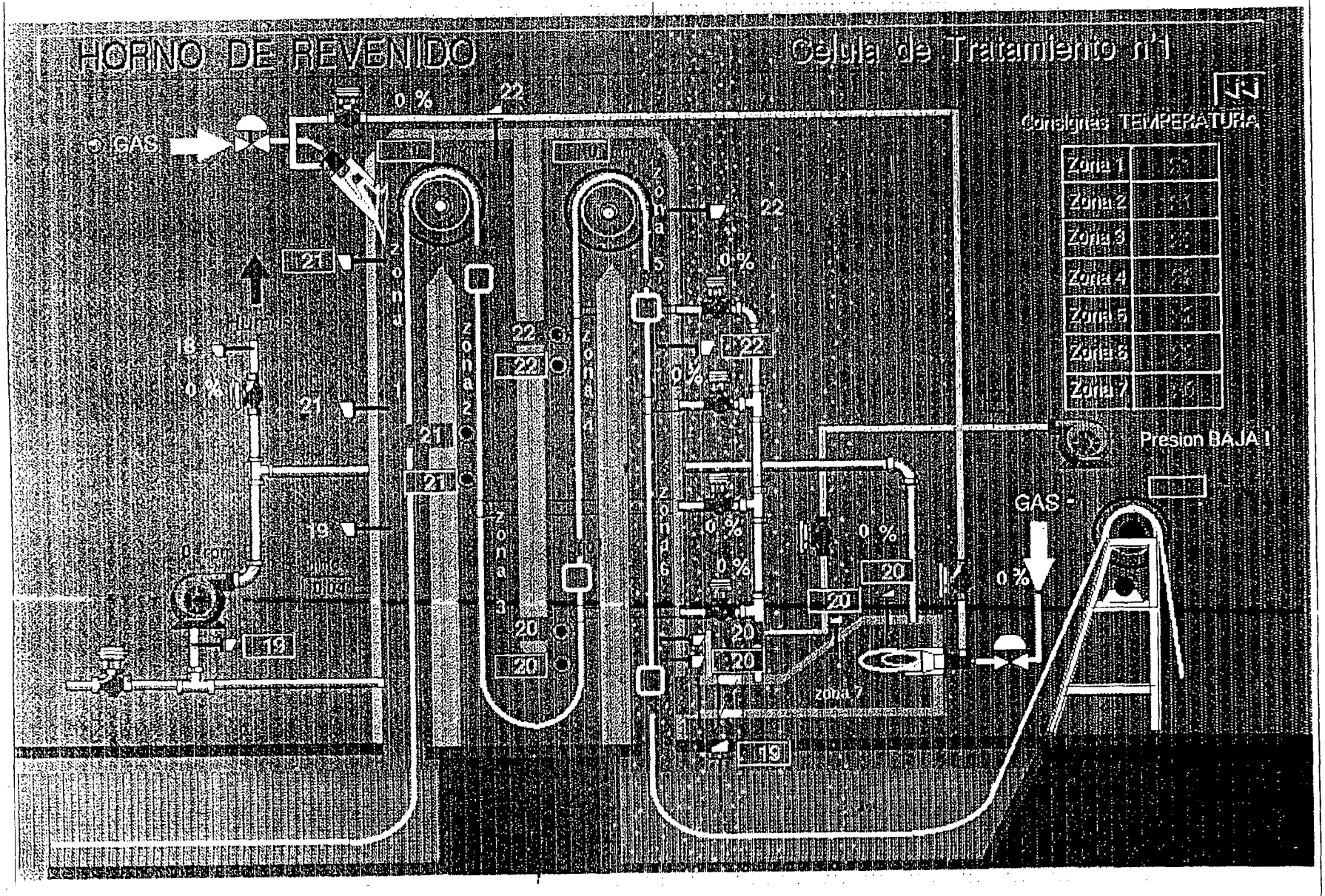

Ficheros Graficos Ver Accion Configurar Informes Ayuda
VICINAY CADENAS S.A.
Monitorizacion y Control
Celula nº1 de Tratamiento Termico
honeywell 30- Sep-96 09:14:40 ["Alarm-" "" "": : vicinay Stn01 Oper Pg 70'0



Honeywell 30-Sep-96 08:30:05 Alarm vicinay Stn01 Oper Pg 611


HORNO DE REVENIDO
Celula de Tratamiento nº1
Consignas TEMPERATURA
Zona 1
Zona 2
Zona 3
Zona 4
Zona 5
Zona 6
Zona 7
Presion BAJA !
GAS
Quemador
Zona 1
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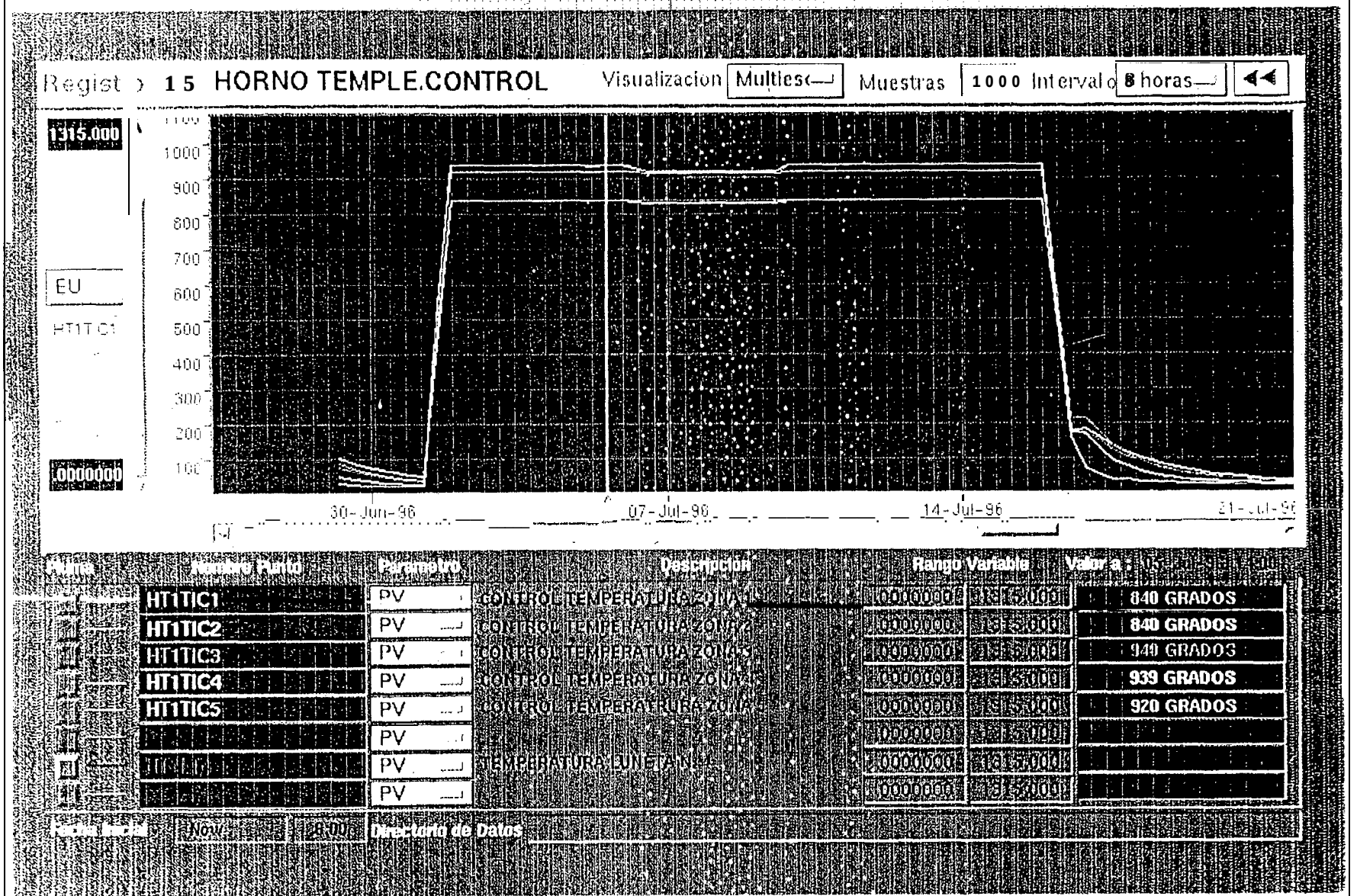
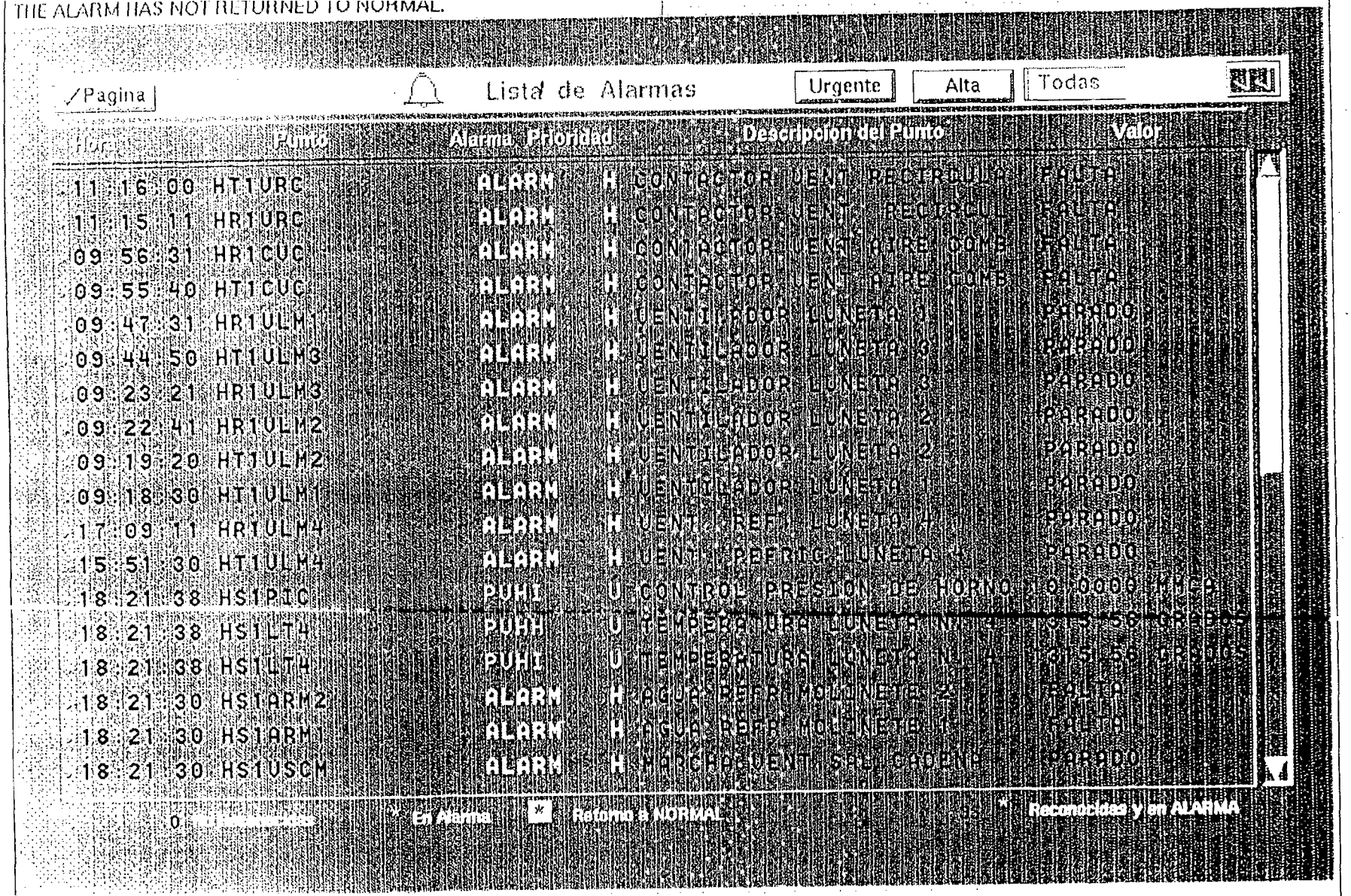
Zona 4
Zona 5
Zona 6
zona 7

Ejecutar Seguridad Ver Acción Configurar Informes Ayuda



THE ALARM HAS NOT RETURNED TO NORMAL.



Estacion Sinopticos Ver Accion Configurar Informes Ayuda

Fecha 3 / 7 / 96 X

| Diam | Grado | Ord Fabricacion |
|---|---|---|
| 120.0 | R3 | 41103 |
| 0.0 | | |
| 0.0 | | |

T.Agua=37 ±7 Velocidad ± 5% 165

Consignas Temple ±10: 840 840 940 940 920

Consignas Revenido ±10: 556 607 650 645 645 645

Hora: 6

## Temperatura de Tratamiento (grados)

VICINAY CADENAS S.A.

Informe de Produccion OK

Fecha 3 - 7 - 96 A.C. --

Notas >> --

Celula de Tratamiento Termico N-1

| Tiempos hh | Tiempos min. | Largos ENTR. | OPER MANDO | Veloc mm/min. | T. Ag. | Horno de Temple Z1 | Z2 | Z3 | Z4 | Z5 | Horno de Revenido Z1 | Z2 | Z3 | Z4 | Z5 | Z6 | Tiempos hh | Tiempos mm | Largos SALIDA | DUREZA Br (15%) | Temple L-3 | Temple L-4 | Temple L-5 | Revenido L-4 | Revenido L-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 0 | BL 6 | Manrigu | 165 | 33 | 839 | 840 | 940 | 935 | 920 | 558 | 607 | 649 | 644 | 645 | 645 | | | | 87,3Kg | 0 | 0 | 872 | 617 | 0 |
| 7 | 0 | | 171 | 164 | 32 | 840 | 840 | 940 | 935 | 920 | 568 | 607 | 650 | 645 | 645 | 645 | | | | | 0 | 0 | 872 | 617 | 0 |
| 8 | 0 | | 522 | 164 | 33 | 840 | 840 | 940 | 938 | 920 | 557 | 606 | 650 | 644 | 645 | 645 | | | | | 0 | 0 | 877 | 617 | 0 |
| 9 | 0 | | | 165 | 33 | 840 | 840 | 940 | 939 | 920 | 560 | 606 | 651 | 646 | 645 | 644 | | | | 87,5Kg | 0 | 0 | 878 | 618 | 0 |
| 10 | 0 | | | 164 | 33 | 840 | 840 | 940 | 940 | 920 | 575 | 609 | 651 | 648 | 645 | 638 | | | | 84,5Kg | 0 | 0 | 880 | 620 | 0 |
| 11 | 0 | | | 164 | 33 | 839 | 840 | 940 | 941 | 920 | 566 | 597 | 647 | 650 | 640 | 629 | | | | | 0 | 0 | 884 | 610 | 0 |
| 12 | 0 | | | 164 | 33 | 840 | 840 | 940 | 940 | 920 | 559 | 580 | 655 | 647 | 642 | 650 | | | | | 0 | 0 | 885 | 600 | 0 |
| 13 | 0 | | | 164 | 34 | 839 | 840 | 940 | 940 | 920 | 549 | 567 | 650 | 645 | 644 | 647 | | | | | 0 | 0 | 885 | 593 | 0 |
| 14 | 0 | | Casimiro | 164 | 34 | 840 | 840 | 940 | 940 | 920 | 559 | 560 | 650 | 645 | 644 | 644 | | | | | 0 | 0 | 886 | 590 | 0 |
| 15 | 0 | | 523 | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 547 | 556 | 650 | 645 | 645 | 645 | | | | 88 Kg | 0 | 0 | 885 | 589 | 0 |
| 16 | 0 | | | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 541 | 552 | 650 | 645 | 645 | 645 | | | | | 0 | 0 | 885 | 588 | 0 |
| 17 | 0 | | | 164 | 36 | 840 | 840 | 940 | 940 | 920 | 536 | 549 | 650 | 645 | 645 | 645 | | | | | 0 | 0 | 884 | 586 | 0 |
| 18 | 0 | | | 164 | 36 | 840 | 840 | 940 | 940 | 920 | 532 | 546 | 650 | 645 | 645 | 645 | | | | 87,5Kg | 0 | 0 | 885 | 585 | 0 |
| 19 | 0 | | | 164 | 36 | 840 | 840 | 940 | 940 | 920 | 532 | 545 | 650 | 644 | 645 | 645 | | | | | 0 | 0 | 884 | 585 | 0 |
| 20 | 0 | | | 164 | 36 | 840 | 840 | 940 | 940 | 920 | 530 | 545 | 650 | 644 | 646 | 646 | | | | 88 Kg | 0 | 0 | 887 | 585 | 0 |
| 21 | 0 | | | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 539 | 553 | 650 | 643 | 645 | 653 | | | | | 0 | 0 | 884 | 593 | 0 |
| 22 | 0 | | Alba | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 544 | 557 | 650 | 645 | 645 | 654 | | | | | 0 | 0 | 884 | 594 | 0 |
| 23 | 0 | | 60 | 165 | 35 | 840 | 840 | 940 | 940 | 920 | 539 | 556 | 650 | 645 | 645 | 650 | | | | | 0 | 0 | 883 | 599 | 0 |
| 0 | 0 | | 249 | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 541 | 555 | 651 | 646 | 646 | 652 | | | | 90 Kg | 0 | 0 | 884 | 600 | 0 |
| 1 | 0 | | | 164 | 35 | 840 | 840 | 940 | 940 | 920 | 567 | 545 | 648 | 1348 | 644 | 645 | | | | | 0 | 0 | 884 | 592 | 0 |
| 2 | 0 | | | 164 | 34 | 840 | 840 | 940 | 940 | 920 | 572 | 536 | 650 | 645 | 645 | 645 | | | | | 0 | 0 | 885 | 582 | 0 |
| 3 | 0 | | | 165 | 34 | 840 | 840 | 940 | 940 | 920 | 567 | 535 | 651 | 642 | 645 | 647 | | | | | 0 | 0 | 889 | 583 | 0 |
| 4 | 0 | | | 164 | 34 | 840 | 840 | 940 | 940 | 920 | 567 | 547 | 650 | 645 | 644 | 653 | | | | 89 Kg | 0 | 0 | 890 | 593 | 0 |
| 5 | 0 | | | 164 | 34 | 840 | 840 | 940 | 940 | 920 | 567 | 548 | 650 | 645 | 646 | 652 | | | | | 0 | 0 | 887 | 591 | 0 |

Honeywell 30-Sep-96 08:26:30 Alarm vicinay Stn01 Oper Pg 620